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GLIESE 581G: A re-examination of current data and new evidence to determine its existence

The (possible) confirmation of the FIRST EXO-OCEANS

HYDRODYNAMIC MODELING analysis of the circulation of the Bay of Fundy

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SUMÁRIO

DEVELOPMENT OF "L-TIP": A NEW DELIVERY SYSTEM COMPRISING MICROSPHERES, NANOSPHERES AND/OR PICOSPHERES MADE WITH BEESWAX AND NATURAL FUMIGANT COMPOUNDS FOR FUNCTION AS A LOW-TOXICITY INTEGRATED PEST MANAGEMENT PRODUCT

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June, 2013

Abstract: Feral and commercial honey bee populations in the USA are at great risk of dying due to parasite infestations by trachea mites, varroa mites, AFB/EFB (American/European Foul Brood Disease) and more recently in southeastern states, the (bee) Hive Beetle. Other risk factors, e.g., exposure to neurotoxins found in man-made, chemical pesticides, present additional concerns. Recalcitrant problems for beekeepers is attack on bee hives by large and small Wax Moths, rodentia and other consumers, resulting in the loss of individuals (larvae) and decreases honey flows/output and harvests. Current pesticide products, although marginally effective, are costly with some containing chemicals and compounds that have been found to

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have migrated into the human food chain with additional concern that these may traverse blood-bell barriers and gain entry to the human genome. Too, these products may be lethal to other beneficial pollinators, to symbiotic insects, ants, for example, which also play a role in pollination. Some products are found to be cumbersome, bulky, difficult to use, costly, and not readily available in more remote regions of the USA. Expense of present products to small/large producers, alike, is also a major consideration. Of further concern is overburden/use of chemical pesticides to remedy honey bee infestations resulting in possible negative genetic impact and consequences to targeted individuals, target-vectors and future apis phylogeny/ontogeny.

Key words: Bees, Americanized Bees, Bees of Malaysia, Pesticide, Residual Affects

1 Introduction and Background

This paper discusses recent advancements in development of a novel delivery system wherein conventional treatment modalities, e.g., bee cakes, wafer-type sheets and products placed on paper (strips), are replaced with microcapsules configured to enable delivery of low-toxicity adjuvants at the macro, micro, nano and pico scales. Unique features of microsphere-manufactures, e.g., ability to configure new delivery modalities in the macro, micro, nano and pico scales-ranges, is discussed with attention to affording the new delivery modulus with specificity for:

1. Targeted treatment vectors;
2. Elimination of lethal chemical components and replacement with low-toxicity , natural, organic compounds; and
3. Reduction of physical, ergonomic and logistical stressors to the colony by eliminating present treatment barriers, i.e., worker bees having to access present treatment products, e.g., densely-formed bee-cakes, wafers and wafer-strips.

A proposal to configure next-generation adjuvants for delivery at the pico-scale enabling delivery of low-toxicity countermeasure to residual neurotoxins, e.g., nicotinomide, is presented.

2 The Problem

In November 2006 about Colony Collapse Disorder (CCD), a potentially new phenomenon described by sudden and widespread disappearances of adult honey bees from beehives in the U.S., the CCD Steering Committee was formed with the charge to help coordinate a federal response to address this problem. The CCD Steering Committee consists of scientists from the Department of Agriculture (USDA), Agricultural Research Service (ARS), National Institute of Food and Agriculture (NIFA), Animal Plant Health Inspection Service (APHIS). Who correspondingly combined their scientific and analytical resources together to bring about some of the finest minds in these governmental and scientifically based organization to solve this ever growing problem.

In addition to the aforementioned sources the Natural Resources Conservation Service (NRCS), Office of Pest Management Policy (OPMP), the National Agricultural Statistics Service (NASS), and also includes scientists from the Environmental Protection Agency (EPA), further provided their own forms of research to help try to find a solution to these problems. At that time, the Committee requested input and recommendations from a broad range of experts in apiculture about how to approach the problem. Out of this, the steering committee developed the CCD Action Plan [1]. Which outlined the main priorities for research and outreach to be conducted to characterize CCD and to develop measures to mitigate the problem. Since formation of the CCD Steering Committee early in 2007, the USDA, EPA and public and private partners have invested considerable resources to better address CCD and other major factors adversely affecting bee health.

3 Intense Levels of Unresolved Research

Despite a remarkably intensive level of research effort towards understanding causes of managed honeybee colony losses in the United States, overall losses continue to be high and pose a serious threat to meeting the pollination service demands for several commercial crops. Best Management Practice (BMP) guides have been developed for multiple stakeholders, but there are numerous obstacles to widespread adoption of these practices. In addition, the needs of growers and other stakeholders must be taken into consideration before many practices can be implemented.

To address these needs, several individuals from the CCD Steering Committee, along with Pennsylvania State University, organized and convened a conference on October 1517, 2012, in Alexandria, Virginia that brought together stakeholders with expertise in honey bee health. Approximately 175 individuals participated, including beekeepers, scientists from industry/academia/government, representatives of conservation groups, beekeeping supply manufacturers, commodity groups, pesticide manufacturers, and government representatives from the U.S., Canada, and Europe.

4 Conclusion and Solution

Studies at UC-Davis in 2007 have demonstrated that parasitic infestation(s) are a contributing factor in the onset of "Colony Collapse Disorder" in honeybee populations, nationwide. According to the USDA, domestic honey production is off by 16% for the year 2012. CCD and recalcitrant infestations by the varroa mite (V.destructor) have contributed to this decreased production and has negatively impacted crop pollination/production, in general.

Our team has developed a new delivery system comprising 100% natural low-toxicity components, called "L-Tip" that has been shown to be effective in treatment of colonies where V. destructor is present. Preliminary field studies indicate effectiveness in treatment of Varroatosis and infestations by the Parasitic Phorid Fly Apocephalus borealis as well. Ongoing studies leading to Chapter 13 certification by the USDA are in progress in the states of NC and CA. RMANNCO Labs, further initiated microscopic analysis and micro-encapsulation denominators for introduction to eliminate the parasites causing infestations. While Stewart Research and Consulting initiated and completed micro-imaging studies to help identify pesticide residual pre and post pesticide residue pathologies within the American Bee population.

4.1 Acknowledgements

The Author and Co-Authors would like to thank all scientists and researchers involved with Feral and commercial honey bee populations in the USA are at great risk of dying due to parasite infestations by trachea mites, varroa mites, AFB/EFB (American/European Foul Brood Disease).

4.2 Financial Stipulations

Financing of this research was made possible by RMANNCO Labs and The Melstevia Corporation.

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GLIESE 581G: A RE-EXAMINATION OF CURRENT DATA AND NEW EVIDENCE TO DETERMINE ITS EXISTENCE

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June, 2013

Abstract: Since 2007 to 2013 GJ-581d and GJ-581g have been two of the most controversial exoplanets known. In 2009 and in 2011 data was revised on GJ-581d and it was estimated to be warmer than previously thought, and likely had one or more oceans upon its surface. However, in 2012 the existence of GJ-581d came into question, and the existence of especially GJ-581g was considered to be just an illusion and new claims proposed that GJ-581g did not exist. The aims are to re-examine some of the current known data on GJ-581d and GJ-581g and provide new data and evidence regarding not only regarding GJ-581d, but to also help determine if GJ-581g exists or not.

Key words: Gliese 581d, Gliese 581g, Radial Velocities, Exoplanets, Oceans.

1 Introduction and Background

1.1 Considering The Known Data About Gliese 581g

Gliese 581, is another known name for also the same star system known as GJ-581. In 2005, Bonfils [6] published his paper proposing the detection of Gliese 581b. In 2007, Udry [29] reported the detections of Gliese 581c of

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5M⊕ and Gliese 581d at an estimated 5-6M⊕. In 2009, Mayor [16] reported the detection of Gliese 581e as the smallest exoplanet discovered as of yet.

All of these exoplanets were detected the radial velocity (RV) method using the famous HARPS spectrograph. It was determined the Gliese 581 star system consisted of four exoplanets being Gliese 581e, Gliese 581b, Gliese 581c and Gliese 581d. In 2010, Vogt [31] reported detecting two additional new exoplanets named Gliese 581g and Gliese 581f. Gliese 581g was estimated to be equal to about 3M⊕. In the detection of Gliese 581g the HARPS and Keck data sets were both used to detect these potential exoplanets. However, greater debate and controversy arose when in 2011 Gregory [12] was uncertain and not clear if the Gliese 581g existed or not. His analysis seemed to have diagnosing problems through his Bayesian amplitude noise harmonics analysis.

This seems to have occurred when implementing the determining red noise amplitude measurements when applying the Bayesian methodology to the circular orbital variations compared to those of eccentrically elliptical type orbits, the analysis of noise could not be depended upon. This was especially true when Gregory [12] applied the same on modeling applications as well. However, a comparison of a corrected filter to have the Bayesian method of application was claimed to have made a difference. Based upon a previous paper also written by this was modified in 2010 by Gregory and Fischer [13] was used on modeling. This filter was supposed to also been used to make the application of the Bayesian methodology more sensitive to noise harmonics, that would be sensitive to the low and high amplitude harmonics expressed in the orbits of either an exoplanet when it would either be in a low or high eccentricity orbit. However, this was strictly only applicable to occasional modeling conditions.

In the center of Figure 1 is a large star named HD-3651 that is about 36 light years (LY) from Earth. In 2003 the ESO discovered that HD-3651 had an exoplanet less massive than Saturn. However, in 2006 a brown dwarf star (shown within the circle) named HD-3651b was also shown to be orbiting HD-3651, in its own orbital path in this same solar system. Just like the previous exoplanet a little smaller than Saturn. According to Shiga [20], three important discoveries were made concerning the HD-3651 star system conditions. First, it was discovered that the orbit of HD-3651's exoplanet did not have a circular, near, circular, or elliptical type orbit. The exoplanets orbit was irregular, stretched, and elongated. More egg-shaped. Second it

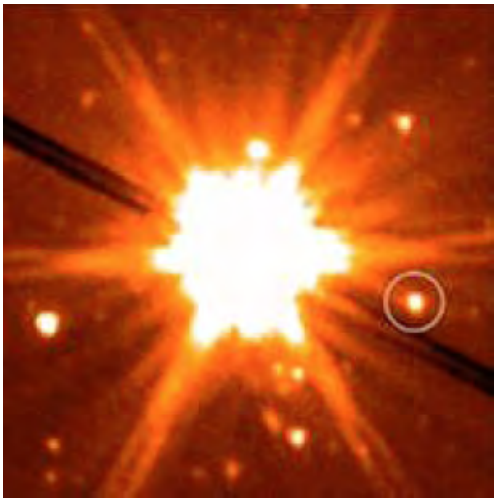


Figure 1: **View of HD-3651 (Source: ESO and Ronald Stewart)**

was again discovered this egg-shaped-like orbit not only affected the orbital path of the earlier discovered exoplanet, but also the brown dwarf star known HD-3651b as well. Third, a new fourth type of orbital status applies to exoplanets within any star system, including Gliese 581.

So, The New Scientist article [20] shows that instead of just three previously known circular, near-circular, and elliptical orbits, (a new fourth orbit was not known before), could exist in a star system affecting its exoplanets. However, the imaging evidence shows a second companion star could exist in any star system with its orbit affected as well. The New Scientist article [20] shows a small star could go undetected, just as an exoplanet could in go undetected with any star system in like manner, including Gliese 581.

This provides new evidence that exoplanets could have four types of orbital path systems instead of just three of them. Being a circular, near circular, elliptical, or irregular orbit. What should be learned from this, is that exoplanets could have a fourth stretched irregular elongated orbital path. Therefore, when taking this factor into account and when considering the two papers by Gregory [12] and [13] and in their Bayesian re-analysis of the exoplanets in the Gliese 581 star system, their re-analysis is flawed and erroneous. When using the Bayesian methodology to calculate and estimate uncertainties about the existence of possibly Gliese 581d and especially Gliese 581g. Because they had not factored into their Bayesian re-analysis that exoplanets in the Gliese 581 star system could also be affected by a new

type of fourth orbit. Which could affect any of the exoplanets in Gliese 581 star. This is especially important when considering a fourth type of orbit could also affect Gliese 581d and Gliese 581g in the Habitable Zone (HZ).

1.2 Bayesian Re-Analysis of Gliese 581g

Other evidence within the papers by Gregory [12] [13] is that they discuss in their papers is mentioned under subsection 4.3 entitled: "Four Planet Model", and also according to Figure 12[1].

The paragraph continues to elaborate that the 4 planet model, Gliese 581d shows a very close 66.9 day orbital period. Which is very close to when Udry [29] corrected his original estimate of Gliese 581d having an 82 day orbital period down to a 67 day orbital period around its parent star instead. Whereas Gliese 581g's orbit was later estimated to be between a 34.0-36.0 day orbital. Again being consistent, and in extreme close estimations to Vogt's [31], estimations reported in his paper. Therefore, Gregory [13] could not have such close estimations to Udry's [29] estimations of Gliese 581d's orbit being at a 67.0 orbital cycle. When considering Gregory's [12] estimate based upon his models that Gliese 581d had a 66.9 day orbit compared to Udry's [29] revised estimate that Gliese 581d had a 67.0 day orbit the measurements are almost identical. The difference only being models 1/10th of 1.0%. On one hand, for the Bayesian methodology models to suggest uncertainty for Gliese 581d, and especially Gliese 581g based upon the Bayesian noise amplitude models, and than on the other hand for Gregory [12] to fully depend upon the extreme closeness of the estimated orbital paths for Gliese 581d and Gliese 581g expressed in the papers by Udry [29] and Vogt [30], would seem to be contradictory to the Bayesian methodology model reanalysis of the entire Gliese 581 star system. Especially when it would come to exoplanets Gliese 581d

[1]The 4th planet model is based upon the last and fourth planet of the Gliese 581 star system being Gliese 581d, they are giving admitted evidence to Gliese 581d. Whereas in Figure 14 of Gregory [12], the parameters for a: "5 Planet Model" the 5th planet model being Gliese 581g. As far as the amplitude is concerned the 5th planet, Gliese 581g is more erratic. However, this does not necessarily mean that there is no existence for a 5th planet, which would be applicable to Gliese 581g. Rather, it would mean just the opposite. In Figure 14 the orange colored perimeter and noise level could be: "an accentuation of Gliese 581g's close position in proximity to Gliese 581d, this could cause an extension of additional noise variations in the noise amplitude harmonics. This will be explained more in upcoming pages of this paper. However, additional evidence is supplied in Gregory [12] in paragraph 2 of the sub-heading entitled: "6 Planet Model". Gregory [12] states quote: "There is considerable agreement with the 4 and 5 planet model marginals shown".

and Gliese 581g. Therefore, because of this type of inconsistencies and confusion on the part of the Gregory's paper [12], it is evident that more doubt is created upon the paper written by Gregory [12] because of the discussions in Gregory and Fischer's earlier paper [13].

2 The 2012 Baluev Bayesian Research Paper Dispute Casting Doubt On The Existence of Gliese 581d

It is important to understand that if doubt can be put on the non-existence of Gliese 581d as a previously confirmed exoplanet, than this would create even more doubt for the existence of Gliese 581g. Therefore, much more discussion for the existence of Gliese 581d is in order before Gliese 581g is discussed further.

In the paper by Baluev [4], the impact of red noise in radial velocity planet searches: Only three planets orbiting Gliese 581? This proposes that because of the "red noise levels" in the RV also known as Radial Velocity Method (RVM), which is the primary scientific technology and instrumentation used for attaining particular and specific data about an exoplanet and its identifying characteristics, like: "mass", etc..., may cast some doubt on the existence of Gliese 581d. This was based upon the fact that in September 2012, Baluev filtered out the "red noise" from the Keck data and concluded that Gliese 581d 's existence is probable only to about a 3.0-4.0 standard deviations. Second, his paper reports that in the past, that because the: "white level of noise" was primarily studied and not the "red noise", than this is significant new scientific evidence that Gliese 581d in Roman Baluev [4] reports that the red noise pertaining to the RVM significantly provides enough new additional evidence that Gliese 581d does not exist. His paper further reads quote:

"We performed a detailed analysis of the latest HARPS and Keck radial velocity data for the planet-hosting red dwarf GJ-581, which attracted a lot of attention in recent time. We show that this data contains important correlated noise component ("red noise") with the correlation timescale of the order of 10 days. This red noise imposes a lot of misleading effects while we work in the traditional white-noise model. To eliminate these misleading effects, we propose a maximum-likelihood algorithm equipped by an extended

model of the noise structure. We treat the red noise as a Gaussian random process with exponentially decaying correlation function.".

This paper proposes that the: "red noise levels" in any RV data (more or less) should be false positives or indicators of what is there in reality as far as exoplanets are concerned in the Gliese 581 star system. However, there are a number of missed points and inconsistencies that when contemplated, and reasoned out with common-sense, and logical scientific deductive reasoning, these numerous points do not agree with what Baluev [4] is reporting for the non-existence of Gliese 581d. This paper cannot list all of these reasons for lack of space in this paper that could be given that disagree with Roman Baluev [4]. However, in Stewart's paper [24] from the top of page 1- the end of page 18 gives at least ten strong reasons as to why the paper by Baluev [4] has too many inconsistencies to be reliable for evidence against the existence of Gliese 581d. Whereas on the other hand, these ten or more reasons only give that much more support in additional evidence for the existence of Gliese 581d.

2.1 More Than Ten Strong Reasons Why Bayesian Study Re-Analysis of Gliese 581d and Gliese 581g Is Erroneous

In the recent paper by Vogt [30] reminds the reader that as far as a Bayesian re-analysis study of the Gliese 581 star system is concerned, that when considering that Gliese 581d has an orbital cycle of about 67.0 days. The Bayesian re-analysis of Gliese 581d, is that exoplanets like Gliese 581g only about one-half of the 67 day orbital period of eccentricity like Gliese 581d. However, the Bayesian calculations have complications. Anglada-Escude & Dawson [2] continue to explain quote: *"If the modeler (who records the measurements), elects to allow the eccentricity of the 67 day planet to "float", least-squares fitting routines will take advantage of this extra degree of freedom, allowing the eccentricity of the 67 day to rise, and thereby largely masking any signal from a real fifth planet near half that period. Aliases from the unevenly-spaced sampling in the data set further complicate the behavior of peaks at or around half the period of the 67 day."*. Therefore, to correct this Anglada-Escudé [2] used over 4,000 Monte Carlo simulations of the effects of both the eccentricity harmonics and its aliases to conclude that the presence of Gliese 581g. Providing that Gliese 581g is the fifth potential exoplanet in the Gliese 581 star system. It also provides a significant amount of additional evidence that is not only consistent with Vogt [31], but supports this paper as well. While

Bhattacharjee's paper [5] supports all of the data for Gliese 581d and Gliese 581g.

Mayor [16] data also brings out and discusses the Gliese 581d 67 day planet circumstances and verifies the same. Which is also discussed in Vogt [30] points out that the HARPS and HIRES data sets just did not merge well under the assumption of an: "all-floating-eccentricity". Which when done leaves larger numbers of peaks in the residuals and periodograms. By contrast, models that assumed all-circular orbits allowed the two data sets to meld much more closely, and produced much better equivalent quality with fewer parameters. Vogt [30] further explains that if a modeler allows the eccentricities of all four known planets to float, that this would add 8 additional parameters to the model. Also allowing more additional degrees of freedom than adding even two more planets on circular orbits. Therefore, when considering this extra data: "The principle of parsimony" clearly favors circular to near circular orbits for all of the planets in the Gliese 581 system. Vogt [30], and two Bayesian studies provided in Gregory [12] and Gregory and Fischer [13], along with Vogt [30] discuss a fourth/fifth planet model applying to Gliese 581g. Which would have circular or at least near circular orbits around Gliese 581. Supporting this data and found, that by adding a fifth planet at 32.1 days to the system, would account for an super-Earth-like planet in the middle of the HZ at about 2.2M$\oplus$.

At the same time, the Tuomi study [28] explicitly concluded that the orbits of the four confirmed planets were all consistent with circular to near circular orbits and cited 99% Bayesian credibility ranges of [0-0.67] for the 67 day planet Gliese 581d. The Bayesian analysis of Gregory [12] also lists uncertainties for 3 of 4 eccentricities in this system that are consistent with circular or near circular orbits around their star.The fact that neither Bayesian analysis found sufficient evidence for more than four planets in the system also deserves further scrutiny. Tuomi [28] and Jenkins & Peacock [14] raised serious doubts about the traditional threshold for the Bayesian Evidence Ratio. Therefore there is an additional amount of significant data and evidence to support the erroneous data of the Bayesian studies not supporting the existence of Gliese 581d or Gliese 581g.

Contrary to the widespread impression that the Bayesian results rule out any more than 4 or 5 planets in the Gliese 581 system, the additional planet claims of Vogt [31] are actually not in discord with these Bayesian analyses. How? Jenkins & Peacock [14] found the Bayesian evidence ratio to be a

noisy statistic, and cautioned that it may not be sensible to accept or reject a model based solely on whether that evidence ratio reaches some threshold noise value. They conclude that the performance of such Bayesian tests is significantly affected by the signal to noise ratio in the data.

3 Evidence That Gliese 581d and Gliese 581g Exist In The Habitable Zone Next To Each Other

Baluev [4] in their paper are confident that the existence of Gliese 581d is questionable and that Gliese 581g is an illusion as stated in their paper. What also proposes that the reliability of their paper should seriously be questioned is because one of their subtitles states that: "Red noise as a detection method can be a misleading agent". Therefore, their paper again shows contradictory inconsistencies that keep proving their paper of Bayesian Studies and re-examination of Gliese 581d and Gliese 581g cannot be relied upon. What is truly surprising and confusing at the same time is the fact that in their paper they claim that while their technology and studies were adequate enough to detect Gliese 581e, Gliese 581b and Gliese 581c, but was not able to detect Gliese 581d or Gliese 581g. The laws of physics do not pick and choose to detect some exoplanets and then not others. Or partially maybe suggest that Gliese 581d exists but should still be question it's existence. The technology is either going to detect all of the exoplanets or not, especially if the technology or partial application of it is not sensitive enough, or has not been attempted enough in measurements over a period of time.

For example; Trentadue [27], Endl [9] and Wittenmyer [32] speaks that when studying exoplanets the ones that should primarily be studied are the ones that are closest to Earth's own solar system, and especially if they have a possible HZ. However, all of these papers strongly suggest and were also in the study of the Proxima Centauri star system that after many years of study using the RVM, that no exoplanets were found to be in the Proxima Centauri star system. Which is the closest star system to Earth. In addition to this Based upon Kasting [15] studied the same star system and found no exoplanets. However, again, Wittenmeyer [32] and Endl [9] determined that only when using the radial velocity method over numerous years and over many attempts giving strong evidence that:

1. Proxima Centauri did not have a HZ; and

2. That no signal was able to be detected despite many attempts with the RVM. No signals were picked up at all. Evidence, indicating not any exoplanets at all in orbit around Earth's closest neighbor Proxima Centauri at just 4.22 LY away from Earth. This included any exoplanets that may equal the mass and size of Neptune and/or any gas giants like Jupiter as well.

When considering that in the case of determining or not "if" there were any exoplanets in Proxima Centauri, this paper again needs to re-emphasize that the "only way" that RVM is going to work not only effectively, but also accurately is when it is used "over numerous years and over many attempts". In Endl [10] presented their findings in looking for low density mass exoplanets for example in Proxima Centauri and M. Endl and M. Kurster [9] determined that when using the radial velocity method and attest to the fact that as far as RVM is concerned as a scientific tool and instrumentation, its accuracy is solely dependent on the fact *"that since sensitivity is a function of RVM accuracy and precision, that following up with as many additional number of measurements and sampling as possible, adds more points to the current data. Furthermore, this methodology allows an improvement of the RVM detection sensitivity over time"*. Therefore, to be able to get a true scientific assessment if any exoplanet- (especially Gliese 581d and Gliese 581g) are there or not, the dependency of the accuracy of the RVM is very dependent on repetitious attempts and detections over a large amount of time. In order to truly get enough accumulative data to accurately determine if an exoplanet is in any star system or not. Especially Gliese 581d and Gliese 581g.

This also proved true when in his paper by Dumusque [8]. An Earth mass planet orbiting Alpha Centauri B, spent over 3 years and numerous attempts to be able to get enough data measurements to determine with any amount of accuracy as that there a mass sized Earth sized planet close to it's parent star in the Alpha Centauri B star system. In like manner, it is the same conditions when determining if Gliese 581d and Gliese 581g are in the Gliese 581 star system as well. However, this also applies to using the RVM in this way. Because if it is not used in this way, than any use of this exoplanet technology would not be accurate.

So, is the case when Gliese 581g was first announced by Vogt [31] when he revealed the probable existence of Gliese 581g that would reside in about the middle of the habitable zone of the Gliese 581 star system. However,

new doubts about Gliese 581g's existence were proposed in Pepe [18] and the Geneva Team used data from HARPS, or the High Accuracy Radial Velocity for Planetary Searcher, a powerful spectrometer on a 3.6 m telescope in Chile. It is well known that the HARPS spectrograph uses the radial velocity method, or measuring the gravitational tugs on stars by their planets by watching the stars' spectral lines "wobble" back and forth due to the Doppler effect. However, The Geneva Team, in Pepe [18], stated that they could not find evidence of Gliese 581g. using the just HARPS technology by itself.

The Geneva Team gave further reasons as to why Gliese 581g did not exist. He stated in so many words *"Since Mayor's announcement in 2009 of the lowest-mass planet Gliese 581e, we have gathered about 60 additional data points with the HARPS instrument for a total of 180 data points spanning 6.5 years of observations"... "From these data, we easily recover the 4 previously announced planets Gliese 581b, Gliese 581c, Gliese 581d, and Gliese 581e."*, said Peppe. However, he then said *"We do not see any evidence for planet 'g', the fifth planet in the system as announced by Vogt and his Team. The reason for that is that, despite the extreme accuracy of the HARPS instrument and the many data points, the signal amplitude of this potential fifth planet is very low and basically at the level of the measurement noise"*.

3.1 What The Geneva Team Did Not Consider

However, in 2010 Vogt [31] stated that Gliese 581g existed. Vogt and Butler used data from HARPS over a 4.3 year period and data from the HIRSE instrumentation, over an 11 year period. It is important to remember that earlier in this paper it was discussed how important it is when using the RVM for detecting exoplanets, that like in the case as aforementioned in Trentadue [27], Endl [9] [10], Wittenmeyer [32], Kasting [15] and Dumusque [4], that the reliability, efficiency, proficiency, accuracy and sensitivity of the RVM to be able to detect exoplanets in other star systems to its maximum capability, is solely dependent on the fact *"that since sensitivity is a function of RVM accuracy and precision, that following up with as many additional number of measurements and samplings as possible, adds more points to the current data and that by this methodology, it allows for the best maximum improvement of the RVM detection sensitivity over time when using it to detect exoplanets"*. In this case especially being applicable in detecting Gliese 581d and Gliese 581g. The overall point here is that when the years that Vogt's Team used both the HARPS data over 4.3 years and the HIRSE data over 11 more years what this mean is that very careful and exhausting efforts were put into the RVM adding up to over 14.3 years that were spent using the RVM

to find exoplanet Gliese 581g. The HIRSE approach is the High Resolution Echelle Spectrometer on one of the 10 m Keck Telescopes in Hawaii. Their analysis searches for planets in the Gliese 581 system using both sets of data, confirming the presence of planets Gliese 581b, Gliese 581c, Gliese 581d, and Gliese 581e while showing evidence for the two new planets, Gliese 581f and especially Gliese 581g. However, what is not known, and what the Geneva Team did not think about or consider are several new areas of evidence that makes the case stronger for Gliese 581g. This comes down to four new areas of data as follows:

1. The Geneva Team use of only the HARPS instrumentation although while impressive was not precise enough by just this technology alone for the 6.5 years to prove that this exoplanet does not exist;

2. The Geneva Team admitted *"The reason for that is that, despite the extreme accuracy of the HARPS instrument and the many data points, the signal amplitude of this potential fifth planet is very low and basically at the level of the measurement noise"* said Pepe. Therefore, since the "Signal Amplitude" was at the same level of the "Measurement Noise", the reason The Geneva Team had a difficult time to distinguish if Gliese 581g was there or not, does not provide any data or evidence that Gliese 581g was not there. Pepe and his Geneva Team cannot determine with any scientific probability that Gliese 581g was not there, just because the precision of their RVM was not sensitive enough to pick up enough of an RV signal to prove that the Gliese 581g exoplanet does not exist. This contrasts with the work of Vogt, which argues that the false alarm probability for these six planets is extremely low.

3. Another important point missed is when a much closer reading of the "Vogt et al, (2010) preprint", is done Vogt and his Team stated *"That both sets of data from HARPS and HIRSE were needed to detect all 6 planets in the Gliese 581 star system"*. Which was done over a period of time totaling over 14 years between the two HARPS and HIRSE data sets. This would also mean:

   (a) That The Geneva Team was evidently agreeable that HARPS and HIRSE did confirm the existence of exoplanets Gliese 581e, Gliese 581b, Gliese 581c, and Gliese 581d, but were not willing to accept that the same scientific principle previously applied all of a sudden was incapable of detecting Gliese 581g. That since both of the HARP and HIRSE technologies were needed to detect all the other

confirmed planets why didn't the Geneva Team just simply "Also duplicate" the use of both technologies just like the Vogt Team did to see if they could also detect Gliese 581g? Apparently they did not and only chose the data that would support their concepts instead of looking at all of the data from A to Z.

(b) The total length of time and duration that the Vogt Team used both technologies to detect Gliese 581g was for a much longer period of time that the Geneva Team used only the HARPS technology. The HIRSE technology secondly re-verified what the Vogt Team found with using the HARPS technology. Where the Geneva Team did not re-verify their findings on an equal basis by using a back up technology to back up their HARPS findings, where the Vogt Team did, and for a much longer period of time as well;

(c) Therefore it's no surprise that the HARPS-only data set cannot confirm the presence of exoplanet Gliese 581g. The fact that the scientific papers "Gliese 581-Extra-Solar Imaging Survey" [22], "First View of Gliese 581d; A Preliminary Surface Survey (Part 1)" [25], "Gliese 581d; Views of Its Atmospheric, Topographical, Geological, and Oceanic and Oceanic Conditions" [24] and "The (possible) confirmation of the first exo-oceans" [1], are papers where conditions, circumstances, and observations were made in close to extremely close up images of an possible exoplanet fitting all of the descriptions in the Gliese 581 star system applicable to the exoplanet in this star system's HZ known as Gliese 581d have been intensely studied from numerous scientific disciplines. The fact that the research Team who intensely studied current known and new consistent areas of evidence pertaining to Gliese 581d, which it was also observed numerous time to also be consistent orbital path for the currently known estimated orbital path for Gliese 581d also allowed the observation of another possible exoplanet in the about the middle of the HZ of the Gliese 581 star system that fits all of the known descriptions that could only apply to Gliese 581g.

In Figure 2 the estimated orbital path is seen for exoplanets c and b. However, the orange arrow points to the previously estimated orbital path made by Udry [29] at originally where Gliese 581d would have been located on the outer edge of the HZ. However, later with many more measurements Udry [29] later revised the estimated orbital path for

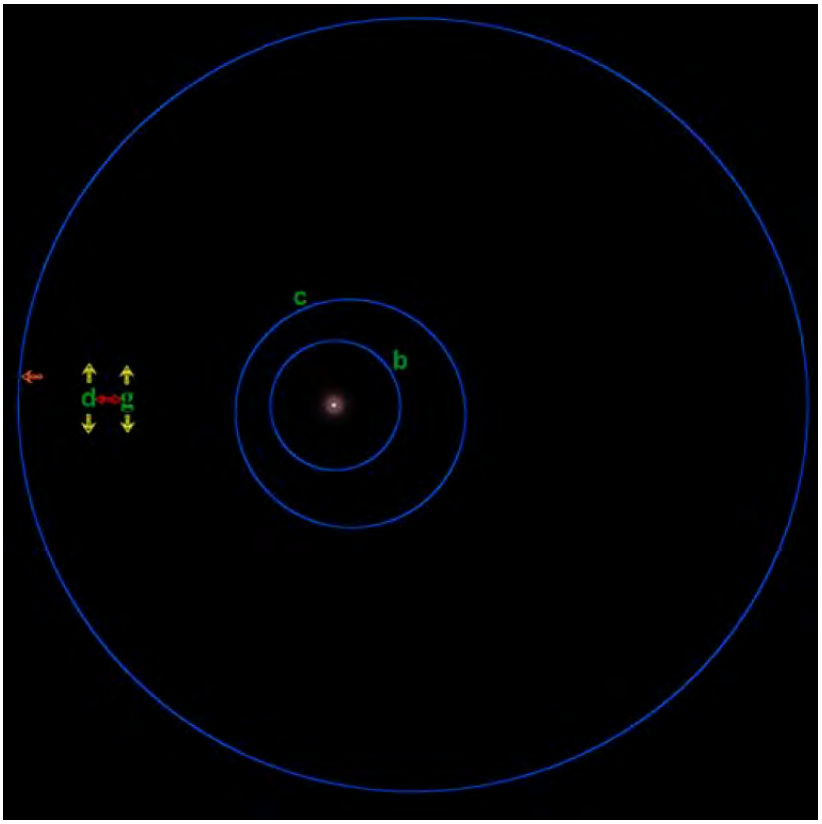


Figure 2: **Gliese 581 star system (Source: Creative Commons License Wikipedia.org 2010-2012)**

Gliese 581d at 67.0 days. Which would place (d) as shown in Figure 2 (where the green colored letter (d) is located in Figure 2), which now according to the latest known estimate would place the location of Gliese 581d at about 2/3's (two thirds) of the way into the HZ instead. Whereas the current estimated physical location for Gliese 581g is depicted in about the middle of the HZ, as depicted Figure 2 where the green colored letter (g) in located in Figure 2. The yellow arrows above and below both Gliese 581d and Gliese 581g depicted in Figure 2 depict the approximate orbital directions that these two exoplanets would orbit around their red dwarf parent star Gliese 581.

It was further observed and estimated by the Gliese 581 research Team as described in R. Stewart "First View of Gliese 581d; A Preliminary Surface Survey (Part 1)" [25] (as shown in Figure 2), that visual observation in the images of the Gliese 581 star system that (as

shown in Figure 2), that the approximate locations and orbital path rotations for Gliese 581d and Gliese 581g is consistent with the latest known data.

The data as shown in Figure 2 is the latest estimated locations and orbital path for Gliese 581d and Gliese 581g. Furthermore, because Udry [29] re-adjusted the orbit of Gliese 581d from 82 days to 67 days, and because Gregory [12] in the: "Six Planet Model" states that there is considerable agreement between the 4 planet model (the 4th planet applying to Gliese 581d) and a 5th planet model applicable to Gliese 581g, as seen in Figure 2. It would make perfect sense, be logical, and reasonable, that because Gliese 581d and Gliese 581g's actual physical locations are only about 7,000,000-11, 000,000 km away from each other as shown in Figure 3.

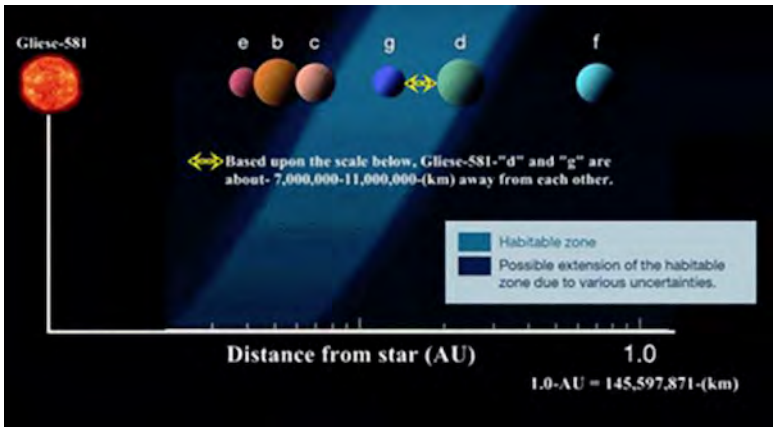


Figure 3: **Gliese 581 star system (Source: Creative Commons License Wikipedia.org 2010)**

In Figure 3 presents and demonstrates Gliese 581g and Gliese 581d as seen in the HZ in the Gliese 581 star system from its parent red dwarf star Gliese 581. The double yellow arrow between Gliese 581g and Gliese 581d as the legend symbol depicts the distance between Gliese 581g and Gliese 581d is about 7,000,000 to 11,000,000-(km) from each other. This also means the following:

(a) As explained in Pepe [18], The Geneva Team states they were not able to detect the existence of Gliese 581g because of a "low RV amplitude signal". However, first what has to be remembered is

that in subheading #3. of item 3.1 of this paper that "In Vogt (2010) preprint", Vogt and his Team explicitly state *"That both sets of data from HARPS and HIRSE were needed to detect all 6 planets in the Gliese 581 star system"*. Why is this another important point?
First of all Pepe and The Geneva Team did not use both of the HARPS and HIRES data sets as Vogt and his Team did. Vogt made it very clear in his 2010 paper that both of the HARPS and HIRES data sets were needed in order to correctly detect these existence of Gliese 581g as an exoplanet. The primary point is that apparently it was a well known fact that if it took both of the HARPS and HIRES data sets to detect the existence of Gliese 581g. In other words, both of the HARPS and HIRES RV technologies combined together would have made the RVM powerful and sensitive enough to detect Gliese 581g's signal harmonics signature in order to give evidence that it existed.
Therefore, because Pepe and his Team only used the HIRES data set this instrumentation by itself was of course not strong enough to pick up the signal it needed to in order to be able to detect Gliese 581g. Second, it would have seemed that if Pepe and The Geneva Team would really wanted to have determine if Gliese 581g was there or not, all they had to be willing to do is simply duplicate the same RVM that Vogt and his Team did with both of the HARPS and HIRES data sets, for the same amount of time duration as Vogt and his Team did. "If" at that point they were able to disprove by Vogt and his Team's own methodologies that they were in error, "then at that point in time", they could have reported what their results showed Vogt to be in error. This would seem to be the appropriate way to disprove Vogt by exactly duplicating his own scientific methodologies exactly by the way he and his Team had approached it. This could have helped prove the existence of Gliese 581g's to a greater degree or not.

(b) Second, because the Gliese 581 star system is 20.3 LY from Earth it that when using just the HIRES instrumentation by itself may barely be strong enough to pick up an amplitude signal as large as Jupiter or larger gas giants within a solar system, including that of Gliese 581 in like manner. When exoplanets are more Earth sized or just a little larger than Gliese 581g or Gliese 581d, by itself the HIRES instrumentation may not be strong enough pick up the amplitude signal of smaller exoplanets larger that the

approximate 2.2-3.1M⊕ and about 1.3 to 1.5 times larger than Earth according to Vogt [31].

(c) A third point to consider is that the Geneva Team only used the HIRES instrumentation. Considering that Gliese 581g and Gliese 581d are likely only 7,000,000 to 11,000,000 km away from each other, what also has not been considered is that it would have been possible that sometimes the signal amplitudes between detecting Gliese 581g and Gliese 581d became mixed up. By The Geneva Team only using the HIRES instrumentation by itself, at times Pepe and his Geneva Team may have believed they were picking up signals from Gliese 581d, when in actuality they were really picking up an amplitude signals from Gliese 581g instead, and vice-versa. Because of these two exoplanets locations, and orbital paths being too close together for the HIRES instrumentation to detect correctly. Because by itself the HIRES instrumentation is not powerful and sensitive enough to pick up the signal of each exoplanet because their physical locations and/or orbital paths are just too close together. However, when considering the methodology that Vogt and his Team took it correctly measured the existence of Gliese 581g as he originally had reported in Vogt [31].

4. Therefore also when Anglada-Escudé [2] present in his paper a detailed discussion when it comes to the orbits of both Gliese 581d and Gliese 581g, when it first comes to the 67 day planet Gliese 581d orbital cycle their paper shows that Gliese 581d produces a harmonic signal near half that period of 33.5 days, relating to the orbital rotational cycle of Gliese 581g. The period of Gliese 581g reported by Vogt [31] is 36.56 days, and one of its yearly aliases occurs near a period near 33.2 days. Because this yearly alias of planet Gliese 581g lies close to the eccentricity harmonic of the 67 day planet Gliese 581d, Anglada-Escudé [2] present suggest that the signal from planet Gliese 581g can be partially or even totally absorbed by the eccentricity of planet Gliese 581d.
[2]

Such consistency is verified again in Anglada-Escudé [2] which shows that they carried out statistical tests to quantify these interactions and calculated False Alarm Probabilities (FAP) of 0.11% and 0.03%

[2]This would be consistent with the very close distance in physical location that Gliese 581g and Gliese 581d are away from each other. In likely not only very close proximity location, but in their orbital paths as well.

for the signals associated with Gliese 581g. They also concluded that the presence of Gliese 581g is well supported by the data presented by Mayor [16] and Vogt [30]. Vogt [31] also goes on to show that the additional 60 HARPS measurements cited back in October 2010 by Pepe [18], plus another full observing season of data were released in September 2011 by Forveille [11], brought the total number of published HARPS velocities for Gliese 581 to 240. The release of Forveille's data, essentially doubled the amount of high precision HARPS data publicly available since Pepe [18] and Forveille [11] presented Keplerian models to that data set. Like Pepe [18], they also chose to exclude all HIRES data from their analysis to avoid any risk of being misled by subtle low-level systematics in one data set or the other.

Forveille [11] presented two multi-planet Keplerian models to this HARPS only data set. The first was a four-planet model with the eccentricities of all orbits allowed to float. These complications are described in detail by Anglada-Escudé [2] and they also go into considerable detail that the eccentricity harmonics of a known exoplanet such as in the case of Gliese 581d can sometimes mask the signal of other planets near half of that planet's period like Gliese 581g. Further describing how any fltting sequence for the Gliese 581 system that proceeds sequentially in order of signal strength (as all previous modelers, including the Bayesian studies have done) would be subjected to the same principles and would produce the same results as aforementioned.

4 New Data by Vogt 2012 Supporting the Existence of Gliese 581g

Vogt [31] presents a significantly extended and goes into much deeper comprehensive detail in a re-examination of he and his Teams original Vogt [31] analysis and very significantly expands their previous HARPS 2011 radial velocity data set for Gliese 581 for the existence of Gliese 581g above and beyond what Forveille [11] presented. Their analysis reaches substantially different conclusions regarding the evidence for a super and RMS values only after removing some outliers from their models and refitting the trimmed down RV set. They denote that after an additional 4,000 N-body simulations of their Keplerian model all resulted in unstable systems in the methodologies approached by Forveille [11] and revealed that their reported 3.6 s detection of e=0.32 for the eccentricity of Gliese 581e is manifestly incompatible with the system's dynamical stability. More evidence that Gliese 581g is in Gliese

581 star system.

However, Vogt [30] also reports duplicating the same type of model that Forveille [11] projects as a Keplerian Earth-mass planet in the star's Habitable Zone. In the paper by Vogt [30] reports being able to reproduce their reported model. However, when it was integrated only over the time baseline of the observations, significantly increases and demonstrates the need for including non-Keplerian orbital precession when modeling the Gliese 581 star system.

Again Vogt [30] found that a four planet model with all of the planets on circular or nearly circular orbits provides both an excellent self-consistent fit to their RV data and also results in a very stable configuration. In this paper the Gliese 581 Research Team agrees with this and contends that Vogt's experimentation of the duplication of the periodogram of the residuals to a 4 planet all circular, to near circular, orbit model reveals significant peaks that suggest one or more additional planets in this system. In this paper we would also like to report that in agreement with Vogt's 2010 and 2012 papers that the Gliese 581 Research Team observed in images to extreme close up images what resembled circular, near circular, like orbits for Gliese 581d.

While Stewart [22] reports in his article that when first performing a rudimentary Gliese 581 survey in the summer to fall of 2011 observed that what have the same strikingly close orbits for Gliese 581e, Gliese 581b, Gliese 581c possible exoplanets he observed in similar images that these exoplanets seemed to exhibit the same circular-near circular and/or combination circular and some what elliptical orbit for these exoplanets in this star system. However would characterize more closely that the exoplanets in the Gliese 581 system follow more closely a circular, near circular, orbital paths.

This paper also agrees with Vogt [30] with their re-evaluations with the total 240 point HARPS data set, that Gliese 581 has fully self-consistent stable orbits, by and of itself does offer significant support for a fifth signal in the data with a period near 32 days. This signal has a False Alarm Probability less than 4% and is consistent with a planet of minimum mass $2.2M\oplus$ orbiting squarely in the star's Habitable Zone at about 0.13 AU, where liquid water on planetary surfaces is a real distinct possibility on Gliese 581g.

Figure 4 depicts a view of primarily Gliese 581d and Gliese 581g as seen in orbit around their parent red dwarf star Gliese 581. The yellow square is a

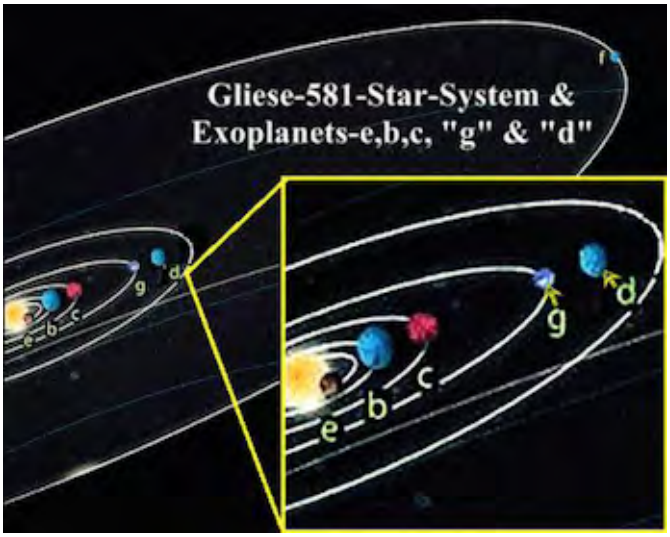


Figure 4: **Gliese 581 star system (Source: National Science Foundation, U.S.A.)**

projection to enhance as a visual aid and updated locations for Gliese 581g and Gliese 581d's orbital paths.

Figure 5: **Gliese 581 star system (Source: Author)**

At the middle top of Figure 5 is an image of the Gliese 581 star system. The double red arrow depicts in the Gliese 581 star system how close Gliese 581d and Gliese 581g are actually located to each other as described in both

Stewart [25] [24]. Gliese 581g is projected in the left bottom corner of Figure 5.

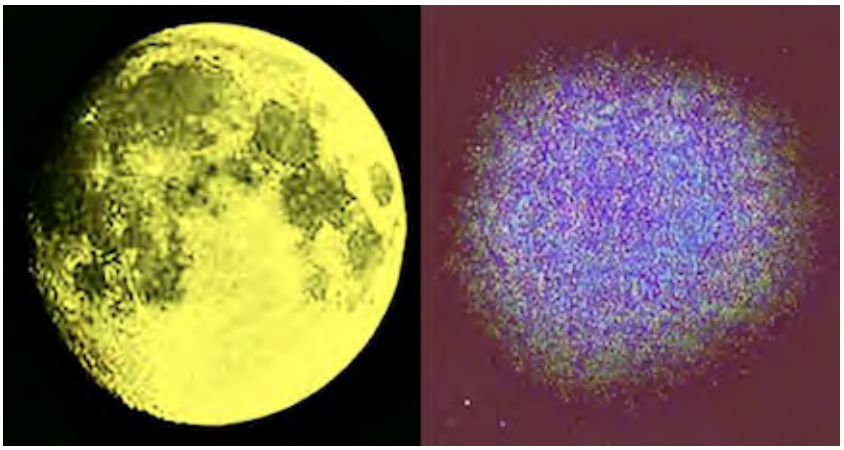


Figure 6: **Moon and Gliese 581g (Source: Author)**

Figure 6 (Left) depicts one of the last phases of Earth's moon before it becomes either a Full or New Moon. Trentadue [27] discusses that when examining exoplanets in other star systems, it is not that much different than how the Earth's Moon transitions itself from about twenty-nine different moon phases every month. This is also true with planets, planetary bodies in our solar system, and exoplanets. (Left) imaging evidence shows Earth's Moon in its last phase before either becoming a full or new Moon. Right image is Gliese 581g also in its last phase before the full circular form of Gliese 581g can next be seen. In both images (in the upper top left corners), both Earth's Moon and in Gliese 581g (both exhibit the same phases). Which have not quite yet reached their (Full and/or New Moon or planet phases) which in the next phase would develop into a full circle shape for either Earth's Moon and Gliese 581g. Proved again in Figure 7. Earth's moon compared to Gliese 581-b's moon.

In Figure 7 is a second example from the Gliese 581 star system. On the left is Earth's Moon in its last quarter half moon phase. Right is possibly the "Moon of Gliese 581-b". Stewart [22] and Antal [3], both Earth's Moon and that of Gliese 581b, have very similar *"last quarter half moon phase-like features and characteristics recognizable imaging patterns when compared side by side to each other"*. As seen in the Figure 6 of Earth's Moon and Gliese 581g. These are just two of numerous comparison examples discovered in the

Figure 7: **Moon and Gliese 581g (Source: Astronomical Applications Department of the U.S. Naval Observatory and the Author)**

Gliese 581 star system that could be given in comparison. The Authors of this paper has named these types of planet, planetary and exo-planetary phases: *"Planet, Planetary Body & Exo-Planetary Phase Pattern Characteristics"*.

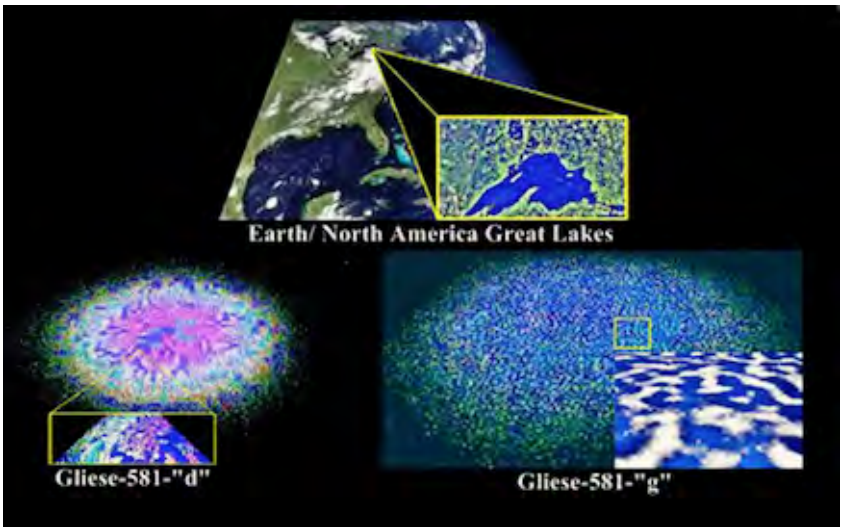


Figure 8: **Gliese 581d, Gliese 581g and Earth Views (Source: Author)**

The top of Figure 8 is an image of the Earth and an enlarged projection of North America and one of The Great Lakes and many smaller bodies of water surrounding each one of the Great Lakes. In like manner, such is the case upon the topographical surface terrain of Gliese 581d (seen in The left bottom corner) and enlarged projection. Extreme close up images of the surface of Gliese 581d was intensely studied by its research Team involving numerous scientific disciplines such as astronomy, astrophysics, cloud dynamics, meteorology, geology, geophysics, vulcanology, glaciology, oceanography, oceanic engineering and imaging.

The Research Team was further able to determine studying these extreme close up of Earth, Gliese 581d and Gliese 581g that like previous data and modeling strongly suggested that Gliese 581d may have a large ocean upon it. However, imaging evidence shows a number of large oceans and many smaller seas. Much like the conditions that may have existed on Earth millions of years ago when Earth was a "snowball and/ or neoproterozoic like Earth" (without any connotation referring to possible astrobiological life). That the topography and terrain is made up of many small seas and oceans, seen for example around the Great Lakes of North America on Earth. It was also determined that it is very likely that Gliese 581d is also made up of several different kinds of tectonic volcanic activity. Such as what resemble imaging-wise resemblances to strata, Icelandic, significant volcanic activity. This is important as far as adding to a CO_2 Greenhouse affect within the exoplanet's atmosphere with Gliese 581. Where as the first primary source as infrared sunlight and other stars infrared and other types of sunlight could produce enough CO_2 gas to create a greenhouse affect upon this exoplanet.

When studying these type of comparative images over and over again, it's hard to deny that such images resembled images of volcanic activity on Gliese 581d as has striking similarities to images of volcanic activity on Earth. Therefore, the research Team concluded what is apparently a very active state of volcanic activity on Gliese 581d that a considerable amount of CO_2 gases are additionally released into Gliese 581d's atmosphere. With the primary CO_2 contribution from the red dwarf' infrared sunlight causes a greenhouse affect. Making it warmer on this exoplanet than previously thought. Enough so, to where evidently the ice melt as it has for likely millions of years contributing to Gliese 581d's many of its large oceans and seas. Which most likely has also been the case on Gliese 581g as well. A second example of comparing some of the images to similar conditions that would be seen on Earth would be areas on Earth like what is seen in and

around the North pole and extreme far northern reaches of Canada. When these extremely close images of the surface of Gliese 581d were compared to cold environmental conditions on Earth, there were many similar and strikingly similarities.

In like manner, Gliese 581g has many similarities to Gliese 581d. However, it is evidently warmer and there are higher rocky mountains and mountain ranges than the flatter looking topography as seen on Gliese 581d.

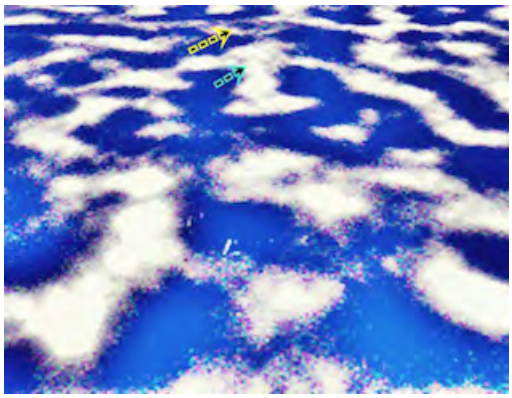


Figure 9: **View of Gliese 581g Surface (Source: Author)**

Figure 9 is an extreme close up view of Gliese 581g. In the image above depicts looking down at the surface terrain from at least 60-70 km above Gliese 581g's surface. The aqua arrow points to a rocky ice shelf, and the yellow arrow is a mountainous surface terrain. Both will be seen at much closer views in Figures 10 and 11. The blue areas are water. It appears that Gliese 581g is warmer, more rocky, and has mountains higher than Gliese 581d which has more of a flattened plateau like terrain. The diameter of the area (the width of the image above) is approximately 80-100 km in diameter. The area where the yellow arrow points to is about 8-12 km in diameter.

Figure 10, depicts examples of the topographical surface terrain of Gliese 581d. Which is more flat plateau like ice shelves, fjord-like sea cliffs with ice caps on top of them and series of many inter-connected chain-like islands.

Unlike Gliese 581d in Figure 11 the topographical surface terrain is not as flat. However, the imaging evidence depicts that Gliese 581g also has many surface areas of bodies of what may be very large oceans that have as

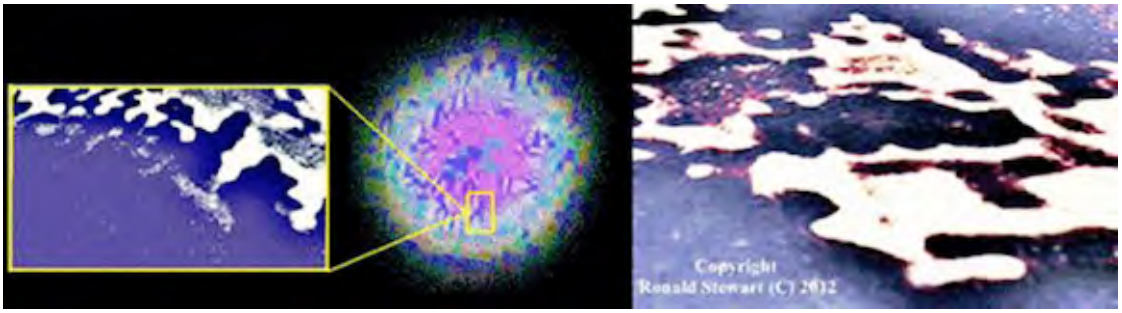


Figure 10: **View of Gliese 581d Surface (Source: Author)**

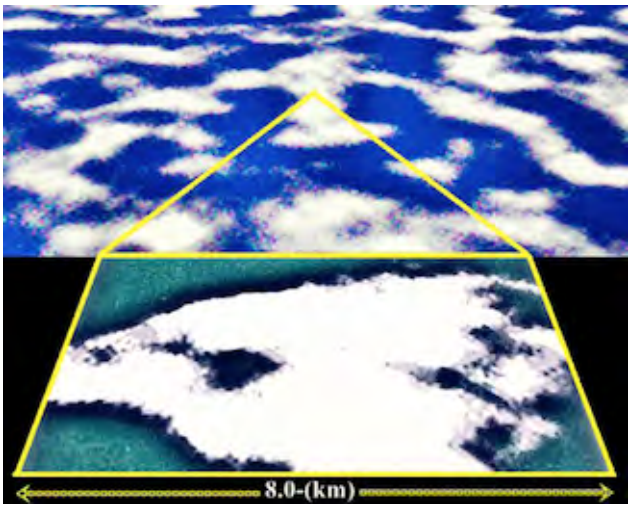


Figure 11: **Views of Gliese 581g Surfaces (Source: Author)**

seen in the top image very elongated inter-connected land masses that are not exactly like Gliese 581d 's many inter-connected chain like islands. The surface terrain of Gliese 581g is composed of rocky, mountainous, plateau, and ice shelf like surface terrains.

Whereas the surrounding water from as high as 60-75 km above this exo-planets surface takes on a deep blue appearance. However, when attaining much closer views of Gliese 581g's topographical surface terrain, the water is green-blue in color. Unlike Gliese 581d 's gray-blue color as depicted in figure 10.

The top of Figure 12 is an extreme close up image of a rocky plateau like ice shelf on Gliese 581g. The green area depicts water. An enlarged projection of the coast line of this surface terrain is seen in the bottom image. In the

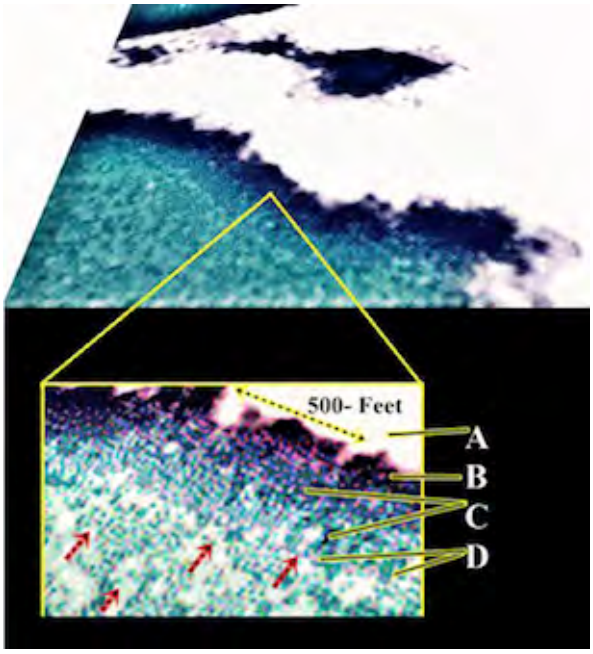


Figure 12: **View of Gliese 581g Surface (Source: Author)**

upper top left corner of the bottom image an approximate measurement scale depicts the size of the surface terrain seen in the projection which is about 150 m in diameter. The red arrows depict the direction of the oceanic wave currents toward the shoreline. The white colorations resemble large amounts of sea foam. (A) depicts the top of the ice caps on top of (B) the pink vertical pink sea cliff wall, which is about 23 m in height. Where at the bottom meets (C) the blue and multi-colored rock slants downward in a gradual declining and sloping embankment. Which next meets (D) the oceans waves at the shoreline.

In order to have a correct understanding of the oceanic conditions on Gliese 581g with this type of surface terrain, there has to be some examples to be able to compare on Earth. So, that similarities and resemblances that are known on Earth may help a person identify with, and relate to similar surface terrain features, and oceanic conditions also seen on Gliese 581g in figure 12.

This may be better understood when considering the book written by Moskalski "Spume Island" [17]. Which discusses the causes for "Sea Foam". In order to help a person attain a deeper understanding and insights as to the surface conditions on Gliese 581g we use an example and explanation

from Moskalski's book. So a comparison may be made on Earth, compared to the surface conditions on Gliese 581g. There is an island that is very near the coastline of the Antarctic Peninsula named "Spume Island/Sea-Foam Island". In 2009 NASA's, satellite images included an orthographic projection of NASA's Blue Marble data set (1x1 km resolution global satellite composite). Scientific experiments and numerous oceanography and glaciology studies were accomplished over many years. This also included using "MODIS observations of polar sea ice which were combined with observations of Antarctica made by the National Oceanic and Atmospheric Administration's AVHRR sensor (Advanced Very High Resolution Radiometer)."

Spume Island is a small, low, rocky island that consists of a sea cliff that is ice capped on top. Which also has resemblances to the land mass and its descriptions of Gliese 581g as shown in Figure 12. At the bottom of the vertical sea cliff the coastline of the island slants downward until it meets the seashore. However, the unusual phenomenon is that when the average high winds up to gale force winds blow against this island striking similarities as to what is seen on Gliese 581g (in the bottom of Figure 12), has many similarities to what happens to the oceanic conditions as seen at: "Spume Island/Sea-Foam Island" [3].

Using this scale, average high winds up to gale force winds equaling an average high wind speeds of 14-17 m/s, would be the minimum wind speed needed to create the same amount of sea foam at Spume/Foam Island as also seen on Gliese 581g. That would create oceanic wave heights of about 4-6 m, using the approximate measurement scale indicated in the bottom image of Figure 12 the wave height for the waves seen in image recognition patterns also measure about 4-6 m in height. Therefore, the imaging measurement recognition patterns seen in the wave height in the bottom image of Figure 12 involving Gliese 581g, is also consistent with the wave height needed at Spume/Foam Island in Earth's oceans to also create the approximate

[3]There is a scientific methodology that measures wind speed on Earth known as: "The Beaufort Wind Force Scale". When using this wind measurement methodology and since average high winds to gale force winds create similar conditions on "Spume Island/Sea-Foam Island", as also depicted, described, and explained in Figure 12, it is also important to understand at what average high wind to gale force wind speeds would create enough sea foam conditions at: "Spume Foam Island" that if photographed would be equal to about the amount of sea foam seen in the bottom image of Figure 12 on Gliese 581g. The amount of sea form created by winds depends blowing over Spume/Foam Island on Earth, would be a determining factor exactly as to how much sea foam is created or not equal to Figure 12.

same amount of foam. Although Gale force winds do reach wind speeds at a maximum of 17-21 m/s, this would create even more sea foam. As observed in images of Gliese 581d the Gliese 581 Research Team did not notice/observe (as of yet) any sea foam possibilities on Gliese 581d, compared to the potential of this as seen most like in Figure 12 of the surface and oceanic conditions as seen in figure 12 of Gliese 581g. Which proposes a very interesting observation. Gale force winds as seen in the evidence of 15-18 m in height on Gliese 581d have not yet been observed on Gliese 581g. This does not mean that sea foam does not exist on Gliese 581d, however is seen on Gliese 581g.

It is also important to note that Stewart [26] staring on subheading entitled *"7.5 Scientific Team Observations Involving Likely-Oceanic Conditions and Activity On Gliese 581d"*, brings up a question for the reader to contemplate on is: "Does Gliese 581d have a climate?" The answer is, that it likely does. First analysis of many observations in the images of the surface of Gliese 581d show very intensely active oceanic conditions and wave activity. A climate would have to be present for the oceans to be active as they most likely are.

It mentions the oceanic currents maintain the distribution of heat and chemicals when a permanent cycle was established. The salinity of the larger bodies of water (seas and oceans) is assumed to be about 30% to 60% lower than 35 ppm, with a circulation determined by the rotation, of largest moon of Gliese 581d and its satellites, that may be in orbit around Gliese 581d about a possible 12,500-18,000 km above this exoplanet's surface. Which may be similar, and could be likened in example as seen in Earth's solar system when it come to the Martian Moons above Mars named Phobos and Deimos. However, if such seas and oceans on Gliese 581d are dominated by a short range of temperatures, than there would seem to be streams and rivers. However, as of yet there have not been any observations of streams or rivers on Gliese 581d. However, this does not mean that they do not exist. They could elsewhere on this exoplanet not yet researched.

Therefore, what is observed and studied rather is most likely only concentrations of chemical components and the high precipitation; so there is a possible existence of differentiation vertically in the masses of large bodies of water when it comes to the oceans and seas on Gliese 581d. However, under the circumstances, it's likely there are many ice-fluids that are also upon the rock mixed with ice-like surface of Gliese 581d the rock-like surface. It is also important to note that it that Gliese 581d had a large moon and other

satellite moon on the southeastern hemisphere of Gliese 581d and that this would also mean that Gliese 581d was not tidally locked. However, because we have not yet seen in this point of the investigation into Gliese 581g that it as of yet a large moon or other satellite moons have not been detected. Does this mean that Gliese 581g is tidally locked with one side of this exoplanet having daylight all of the time and the opposite side would have no sunlight and permanent darkness with exceedingly cold temperatures? No it does not. Why? One strong reason is as this paper presents and demonstrates in the left image in Figure 6 depicts Earth's Moon in one of its last phases before becoming either a Full or New Moon. Again seen in Figure 7.

Stewart [26] also discusses that when examining exoplanets in other star systems, it is not that much different than how the Earth's Moon transitions itself from about twenty-nine different moon phases every month. This also true with all planets, planetary bodies in our solar system which includes other star systems as well. As depicted and described in Figure 6 and Figure 7, in both images (in the upper top left corners), both Earth's Moon and in Gliese 581g (these phases) have not quite yet reached their Full and /or New Moon phases which in the next phase would develop into a full circle. This would mean that Gliese 581g is going through Moon-like/ planetary-like phases and that it has an axis and rotational movement. Which would not be the case if this exoplanet was tidally locked. Just because (as of yet), there has not been one of moons (or satellites) a moon for Gliese 581g does not mean that they are not there. Why? It could just be a matter that the one or moons/ satellites for Gliese 581g could simply be hidden on the other side of this exoplanet. Or, just a matter that as of yet the Gliese 581 Research Team has not yet discovered any moon or satellites above the surface or Gliese 581g and that could be discovered at some point into the future.

The next point is Stewart [26] discusses and shows some similarities in some surface and oceanic conditions on Gliese 581g just like there is on Gliese 581d. However, Gliese 581g is another very unique exoplanet as a singularity in the Gliese 581 star system and there may not be another unique exoplanet like it anywhere in the Gliese 581 star system, and likely in the universe as well. At the writing of this paper it is theorized that Gliese 581d and especially Gliese 581g may be the only two exoplanets in Gliese 581 that are likely habitable. At this point the impression about Gliese 581c is, that planet may be a much warmer exoplanet that Gliese 581d or Gliese 581g and it possibly could have some limited liquid water upon its surface. However, that it is much more teutonically/volcanically active than Gliese 581d or

Gliese 581g, and it is like a more diverse exoplanet to study geologically than Gliese 581d or Gliese 581g is. However, that will be in another subject of discussion in another near future research paper.

Stewart [26] also discusses that ocean and sea wave heights were estimated on Gliese 581d to be on an average of about 15-18 m. Further meaning; that the: "Daily Average Wind Velocity" on Gliese 581d was estimated and compared to wave height. That wind velocities on a daily basis would be at least a have to be above gale force strength between 17-20 m/s. Which could create waves in excess of 15-18 m in height. The gale force wind speeds on Gliese 581d would most likely be considered Minimal Calm Wind Speeds On A Day To day Basis On Gliese 581d. It may not be unusual for wind gusts on an average day on Gliese 581d to reach speeds of 35-50 m/s. Whereas on Gliese 581g, most likely average wind speeds as aforementioned before would be about 14-17 m/s.Which this paper would like to re-emphasize, that this wind speed is the minimum wind speed needed to create the same amount of sea foam at Spume/Foam Island on Earth (as also seen on Gliese 581g) as indicated Figure 12. Secondly, this would also create an approximate ocean and sea wave height of about 14-17 m/s instead. So, in simple terminology the wind and ocean wave conditions on Gliese 581g are only about 1/3 (one third) about what they are on Gliese 581d. Including that Gliese 581g is also warmer than Gliese 581d as well.

5 The Unique Emerald Colored Mountains of Gliese 581g

Trentadue [27], Stewart [22] [25] [26] and Aguiar [1] papers bring to the reader's attention that whether it be a star system close to Earth like Proxima Centauri, or where a recent exoplanet was discovered in Alpha Centauri B, or exoplanets in Gliese 581, the primary point is that each and every exoplanet that exists anywhere in the universe is so unique in its own way, that no two exoplanets anywhere in the universe may be the same. Figure 15 will present and demonstrate that Gliese 581g is also very unique. For on this exoplanet there are several mountains that look as though they are covered in emerald color geophysical sedimentary strata that is simply breathtaking.

Figure 13 is detailed; (1) where the yellow arrow points to is the original location of the emerald colored mountain region upon the surface of Gliese 581g where the next two enlarged projections emit from. (2) inside the first

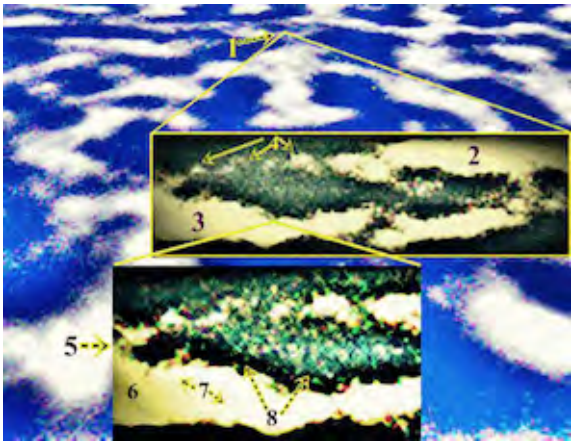


Figure 13: **View of Gliese 581g Surface (Source: Author)**

enlarged rectangular projection is a ice shelf plateau like area that may be as much as four to six thousand feet in height. Whereas (3) appears or could be a dirty ice and snow mixture upon the rocky surface of Gliese 581g. The yellow colored (4) where the yellow arrows are pointing to present and demonstrate where the multiple ice covered mountain peaks are at. Which could be approximately ten to twelve thousand feet in height. (5) points to the next much closer view of these emerald colored like mountains. Which apparently have peaks and in some ways are much higher in elevation that the flat appearing terrain on Gliese 581d. (6) depicts and even much closer view of what may be a mixture of dirty ice and sedimentation. Where (7) shows the ice covered rocky areas at the base of these mountains. It appears that from the distance. Whereas (8) depicts in great detail and quantity what may be geological strata that is very abundant in emerald colored like quartz as on Earth example in Figure 14. The red/ yellow spots are likely lava/sulphur deposits.

Figure 14, as seen in Figure 13, there are several emerald colored mountains on Gliese 581g. Which most likely the geophysical structure is not made up of precious or semi-precious stones like Emeralds. For there are a number of other types of mineral geophysical stratas on Earth to compare with, that have a emerald-like precious stone appearance. Rather, these emerald-like colored stones on Earth are minerals that are made up of a geophysical composition for example like: "Emerald Colored Beryl Quartz and/or Chrysocolla Quartz" properties, as seen in the image to the right.

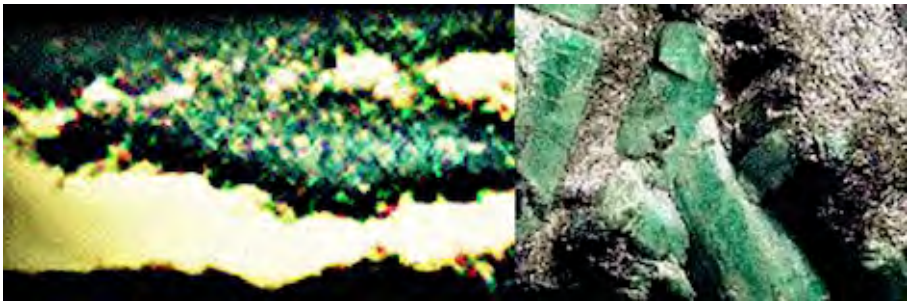
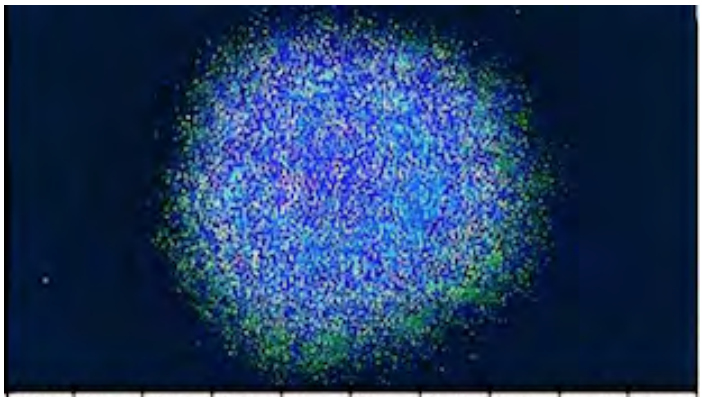


Figure 14: **View of Gliese 581g Surface and a Mineral Earth Sample (Source: Author and www.mineralminers.com)**



GJ-581 "g" Data	Orbital Distance AU	Orbital Period P=days	Orbital Inclin.	Mass Earths	Diam. Earths	Radius Earths	Surface Gravity (g)	Low/Hi Temp. (F)	Aver. Temp. (F)
Known Data	0.146	32.0	40-85	3.1-4.3	1.5	?	1.3-2.0	-37- +10 (F)	?
Updated Data	0.146	32.0	40-85	3.1-4.3	1.3-1.5	0.65	1.1-1.7	-25-+40 (F)	+35 & (Above)

Figure 15: **Gliese 581g View and data (Source: Author)**

Figure 15, The known data for Gliese 581g, is based upon Vogt paper [31]. According to this paper it is estimated the average global equilibrium temperature (the temperature in the absence of some types of atmospheric effects) of Gliese 581g range from 209 to 228 K. However when taking into consideration that this paper is estimating no doubt the affect of some CO_2 greenhouse affects upon this exoplanet from the infrared sunlight coming into Gliese 581g the temperatures would be about 236 to 261 K. However, in an article by Stephens [21] and according to Pierrehumbert [19] Gliese 581g is in an orbit where a CO_2 weathering thermostat can operate, and this can lead to accumulation of sufficient carbon dioxide in the atmosphere to permit liquid water to exist at the surface, provided the planet's composition and

tectonic behavior can support sustained out gassing.

In other words, the infrared contribution of the Gliese 581 red dwarf parent star provides some CO_2 in the atmosphere of Gliese 581g. However, additional factors volcanic/teutonic activity would have to also be enough to provide enough warmth to the Gliese 581g atmosphere for liquid water to be able to exist above 273 K. Or else the state of Gliese 581g would not have liquid water but just ice. So, even at a certain point the temperature would have to stay above freezing long enough to maintain a balance of maintaining liquid water upon Gliese 581g 's surface. By comparison, Earth's present global equilibrium temperature is 255 K, which is raised to 288 K by greenhouse effects. However, the Sun's energy output is thought to have been only about 75% of its current value, Two previously discovered planets in the same system, Gliese 581c and Gliese 581d (inward and outward from planet Gliese 581g respectively), were also regarded as potentially habitable following their discovery by Udry [29].

Whereas when Figure 8 is again re-examined it is known that some of the green colored areas on Earth (as seen a the top middle of the image) is vegetation and that CO_2 it provides in Earth's atmosphere. However, when similar green areas are seen in extreme close up views on the topographical surface terrain of both Gliese 581d and Gliese 581g, this is mostly different types of ice. Similar as would be seen in the colder environments of Earth. Which could also be likened to another Stewart paper [25]. Starting with Figure 5 to Figure 8 in this paper describes how at one time Earth's oceans may have theoretically have formed from carbonaceous chrondrite meteors/meteorites over billions of years and unlike Earth of today where as shown in Figure 8 of this paper where some of the green areas could be vegetation that allow the CO_2 in Earth's atmosphere to be absorbed by Earth vegetation and in turn expel oxygen. However, in the left bottom corner Gliese 581d also has green colored areas similar as also seen in the images of Earth. However, it is more likely that on both Gliese 581d and Gliese 581g if there is any current oxygen in the atmosphere of either of these two exoplanets, as shown by Stewart [25], that Earth likely has greater quantities of oxygen than either Gliese 581d or Gliese 581g. As explained before, Earth's early developmental stages allowed oxygen to develop primarily by meteor/meteorite strikes on the Earth and eventually volcanic gas accumulation over time. Likely any additional oxygen in the atmospheres of either Gliese 581d or Gliese 581g developed over time. Whereas Earth's greater quantities of oxygen developed through the discharge of oxygen through its vegetation, etc.

6 More Incoming Infrared (IR) Sunlight In The Gliese 581d Star System Then Previously Thought

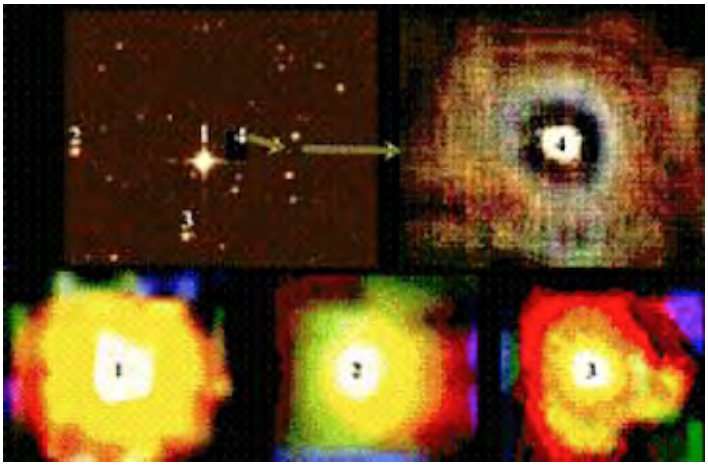


Figure 16: **Views of Dwarf Stars (Source: Author and ESO/2007)**

Figure 16 (1) shows Gliese 581. When Figure 2 is reviewed again, it was discussed and made known by Shiga [20] in an article in "New Scientist", that in a star system just a little further away from Earth than Gliese 581, that in a star system known as HD-3651, that there was a small brown dwarf star named HD-3651b in the same solar system as HD-3651 went undetected for years, after a previous exoplanet near HD-3651 was also discovered several years earlier. The point is, that if the small brown dwarf star known as HD-3651b could go undetected for years in the HD-3651 star system, than it is also very possible that other similar like stars near the Gliese 581 star system could go undetected as well.

Matter of fact, Stewart [25] uses the same images seen in Figure 16 appear in this paper as well. In the upper top left corner of Figure 16, the star marked (4) is a brown dwarf star. In the original image it was undetected until the Infinite Microscopic-Macroscopic Imaging (IMMI) technology was applied to this image. Evidently it went undetected as well. However, can be seen in great detail in Figure 16. Therefore, four stars are depicted in the images in figure 16. In which all four stars are also enlarged as they appear in true color starting in the upper top left corner and at the bottom of Figure

16. Stars (2) and (3) are two more stars imaged by the IMMI technology (in addition to the Gliese 581 parent star) Stars (2) and (3) may also be red dwarf stars like (1) Gliese 581.

These three (or more) red dwarf stars, is new imaging evidence, that there is more IR sunlight coming into the Gliese 581 star system than previously thought and known. Therefore, this new data could additionally mean that there could be even more undetected red dwarf star stars in and around Gliese 581 than previously thought or known. This also does not include other brown dwarf stars as depicted in (4) in Figure 16 that could be undetected around and/or adjacent to the Gliese 581 star system that could be contributing additional sunlight into the Gliese 581 star system, and could be applicable to red dwarf star and other systems in like manner.

This could make the exoplanets especially in the HZ warmer than previously thought. This would not only create additional CO_2 in these exoplanet's atmospheres, but when combining this with additional tectonic or/and volcanic activity upon the surfaces of Gliese 581d could maybe make it habitable to a point, but certainly not as much as could be seen upon Gliese 581g. However, in order to fully determine this further studies need to be made upon more of the surfaces of both Gliese 581d and Gliese 581g as HZ exoplanets. The next subheading will help in being able to further determine not only more of the conditions on Gliese 581d but also Gliese 581g.

7 Magnetic Field, Thermal, CO_2, Cloud Cover, Water Vapor, Ice and Liquid Water Estimations On Gliese 581d

In Stewart paper [25], Figure 17 is depicted and explained much as it will be in this paper about Gliese 581g. The point to make here about some of this same data is because if pertinent data about the atmosphere and surface conditions of Gliese 581d are presented and demonstrated in this paper, since Gliese 581d most likely has water, and because the accumulative evidence shows that Gliese 581g is warmer and has even more large bodies of liquid water such as oceans and small seas than Gliese 581d. To present some of this data again in this paper makes it more readily convenient to help understand Gliese 581g better since its warmer, has more water than Gliese 581d. making Gliese 581g in a better position than Gliese 581d to be

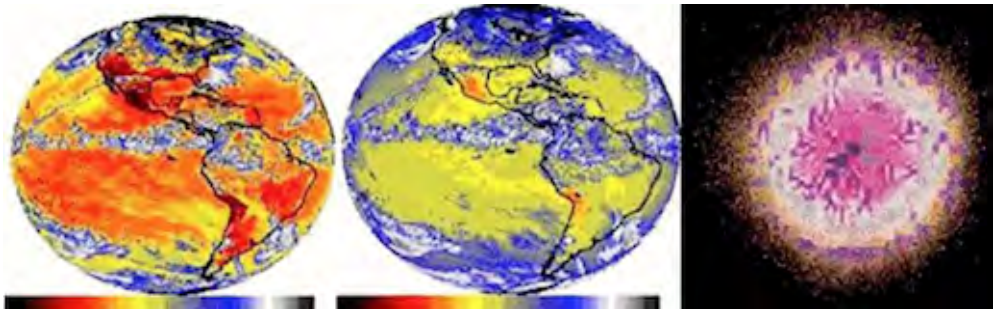


Figure 17: **Views of Earth and Gliese 581d Surface (Source: Author and NASA)**

maybe be a more potentially habitable exoplanet, especially since it is about in the middle of Gliese 581's HZ.

When Figure 17 is studied above it shows that the estimated magnetic field for Gliese 581d (image to the far right), is compared to Earth (in the first two images to the left), presents and demonstrates a comparison of Earth taken by the NASA Geo-Stationary-Operational-Environmental Satellite (GOES), demonstrating in color coded sequences the thermal and CO_2 levels on Earth. In like manner, the IMMI imaging technology uses its thermal, near-infrared, and infrared capabilities to determine the thermal and CO_2 levels on Gliese 581d as well. as shown in the far image to the right.

Just like the NASA GOES, the IMMI technology has the capability to duplicate in similar Raleigh scattering color spectrum sequences near-infrared and infrared, thermal and other to detect what the thermal, CO_2, water vapor, ice, cloud cover, and limited magnetic field capabilities would be on Gliese 581d as well. Which in some ways has similarities as seen in some types of LIDAR remote sensing and imaging technologies do in like manner. More discussion on the IMMI technology may be found in considerable detail near the end of this paper.

In similar ways, just like the GOES satellite can calculate the Earth's magnetic field, CO_2, cloud cover, water vapor and other atmospheric conditions of the Earth, in like manner the IMMI technology has the capability of determining in an image of an exoplanet that uses "Virtual Reality Modeling Images" to also diagnose the thermal, CO_2, water vapor, ice, cloud cover, and limited magnetic field capabilities would be on Gliese 581d. Than as shown in Figure 17 a comparison is made with Earth in order to determine

in what similar kinds of ways Gliese 581d may resemble different aspects of habitability as would be seen on Earthy as well.

The IMMI capabilities show Gliese 581d's surface areas such as (red) as the hottest thermal surface areas, followed by (Rose) colored surfaces, while (Purple Areas) indicate surface water, (Gold) surface areas depict CO_2 levels, (White) cloud cover or H_2O as ice, and the (Black) surface areas mostly indicated in these regions seen in black would represent the coldest regions of this exoplanet.

Which are observed at being mostly in the North and South Pole regions of this exoplanet. Estimations were given that the purple to blue primarily represent water. As had been verified when making close observation investigations of these areas in extreme close ups of this exoplanet's surface. This is the first example where scientifically acceptable estimations have been made on the surface of Gliese 581d. It is estimated by these comparisons between Earth and Gliese 581d being an: "Earth-like to Water World like" exoplanet has approximately about 0.667% of similarities as may be seen of Earth when it was in some where between its first and second snowball-like periods in Earth's ancient history. However, at the same time the Gliese 581d Research Team also believe that Gliese 581d is also going through a transitional climate period in its current similarities to Earth as well.

8 Other New Unknown Contributing Factors That Contribute To The Warm of Earth, Gliese 581d, and Gliese 581g In Similar Cold Environments

Besides the Earth on both Gliese 581d and Gliese 581g due to the infrared sunlight coming into both Gliese 581d and especially Gliese 581g's atmospheres creating CO_2 and it being retained into both of these exoplanet's atmospheres, according to the original paper by Vogt [31], there are more reasons why both Gliese 581d and Gliese 581g are warmer. This paper has discussed as shown in Figure 16 that there are more stars that may be letting in additional sunlight into the Gliese 581 star system. This is new data not found in other papers than the Gliese 581 Team has written together on this as co-authors. Furthermore, since there could be more than just a total of 4 stars letting infrared sunlight and/or additional other types of sunlight into

the Gliese 581 star system, this has to also be taken into account. At the writing of this paper, there is supplemental material videos made by Stewart, the links are in subsection 10.2.

It is suggested and recommended that you watch these videos. For not only does they present and demonstrate viewing actual extreme close ups of Gliese 581d and its largest moon and some of its satellite moons in the first video, which would also have an affect on the conditions on Gliese 581d and it's oceans but on everything affected on this exoplanet as well. Whereas the second video shows extreme close up images of the surface of Gliese 581d and the conditions that help contribute to it being a warmer exoplanet than previously though and/or expected in the known data. Where as these videos: (Parts 1-3) explain/ describe in greater depth past this paper the conditions on Gliese 581g.

Stewart [26] presents very detailed observations and studies are made by the Research Team give evidence to an assorted type of different oceanic conditions that exist not only in the large and small oceans, and seas on the surface of Gliese 581d. Having a number of but similar oceanic dynamics. laws of physics, and empirical laws as seen on Earth. However, when looking at Gliese 581d, it has its own unique oceanic conditions unlike Earth's oceans. However, when it comes to Gliese 581d which is further away from its parent star Gliese 581, and since all of the accumulative evidence shows that Gliese 581d has oceans this would mean that in summer months of June, July and August the average surface temperature would have to be 273 K or above for liquid water to exist on Gliese 581d 's surface. As also shown in considerable detail in Figure 15.

In Figure 15 under the "Low/High Temperature" data for Gliese 581d in the known data low temperatures were estimated according to "Science question of the week", Goddard Space Center/NASA. The North Pole is significantly warmer than the South Pole because it lies at sea level in the middle of an ocean (which acts as a reservoir of heat), rather than at altitude in a continental land mass. Summer temperatures (June, July and August) average around the freezing point 273 K. The highest temperature yet recorded is 278 K.

However, what has been additionally discovered is that as the hottest summer months on Earth in and around the Arctic region when the ice begins to crack and break apart water vapor and other gases trapped in the ice

actually tend to make the air in and the ice warmer and release of these gases for the entire Attic region provides additional warmth when according to different Arctic region locations. Before 2013, it was not known that there is such a large amount of variability in climate across the Arctic, but all regions experience extremes of solar radiation in especially the warmest summer month of June. Especially applicable to July and August of every year. Furthermore, it has also been found summer for example the average July temperatures range from about 263 K to 283 K, with some land areas occasionally exceeding 303 K in summer. This also creates an underlying amount of warmth of the water under the ice and the water is warmer that the ice itself.

In the previous paragraph was applicable to the frozen part of the Earth that has many similarities to the conditions on Gliese 581d to some extent and much more applicable to Gliese 581g since it is warmer than Gliese 581d. However, discussing the new data in the previous paragraph when putting this into perspective and relative to the oceanic dynamics in these colder regions, this data needs to further be put into deeper perspectives regarding Gliese 581d and Gliese 581g.

Since this paper mostly discusses Gliese 581g when putting this new data into perspective for Gliese 581g this is new additional data that certainly if this happens on Earth in a number of cold places on Earth that also have many similarities to Gliese 581d and Gliese 581g, when it come to applying this new data to Gliese 581g and since it is warmer than Gliese 581d, as far as Figure 15 is concerned that the previously estimated low and high temperatures for Gliese 581g need to be updated and revised. Meaning; that certainly if such conditions happen on Earth than since the same type of laws of physics and oceanic empirical laws no doubt apply on exoplanets that may have oceans just as well as they do on Earth, although they most likely have their own unique conditions, than there is no need to believe that these same laws of physic and oceanic empirical laws should not also apply to Gliese 581d and especially Gliese 581g which may have more water than Gliese 581d or maybe even the Earth itself. Since Gliese 581g is larger than Earth, which could allow it to has larger volumes of water upon its surface. As seen also in Figure 8.

Therefore, in Figure 16 the estimated low and high temperatures of and average temperatures in Vogt's paper [31] are higher than previously estimated. The previous estimated low and high temperature for Gliese 581g

was as low as 235 K and as high as 261 K, and the average temperature was simply not known. However, due to the updating of this paper and new data that has been revealed it is suggested and proposed that the low temperatures for Gliese 581g would be about 241 K and may be as warm as 278 K. That the average temperature on Gliese 581g would be likely just a little above freezing to maintain liquid water and may be anywhere from 275 K and slightly warmer.

9 The Contributions of Oceans Salt Water May Add Warmth to Gliese 581d and Gliese 581g's Atmospheric Warmth

Besides the additional reasons given before as to why both Gliese 581d and Gliese 581g are considerably warmer as exoplanets than previously known. What has also never been thought of, recognized, or even realized, is that just like in the frozen reaches of some of the coldest surface locations on Earth that have a number of similarities to striking similarities like what is also seen upon the surfaces of Gliese 581d and Gliese 581g, both "Oceanic and Sea-Saltwater" liquid bodies of water may additionally contribute to Gliese 581d and Gliese 581g's atmospheric warmth just like it does on Earth, with more variability and diversification than previously realized". All factors that could contribute to this have to be taken into consideration.

First of all a simple H_2O water test can be done to make a point here. The author of this paper took two laboratory flasks and filled both of these about half of the way with fresh water and seawater from the Gulf of Mexico. This has to be done a number of times in order to get an average. In this experiment it has to be made sure that a person boils the same amount of fresh water and sea water and equally as close as possible records the time it took each time the simple experiment was carried out.

The ending results out of 10 experiments was that saltwater boiled faster than the fresh water. I did an experiment on this for my science project and it was saltwater that boils easier. If you do this experiment you have to do it multiple times to make sure you get the average. Evidently, it simply boils faster, because it has more particles which makes it warmer. For example, this can be closer identified with and related to by the use of this simple illustration. When person exercising wears sweat pants, they get warm as they exercise. Therefore, when a person wears less clothing, it take longer

to warm up. Just like the particles. More particles implies more heat and Less particles implies less heat. Therefore, in like manner as the warmth of the oceans on Earth that are around colder environments of landmass and ice the water especially under the ice can create much warmer water which like on Earth can add to the warmth of our planet. In like manner, since the laws of physics evidently work the same throughout the universe no less should be expected on Gliese 581d and Gliese 581g having oceans. Since Gliese 581d and especially Gliese 581g may have more water on them as may also be seen by the imaging evidence as shown in Figure 8, especially when it comes to Gliese 581g, because its larger than the Earth there may be greater variability and diversification in the warm waters under the ice on Gliese 581g since there is also more water volume on this exoplanet when compared to Earth and Gliese 581d.

What also has to be considered is since Gliese 581g may be only 7,000,000 to 11,000,000 km closer to Gliese 581 d, and its parent star, when considering all of the aforementioned conditions that make Gliese 581d have surface water and that Gliese 581d's average surface temperature would have to be above 273 K. Therefore, this in itself would also mean that since Gliese 581g is closer to it parent star and all that has been aforementioned is a significant amount of evidence that Gliese 581d has a very large amount of water upon its surface, the fact that Gliese 581g has even more water upon its surface makes conditions for Gliese 581g that much better to have surface water as well.

When going back and again reviewing Figure 8, presents a comparison of viewing a three enlarged projections. The comparison is to show that just like on Earth it has large bodies upon it surface such as depicted on one of Earth's continents known as North America. Which depicts a partial image of Earth in the background and some of the largest bodies of water known as: The Great Lakes. The idea is to show that just like on Earth, that also on Gliese 581d, and Gliese 581g, seen in the two images on the left and right of Figure 8, that just like on Earth, that there are also similar large liquid bodies of water on Gliese 581d and Gliese 581g as well. That all three images show enlarged projections at about the same height above each planet's surface.

However, when comparing the image and projects on the bottom of Figure 8 of Gliese 581d on the left bottom of Figure 8 and of Gliese 581g on the right bottom of Figure 8, the imaging evidence clearly depicts that there is more surface water upon the surface of Gliese 581g than there is upon the

surface of Gliese 581d. This is also consistent with the fact that such would be the case, especially if Gliese 581g being closer to its parent star Gliese 581 was warmer. The result being of course that more water would be upon its' surface, most likely because whatever large amounts of ice that would be upon the surface would have melted in larger quantities of water that would be upon the surface of Gliese 581g especially when compared to the surface water upon the surface of Gliese 581d. This would make Gliese 581g a better suited candidate for being more habitable as an exoplanet, especially since its location is in about the middle of the HZ.

10 Brief Concept On Re-Organizing Exoplanet Methodologies For Greater Exoplanet Detection Capabilities

10.1 Conclusion

In the science of "Exoplanetology" whenever a scientist, astronomer, astrophysicist, decides to investigate any star system to look for exoplanets whether it be either in or out of it's HZ, they may only use one type of exoplanet detection methodology. However, the question has to be asked: "Could there potentially be a better, more powerful, sensitive, accurate, precise, scientific current methodology available for detecting and confirming exoplanets in any star system with much less overall problems?" The Authors of this paper believe the answer to this question is: "Yes"!

When it comes to current available exoplanet detection methodologies the best way to explain this is by use of to illustration. We will use the exoplanet detection methodology known as RVM as an example.

The first point is, when RVM by itself for detecting exoplanets in another star system, and/ or if it also be with HARPS or HIRES data, the best way to use it may best be explained, described, and understood when Dumusque [20] discusses this in his paper when he states *"that the reliability, efficiency, proficiency, accuracy, and sensitivity of the RVM to be able to detect exoplanets in other star systems to its maximum capability, is solely dependent on the fact that since sensitivity is a function of RVM accuracy and precision, that following up with as many additional number of measurements and samplings as possible, adds more points to the current data and that by*

this methodology, it allows for the best maximum improvement of the RVM detection sensitivity over time when using it to detect exoplanets".

The previous quote only pertains to one methodology used when it comes to detecting exoplanets. So, the second question is: "How may this methodology for exoplanets be improved upon?" It is not so much a matter that the individual exoplanet RVM needs to be improved upon. Except as a singular scientific methodology the sensitivity of the technology could be and one day will be improved upon. Rather as far as the preent and current way of detecting exoplanets it could be potentially greatly improved upon that if instead of just using one scientific methodology to look for exoplanets in a star system, why not use as many as possible instead?

In other words for instance, suppose a scientist wants to do a deeper investigation into the Alpha Centauri B star system to determine if there may be one or more exoplanets in its HZ? The immediate thought and approach may be to want to only use the RVM. However, why do this when there are also other additional current available exoplanet detection technologies available that could be used in addition to just the RVM that could greatly enhance the prospect of greater detection of exoplanets in the Alpha Centauri B habitable zone?

In addition to just using the RVM just by itself a scientist could prudently choose to also use any and all of the additional methods of exoplanet detection to make a much stronger case for the detection of exoplanets if thet also used in addition to the RVM in this example, if they also used: "Astrometric Measurement, Gravitational Microlensing, Transit Method", and any other technology and instrumentation available, in order to provide a much greater scientific approach in the detection and confirmation of any exoplanets in the HZ of Alpha Centauri B example this paper has just aforementioned". Even if a research facility only has one exoplanet detection methodology available to them, they could still collaborate with another facility, university or scientist(s) that has any of these other exoplanet detection methods, which would only enhance the detection and confirmation of suchlike exoplanets. Especially, when it comes to exoplanets in any star systems' HZ. However, since this concept was originally thought of by the Author of this paper, this concept and it's use falls under copyright and intellectual property and proprietary rights under the scientific research consortium known as: International Consortium On Microscopic To Macroscopic Research (ICOMMR) if anyone wishes to use this concept please contact the first author of this

paper.

This paper has also presented and demonstrated new data never thought of before, and imaging evidence that is consistent, that in the Gliese 581 star system all of the accumulative evidence revises and updates, that not only is there a exoplanet in the HZ named Gliese 581d, but especially an exoplanet in the middle of the HZ Gliese 581 star system also known by the name of Gliese 581g.

10.2 Supplemental Material Videos

For more data, images and accumulative evidence regarding Gliese 581d and especially Gliese 581g, that due to space restrictions was not able to be presented and demonstrated in this paper please go to the following URLs and watch these videos as follows:

http://www.stewart-research-consulting.com/2—exo-scope.html

http://www.stewart-research-consulting.com/4-other-star-systems.html

http://www.stewart-research-consulting.com/gliese-581-d.html

http://www.stewart-research-consulting.com/gliese-581-g.html

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NEXT GENERATION MICRO-ENCAPSULED SUPERIOR ROCKET FUEL

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June, 2013

Abstract: Today's rocket fuel is outdated, is heavy to transport, is extremely expensive to manufacture and use in chemical and/or oxygen derivatives and is not good for the earth's environment and/or ecology. Therefore, it is time to develop the next generation rocket fuel that is at least 50-100 times more powerful than today's available rocket fuel, and is much more efficient and proficient to use and is safe for the earth's environment and ecology as well. The project focus was to develop next-generation solid-sphere prillings that have secondary and tertiary matrixes comprised of microcrystalline hydrocarbon nano particles for use as an advanced hybrid rocket fuel based on liquid layer hybrid combustion theory.

Key words: Propulsion, Fuel, Space, Rocket.

1 Introduction and Background

We produced prillings in sizes ranging from 0.25 μm to 8,000 μm using synthetic PCM's that are highly stable. The end result is demonstration in a video presented at the end of this paper that shows that when only 2 grams of microencapsulated prillings is formulated with a prillings with crude, bench rocket motor test that this test demonstrates how this rocket formula fuel is at least 50-100 times more powerful, efficient, proficient, and economical to produce and manufacture than today's conventionally used rocket fuel.

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1.1 Basic Testing and Microencapsulation Processes

Our microencapsulation process [1] and instrument is a NASA Spinoff technology first used to produce glass microbeads in space on STS-41 and STS-43 and later to spawn creation of an arsenal of oilspill cleanup, medical, pharmaceutic and food products.

The project focus was to develop next-generation solid-sphere prillings that have secondary and tertiary matrixes comprised of microcrystalline hydrocarbon nano particles for use as an advanced hybrid rocket fuel based on liquid layer hybrid combustion theory. We produced prillings in sizes ranging from 0.25 μm to 8,000 μm using synthetic PCM's that are highly stable.

1.2 Spin-off NASA Technology and Applicable To Other Products

The video demo [2] shows small scale static test (burn) using just 2 grams of prilling product that is 250 μm in size and encapsulated in a polypropylene sheath comprising the solid rocket fuel component. The oxidizer is O_2 (gas). This technology is representative of next-generation 'future fuels' that produce a very thin, low viscosity, low surface tension liquid layer on the fuel surface when it burns. Driven by the oxidizer, lift off and entrainment of PCM, droplets and secondary nanoparticle hydrocarbon components greatly increase the overall fuel mass transfer rate simulating a continuous spray injection system with the fuel-components vaporization occurring around the droplets convecting between the melt layer and flame-front resulting in higher regression rates and exponential increase in thrust.

2 Conclusion

Is simple that this paper provides a new breakthrough in the production of a superior next generation rock fuel. Which will also compliment the next generation in space exploration in our solar system as well.

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THEORICAL OBSERVATIONS OF THE ICE FILLED CRATERS ON MARTIAN MOON DEIMOS

Baziotis, I.P.*

June, 2013

Abstract: For decades mankind has envisioned a manned mission to Mars. Some plans initiated the concept that using Martian Moon Deimos as a possible stepping stone to Mars. However, within the last several decades one of the questions that has evaded scientists is: "Does Deimos have any ice upon it's surface and/ or in it's craters?" Why? Because ice is a form of water, and water as far as outer space is concerned in the number one most precious resource. Not only because water is a fundamental essential for sustaining life, but it is also necessary for producing rocket fuel. However, one of the foremost problems in being able to ascertain if there is any water on Deimos is the fact that the closest images ever taken of Deimos last occurred when the Voyager 2 Orbiter mission was able to take some images of the surface of Deimos as close as 30 km. However, at even this close a distance to the surface of Deimos these images were still not close enough to determine if ice was upon the surface of Deimos or in its craters. In order to provide enough ice so that a manned mission to Deimos is feasible. Therefore, at this point in time in 2013 there is still not enough data to seriously determine if a manned mission to Deimos as a stepping stone to Mars is a practical viability or not.

Key words: Mars, Deimos, Mission.

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1 The Availability of Water Throughout The Universe Increasing The Likeli-hood of Water On Deimos

Bradford [2] brings to the reader's attention that a vaster entire quasar in outer space was discovered by astronomers that provides new data and evidence that water is abundant in outer space.

This discovery occurred in 2011 and according to researchers this discovery shows that water has been prevalent in the universe for nearly its entire existence. Therefore, it would also exist in abundant amounts in our solar system and on planetary bodies such as upon the surface of Mars Moon Deimos as well.

In a new hypothesis and theory when Earth's solar system and sun were first formed billions of years ago the most abundant components were hydrogen and oxygen. In like manner, when Earth's solar system formed water in different forms such as ice would also be available.

However, two questions are: "Where"? and: "In what amounts"? Including, is there any water at all in the form of ice on Mars Moon Deimos?

2 What Types of Craters Would Likely Hold The Most Water On Martian Moon Deimos

What was known about Deimos and Phobos before the 1990's? From 1877 when Deimos was first discovered until the 1990's for the most part telescopic, radar telescopes, and spectroscopy were used in addition to a few images of Deimos up until that period of time existed and as far as the origin of the Martian moons has still controversial as discussed in Burns' paper [3]. The primary hypotheses are that they formed either by capture or by accretion. Because of the similarity to the composition of C-type or D-type asteroids, one hypothesis is that the moons may be objects captured into martian orbit from the asteroid belt, with orbits that have been circularized either by atmospheric drag or tidal forces. While Cazenave [4] further discusses and proposes that Deimos was captured by Mars in the beginning in the formation of Mars when energy creating the Mars, Deimos, and Phobos system. While otherwise, Landis [9] stipulates that the current Mars atmosphere is too thin

to capture a Phobos-sized object by atmospheric braking. However, on the other hand in the same paper Landis [9] offers a second alternative hypothesis when he points out that the capture could have occurred if the original body was a binary asteroid that separated due to tidal forces.The main alternative hypothesis is that the moons accreted in the present position. Craddock [6] and ESA [7] further explains the current accepted hypothesis is that Mars was once surrounded by many Phobos and Deimos sized bodies, perhaps ejected into orbit around it by a collision with a planetesimal.

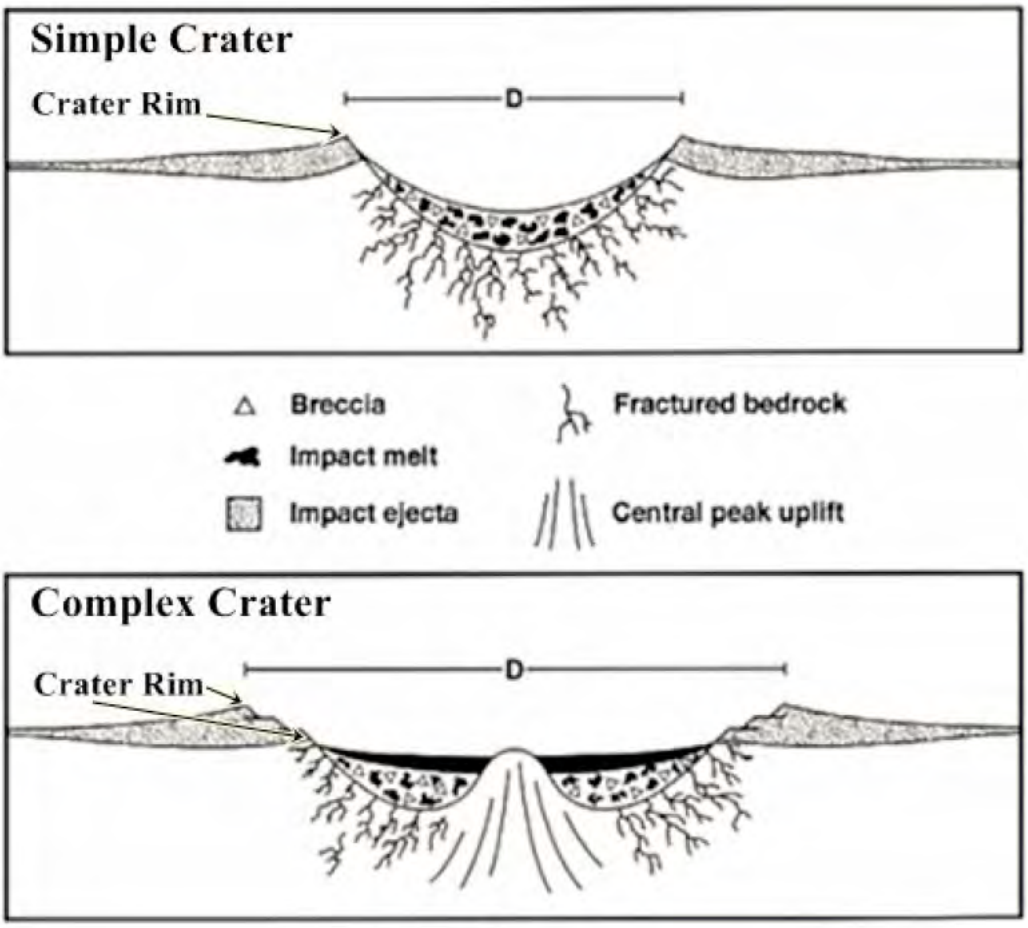

Figure 1: **Craters Types (Source: Geologyrocks)**

However, previously before 1986 spectroscopy and radio telescopes were used to try to formulate images as to what Deimos looked like and based upon this data. However, it was not until after 1986 that space probes like Phobos II was sent to investigate the two moons of Mars both Deimos

and Phobos that although this robotic spacecraft most likely crashed it was able to send back some data as to the conditions for ice and/or water on the surface of both Deimos and Mars. The paper by Bell [1] captivates the attention of the reader that before the Viking 2 mission that infrared spectroscopy revealed that Deimos as the outer most moon of Mars had very little if no ice present on Deimos. Except, at it's north pole. Which would only pertain to conditions of permafrost and at the most would be no more than 100 meters in depth. However, it was not until after 1986 that space probes like Phobos II was sent to investigate the two moons of Mars both Deimos and Phobos that although this robotic spacecraft most likely crashed it was able to send back some data as to the conditions for ice and/or water on the surface of both Deimos and Mars.

The top and bottom images in Figure 1 illustrate both simple and complex craters that could be the types of craters that may have ice in them on Mars' moon Deimos.

Figure 2: **Views of Deimos (Source: NASA and Ronald Stewart)**

The left side (before) of Figure 2 taken by Mars Reconnaissance Orbiter (MRO - NASA/JPL/Univ. of AZ, 2006) is a image of Mars' Moon Deimos. The image on the left was taken about 420-500 km from Deimos. The right side (after) is a Infinite Microscopic-Macroscopic Imaging (IMMI) enhanced

image of Deimos on the left as it truly appears. Bell [1] shows that before 1993, spectroscopic infrared technologies, and even Phobos 2 only detected permafrost at the north pole and ice deeper within the surface of Deimos. However, as seen in the IMMI enhanced image to the right of Deimos, that the white and light bluish colored areas at the top of the image to the right, is what appears to be a very significant amount of ice. Especially around the northern hemisphere of Deimos located at the top of the image.

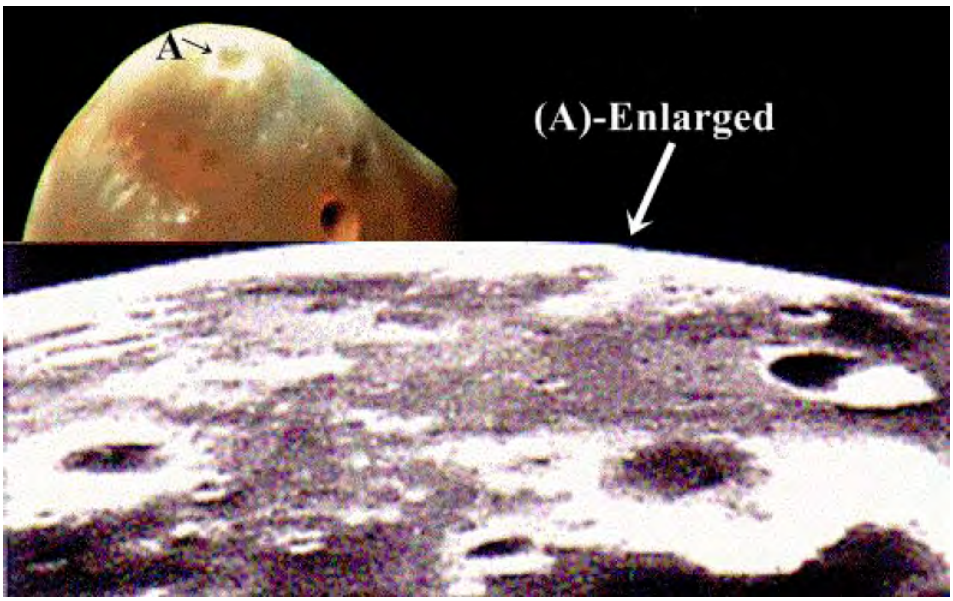

Figure 3: **Views of Deimos (Source: Ronald Stewart)**

Figure 3 presents and demonstrates in the upper top left corner marked (A) presents and demonstrates the surface area of Deimos seen where the black arrow points away from an enhanced IMMI image of Deimos, also showing a white area within and around one of the large craters on Martian Moon Deimos, which may also be ice.

However, in the larger image of the same area as marked in (A) enlarged and projected at the bottom of Figure 3. Showing extreme close ups of ice on the surface of Deimos. Not only does this enhanced and enlarged projected image depict the first large crater area that has ice within and around the crater itself, seen in the top image marked (A) and also seen in the bottom image (far middle right), but the enlarged projected image shows much more detail.

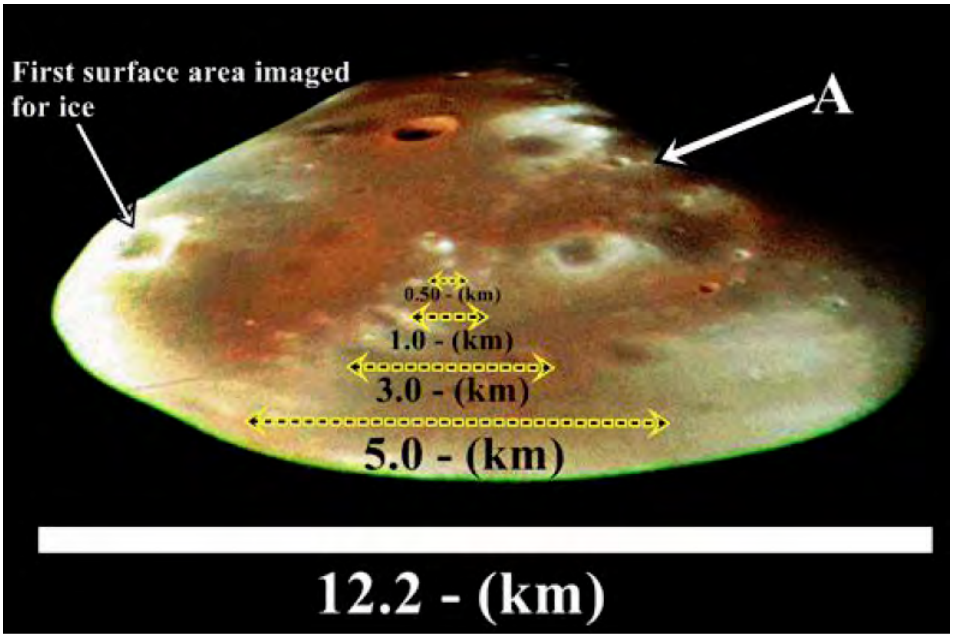

Figure 4: **View of Deimos (Source: Ronald Stewart)**

This also includes numerous other not see large and smaller craters that present and demonstrate new imaging evidence that there is more ice on Deimos. Beside ice not only in, and around the circumference of the craters, but there is also further imaging evidence that there is a large amount of surface ice on Deimos as well.

It is also important to recognize that just because even an asteroid may have a certain color that resembles Mars, that the above false color is used in order to enhanced and act as a visual aid to depict the true amount of ice that is upon the surface of Deimos.

3 Deimos Extreme Image Close ups of Deimos With Ice On It's Surface and In It's Craters

However, the question needs to be asked: "How much ice is there truly upon the surface of Deimos?" To answer this question a much larger view of the entire area of Deimos at least on one side has to be observed, and studied from outer space right above this Martian Moon. This may be better observed and studied by zooming into the surface of at least on one entire sire of Deimos. This is presented and demonstrated in Figure 4.

The Left top corner of Figure 4 depicts the previous surface area of Deimos in extreme close up images as demonstrated in Figures 2 and 3 giving a significant amount of new imaging evidence that Deimos has a very abundant amount of ice not only on its surface, but inside its deep and large craters as well. In this limited 3D elongated/longitudinal view of the surface of Deimos (was taken at about 300 km in space). However, this view shows Deimos at a diameter of about 12 km. (A) is the next area of ice.

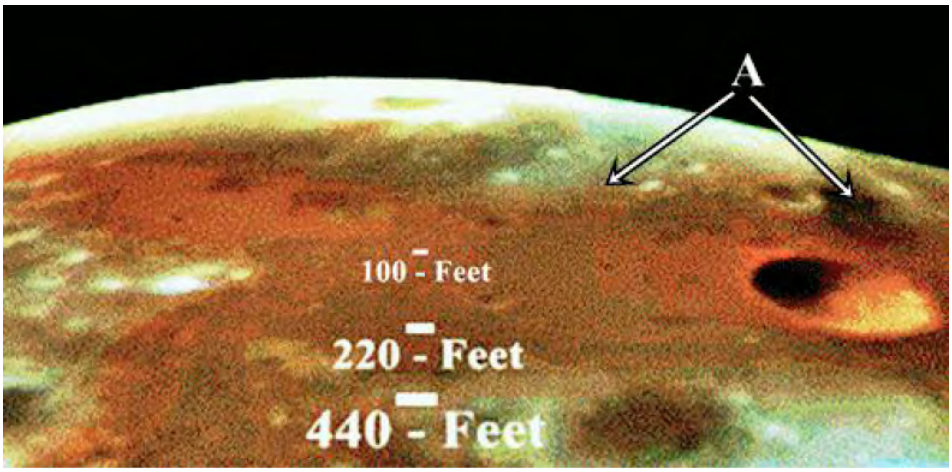

Figure 5: **Closer View of Deimos (Source: Ronald Stewart)**

Figure 5 is a closer a view of the surface of Deimos. (A) is a second closer view of the second and next surface area of Deimos (between the two white arrows) that's being investigated to determine how much ice may be upon the surface of Deimos and inside its craters. The size of these craters seem to range in size from about 30 to more than 240 m in diameter and many of them are at least 90-120 m deep. However, with the apparent amount of ice upon the surface of Deimos and in its simple to complex type craters, a growing amount of imaging evidence supports that there is a very abundant amount of ice on Deimos. This is in excess of the also great amount of ice at Deimos' north pole and subsurface ice in like manner. Allowing astronauts to not only survive on Deimos, but to use such ice as fuel to continue a manned mission to Mars.

The top of Figure 6 represents a yet closer image of the second area under investigation to determine how much ice is upon the surface and in the craters on Deimos. A measurement scale depicting a white bar shows the diameter of the surface area of Deimos measuring from about 30 to 120 m in diameter.

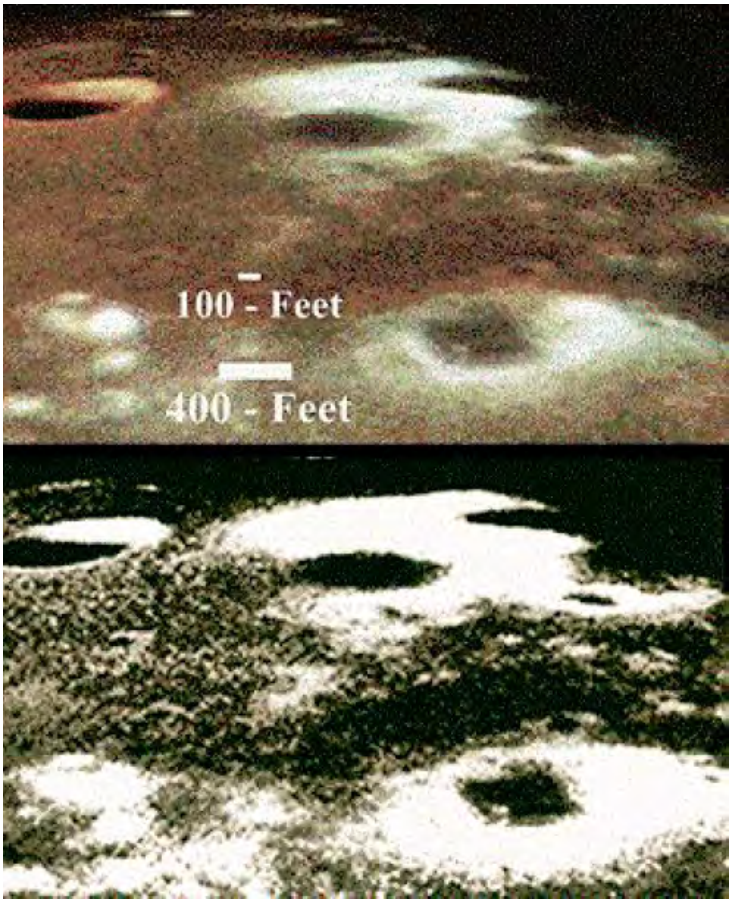

Figure 6: **Closer Views of Deimos (Source: Ronald Stewart)**

While the bottom image is the IMMI maximum enhancement of these craters, and shows an extreme close up view of what not only the area looks like, but a true overall picture of what the ice conditions are also compose of on Deimos as well.

As was discussed in Figures 3 through 5 what is observed is that there are numerous large and smaller craters that not only have ice within the crater but also around the outer circumference rim of the crater itself in like manner.

For years scientists and researchers of Deimos and Phobos have both believed that there would be carbonaceous chrondrite like ice in the regolith sedimentation of the geological strata on both Deimos and Phobos as well. However, the contention was more like that the ice would be ice that would

only be sort of a permafrost condition on these Martian Moons, and that the ice would be more of what is also referred to as "Dirty ice". Rather a mixture of the regolith and sedimentation on top and with the first 30 m in depth of the depths of both Deimos and Phobos. However, a more detailed explanation and description is seen in Figure 7.

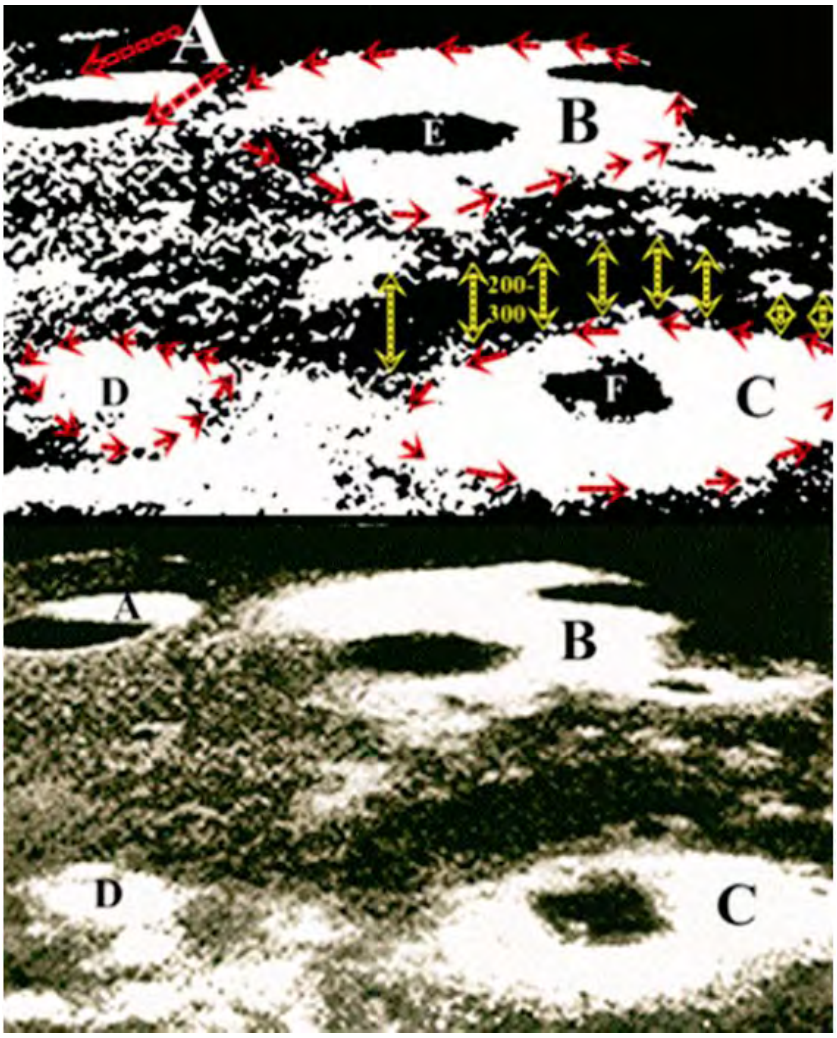

Figure 7: **Closer Views of Deimos (Source: Ronald Stewart)**

The top of Figure 7 depicts both simple and complex types of craters on Deimos. This also an illustration, depicting the topography and terrain in detail around craters (A), (B), (C), and (D). (E) and (F) depict the small areas not yet filled with ice in craters (A), (B) and (C). Crater (D) is full

of ice. The red arrows show the crater outline/shape. The yellow vertical arrows depict the crater depth and cliff wall outside of it. Which measures approximately 60-90 m in height.

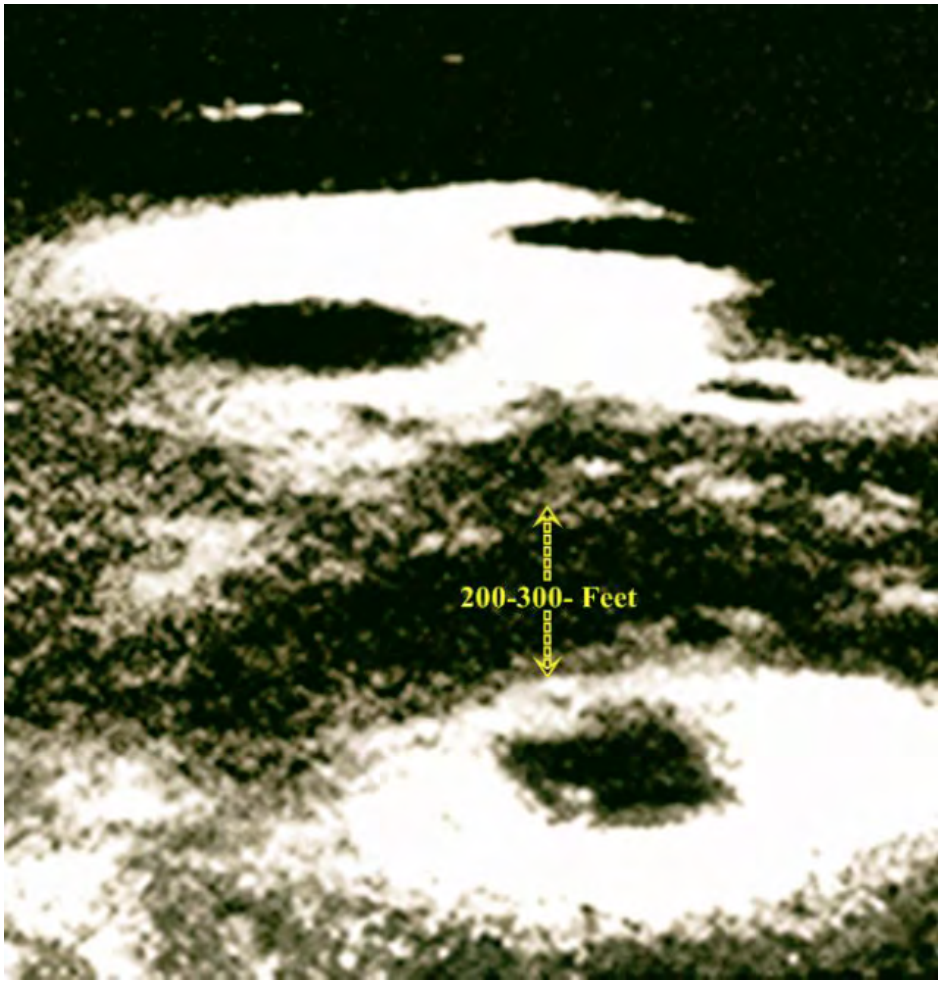

Figure 8: **Much Closer View of Deimos (Source: Ronald Stewart)**

Figure 8 is an enlarged image of the significant amount of the ice in the craters, around the crater rim's circumference, upon the surface of Deimos itself, and also what is likely dirty ice. Which is also a mixture of regolith, sedimentation, and ice that has a pleated appearance to it in the image above in Figure 8.

4 Why At Least A Robotic Or Manned Mission To Deimos

Landis [8] discusses that in the 1990's the political and economic conditions would have been a good timing prospect for a manned mission to Mars. However, one of the reasons this did not happen was because of what some refer to as "Moon Mission Lag". Meaning; some people believe mankind had enough space exploration from the Apollo Lunar Missions. That any additional venture to Mars would not have been accepted with open arms. However, today in 2013 a manned mission to Mars is taking on a new sense of invigoration. NASA's series of rover missions has kept the spark alive. On the other hand and other space agencies around the world and the private industry sector has become much more involved. Some private venturing aspects talking about putting a manned mission around Mars by sometime between 2018 and 2023.

With an the announcement by President Barrack Obama to put a manned mission on an asteroid and private enterprise of companies like Planetary Resources and Deep Space Industries in an apparent race for mining asteroids has also made many persons regain new invigorated belief that the wealth of space resources, could be good for both mankind in opportunity for wealth and technology as well. However, at this time there is a considerable amount of discussion as to how all of this should be approached. Asking: "Is it feasible to send a manned mission directly to Mars?" Or should there be a much more practical approach that could accomplish several space exploration missions all at one time?

Making a case to use Deimos as a potential stepping stone for a manned mission to Mars not only makes sense, it is logical, practical, and reasonable, but it is also the most cost effective as well. How?

Since President Barrack Obama announced a goal to put an man on an asteroid by no later than 2035 this could fit in well by sending a man to Mars' Moon Deimos. Why? Since some scientists may consider Deimos an asteroid like moon of Mars, and since sending a manned mission to an asteroid will be out of the confines of earth's orbit, which would be millions of km into outer space, what has to be considered is that since Deimos is also millions of km away from Earth, why not just make the trip to Deimos? At the same time it would also accomplish several goals at the same time such as:

1. Using Deimos as a stepping stone to a Mars manned mission;
2. Deimos could be studied as an asteroid like moon of Mars. Answering questions of it's primordial origins;
3. Deimos could be looked at in the context that it may also offer the advancement of new knowledge, understandings, enlightenment, and insights and the development of new technologies that could be used to mine asteroids; and
4. More could be learned about Deimos as to whether or not it was formed about the time Mars was or at the beginning of our solar system.

Deimos is the smallest and outermost moon of Mars, and hence the near-Mars target that is most accessible in terms of required delta V. A Deimos landing would be the first manned landing on celestial body outside Earth's orbit.

5 Conclusion

Deimos is easier, far less costly, safer, and can be done much sooner. In the paper by Singer [13] proposes that because Deimos is in near-synchronous orbit, with the entire Mars surface (except for extreme polar latitudes) coming in view over a period of about 125 days, that coordinating a first manned mission to Deimos would create a perfect opportunity either for a rover-like robotic mission and/or hopefully a manned mission to take place on Deimos, Cordell [5].

Cordell [5], O'Leary [10] and Thomas [14] explore that if Deimos would have ice that it would be extremely important and useful as a resource for in-space propellant production."Water is rocket-fuel ore".

These papers further discuss that since Deimos and Phobos are spectroscopically similar to carbonaceous chondrites (as previous and current evidence has also strongly suggested) it had been highly suspected that Deimos had permafrost at it's north pole. However, although the past and current evidence is re-affirmed and confirmed with the new imaging evidence in this paper, besides just being able to confirm the past and current evidence much more data now comes to light. that just besides having permafrost dirty ice conditions where ice does exist, there is now additional imaging evidence that an abundant amount of ice exists not only within the craters, in and around

the crater rim, but also exists upon the surface of Deimos as well. Therefore, in addition to all of this, previous evidence also indicated that the subsurface of Deimos contained sub-surface chemically bound water, and that Deimos was also thought to be anhydrous as also strongly suggested by Bell [1] and Palmer [12]. That Deimos would also have in it's sub-surface sedimentology carbonaceous-chondrite-like assemblages of anhydrous silicates, carbon, organic compounds, and ice.

Since this paper has provided strong new data and imaging evidence that Deimos not only has a very abundant amount of ice upon it's surface and deep large craters, is that much more of a reason for a manned mission to Deimos as a stepping stone to Mars.

5.1 Acknowledgements

The author of this paper would like to extend their gratitude for the many years of work that has gone into researching any an all papers written by researchers and scientists alike, and the ongoing research on Martian moons Deimos and Phobos, and Mars as a planet. For without such dedication papers like this one would not be possible, and also like to thank Dr. Ronald Stewart for the IMMI/EXO-SCOPE technologies that made the images in this paper possible.

5.2 Supplementary Reference Materials

For additional reference videos in addition to the references made in the context of this paper on Mars' Moon Deimos, please refer to videos numbers 11 to 14 at http://www.stewart-research-consulting.com/2—exo-scope.html.

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THEORETICAL COSMOLOGY-CELESTIAL MECHANICS CONSIDERING ECCENTRICITY OF THE PLANETARY MOTIONS, PATHS, OF PLANETS, AND EXOPLANETS AND MERCURY'S PARTIAL IRREGULAR RETROGRADE-PATH

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Abstract: Context- In the current formulas for astronomical application to the movement and orbital paths of not only planets and planets in our own solar system is based upon concept of circular motion, and Kepler's three Laws of Planetary Motion. Therefore a new theory is needed to improve the current understanding of kepeler's Laws and how they truly apply, not only in Earth's own solar system, but across the universe in like manner. Aims/Goals/Results- However, little thought is given to a relation of the circular orbits in relation to the theoretical elliptical motion of celestial bodies and the wider analysis of the known laws which govern the movements of celestial bodies around not only Earth's sun, but in theory would be applicablke to other stars, in other star systems across the universe as well. Which demands that this be taken into consideration when considering any type of astronomical phenomenon and that a derived theoretical formula for calculating the eccentricities of a planet, planetary body, in our own solar system, or beyond applies equally as well pertaining to all star systems. Within each star system there is also the theoretical probability that at least one planet/exoplanet could have a partial irregular retrograde path as is also

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seen within our own solar system when it comes to the displaced irregular movements of the planet Mercury. Therefore, theoretically such will be discussed in existing and new theoretical and mathematical formulas of such processes as an astronomical invariant with respect to the planets, in our own solar system and application in theory to exoplanets in other star systems in like manner in which evidence is also made in current bibliographical references as well.

Key words: Cosmology, Solar System, Planetary Bodies, Mercury, Exoplanets.

1 Introduction

An introductory path in understanding connection concerning this paper may well be best explained in "Theoretical Celestial Mechanics" [1], "which gives both theoretical and mathematical computations, and bibliographical references, as to why there possibly exists numerous star systems that could have at least one planet and/or planetary body (such as a minor planet),which in theory could have a partia and/or fulll irregular retrograde path as is also seen within our own solar system, when it comes to the displaced irregular movements of the planet Mercury. This is explained further in this logic line:

PLANETARY MOTION

1. a is the major semi-axis (velika poluosa ellipse)
2. b is the minor semi-axis (mala poluosa)
3. c is the focal distance (fokusna udaljenost)
4. p is the focal parameter (fokusni parameter)
5. t is the orbit tangent line (tangenta)
6. n is the orbit normal (normala)
7. φ is the polar angle of of the radius vector r, mesure from the axis x in counter-clockwise direction ro the radius vector r (polarni ugao radiusvektora r, mjeren od ose x u suprotnom smjeru kazaljke na satu do radiusvektora r)
8. ε is the numerical eccentricity (numericki ekscentricitet)

From the kinematics of the point M in Fig.1 and Fig.2 can be written following relations:

$$p = \frac{b^2}{a} = a(1-\varepsilon^2) \tag{1}$$

$$r_1 = a + \varepsilon x \tag{2}$$

$$r = a - \varepsilon x \tag{3}$$

$$r + r_1 = 2a \tag{4}$$

$$r = \frac{p}{1+\varepsilon cos\varphi} = a(1-\varepsilon cosu) \tag{5}$$

$$S = \pi ab \tag{6}$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \tag{7}$$

$$tg(\frac{\varphi}{2}) = \sqrt{\frac{1+\varepsilon}{1-\varepsilon}} tg(\frac{u}{2}) \tag{8}$$

$$tg(\gamma) = \frac{1+\varepsilon cos(\varphi)}{\varepsilon sin(\varphi)} \tag{9}$$

$$v_r = p\varepsilon\omega_0 sin(\varphi) \tag{10}$$

$$v_\varphi = p\omega_0(1+\varepsilon cos(\varphi)) \tag{11}$$

$$v = p\omega_0\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi))} \tag{12}$$

$$\omega_\varphi = \frac{d\varphi}{dt} = \omega_0(1+\varepsilon cos(\varphi))^2 \tag{13}$$

$$\omega_0 = \frac{C_2}{p^2} = \sqrt{\frac{kM}{p^3}} \tag{14}$$

$$C_2 = \sqrt{kpM} \tag{15}$$

$$cos(\gamma) = \frac{\varepsilon sin(\varphi)}{\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi)}} \tag{16}$$

$$sin(\gamma) = \frac{1+\varepsilon cos(\varphi)}{\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi)}} \tag{17}$$

From derived is (Iz izvedenog je):

$$\omega_\varphi = \frac{d\varphi}{dt} = \omega_0(1+\varepsilon cos(\varphi))^2 \tag{18}$$

There is (Odavde se nalazi) $t_\varphi = f(\varphi)$

$$t_\varphi = \frac{1}{\omega_0}\int_0^\varphi \frac{d\varphi}{(1+\varepsilon cos(\varphi))^2} \tag{19}$$

$$t_\varphi = \frac{1}{\omega_0}[\frac{2}{\sqrt{(1-\varepsilon^2)^3}} arctg(\frac{(1-\varepsilon)tg(\frac{\varphi}{2})}{\sqrt{1-\varepsilon^2}}) - \frac{\varepsilon sin(\varphi)}{(1-\varepsilon^2)(1+\varepsilon cos(\varphi))}] \tag{20}$$

If we take (Ako se uzme da je)

$$\frac{1-\varepsilon}{\sqrt{1-\varepsilon^2}} = \sqrt{\frac{1-\varepsilon}{1+\varepsilon}} \tag{21}$$

will be obtained (dobice se):

$$t_\varphi = \frac{1}{\omega_0(1-\varepsilon^2)}[\frac{2}{\sqrt{1-\varepsilon^2}} arctg(\sqrt{\frac{1-\varepsilon}{1+\varepsilon}} tg(\frac{\varphi}{2})) - \frac{\varepsilon sin(\varphi)}{1+\varepsilon cos(\varphi)}] \tag{22}$$

From equations (13) and (14) (Iz (13) i (14) je):

$$\omega_0 = \frac{kM}{p^3} = \sqrt{\frac{4\pi^2 a^3}{T^2 a^3 (1-\varepsilon^2)^3}} = \frac{2\pi}{T(1-\varepsilon^2)\sqrt{1-\varepsilon^2}} = \frac{2\pi\sqrt{1-\epsilon^2}}{T(1-\epsilon^2)^2} \tag{23}$$

2 Planets, Planetary Bodies, Affected By Our Sun, and Exoplanets Affected By Their Parent Stars

In astronomy, Kepler's Laws of planetary motion are three scientific laws describing orbital motion, originally formulated to describe the motion of planets around Earth's Sun.

Kepler's laws are:

1). The orbit of every planet is an ellipse with the Sun at one of the two foci. 2). A line joining a planet and the Sun sweeps out equal areas during equal intervals of time.] 3). The square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit. Kepler's Laws and his analysis of the observations on which they were based challenged the long-accepted geocentric models of Aristotle and Ptolemy, and generally supported the heliocentric theory of Nicolaus Copernicus . Although the implementation of Kepler's Laws continued to support the fundamental generalized theories of Nicolaus Copernicus.

For example; in relation to and what is consistent with the (original paper paper written by this author in both Serbian and in a limited translation of English),the original paper's theoretical calculations are also consitent with the laws of physics, and of the currently understood explanations, and descriptions, expressed in detailed calculations regarding the orbit of the planet Mars. Which was first indicated to Kepler its elliptical shape, and he inferred that other heavenly bodies, including those farther away from the Sun, have elliptical orbits too. It was in such like assertions of Kepler's laws and his analysis of the observations on which they were based, challenged the long-accepted geocentric models of Aristotle and Ptolemy. However, Kepler's laws also did away with Copernicus's circular orbits and epicycles), by asserting that the Earth orbited the Sun, proving that the planets' speeds varied, and using elliptical orbits rather than circular orbits with epicycles.

Since bibliographical references are needed in any scientific research paper, in order to comapre and show the difference between the knowledge on a subject that is currently known and how the new paper-(like the one you are now reading) in the English language textual explanation may be able to explain as best as possible in written text how the new theories may apply as an improvement past the current theories and knowledge. In correlation with this in a previous paper [1], by Gregory and Fischer (2010), when this paper also considers the current thinking on planetary motion the authors of this paper propose that when considering the aspect of planetary motion the eccentricity from this equation cannot calculate the true value of eccentricity because it is an equation with two unknown factors. However, this paper a new in theory proposes that the calculations may find important relationships for calculating the surface segment of the ellipse corresponding to the angle of a planet and/or planetary body when it is in motion in rotational orbit around its sun. However, a second variant is applicable when pertaining to the eccentric rotation and movement of planets, and planetary bodies especially in our own solar system. In theory, this may also include exoplanets in other star systems in our universe as well. When the formulas are further studied beyond this paper, what is revealed is in theory that when the Sun is intensely involved in its function of movement the angle of a planet's movement is in relation to its direct influence by its sun, and the closest planets to the sun most likely (in theory) like Mercury's partial irregular retrograde path is directly related to it being the closest planet to our sun.

3 Radial Velocity and Circulating Components Follow The Relationship To Kepler's Law

However, when it comes to Kepler's second law for example; a planet would move faster near the Sun so the same area is swept out in a given time as at larger distances. This would also mean; that where the planet moves more slowly, would be a representation of the planet's proposed velocity and the force on the planet as well. This would be consistent with the first existence in conjuction with the laws of physics. Especially, in relation to the technology known as (RV). Or the radial velocity method which is also used as a primary technology in the detection of exoplanets.

For the angled orbital rotational path for planets in our own solar system and for exoplanets in other star systems as well, the relationship for the angle for the orbital rotational path for a planet or planetary body in any star system is conducive and obeys Kepler's Law in also in relation to its radial velocity and circulating component velocities in relation to its parent star.

As expressed before [1], as also discussed in the paper by Gregory and Fischer,(2010) although this paper primarily discusses this same type of subject in relation to exoplanets However, this paper proposes that the evidence is seen in our own solar system as it could be in other star systems involviung exoplanets as well. The evidence is in the fact, how this also applies in evidence to Earth's own solar system. Where the planet Mercury's irregular planetary movement is also a good example of that. Current thinking has come to the conclusion the first two of Kepler's Laws relate to an ellipse , and claims to be the path of a celestial body mass. However, not only does this paper propose evidencein theory that is somewhat different. This paper also proposes that the center of mass also includes all satellites. Such as minor planets, asteroids, and moons. Whether they are either stationary or revolving in orbit around their larger centers of mass like a planet/ exoplanet as well. This applies whether it be in our own solar system and/or another star system.

Isaac Newton also gave evidence to kepler's law in:"Principle Mathematics". Further meaning; " That if an instantaneous force is considered on the planet during its orbit, the area of the triangles defined by the path of the planet will be the same, for any fixed time interval. When the interval tends to zero, the force can be considered continuous".

Whereas in this paper in theory it is proposed that an angle of a planet in motion to its star that the angle of the ellipse is one-quarter to that of its eccentricity as well.

Therefore the author of this paper, and especially in the original paper written in the Serbian language as well emphasizes the strong use of calculations to propose that the center of mass in planetary systems is its barycenter. That a planet has completely different actual path. This range gives the mean radius of inertia of the body, measured from that barycenter and/ or from the rotation of all masses around a planet or in a planetary system, the current value of the radius of inertia or radius of movement of the planets being around their center. Equating to our sola system's sun.

The planetary system radius of inertia, and movement around its parent star/ sun could also be expressed in the following abbreviations. This is as follows: t_s is own time rotation; T is the time of revolution; a is the major axis of the ellipse; ε is the eccentricity of orbit and ϕ is the right anomaly-angle between the alignment of its parent star; in relation to its planets/ exoplanets.

4 Planetary Mass Moving In An Ellipse In A Clockwise Directional Motion

Therefore, accordingly the Center of this radius the ellipse of a planet/ exoplanet moving in an elliptical orbit around its own parent star/sun, moves in a clockwise direction.

For example: in theory in our own solar system in relation to how the planet Mercury revolves in an irregular orbit and round our own sun. In like manner, elliptical orbits of exoplanets around their parent star/sun could have some similar irregular movements around their parent stars as well. Just like Mercury in our own solar system moves around our sun in also an irregular orbit in like manner.

In this theoretical case whether it be mercury in our own solar system, or an exoplanet in another star system, both of these situations could both also have retrograde motion around their stars/suns in like manner.

However,some forms of orbital rotation cannot be calculated because of at least two or more unknown factors. However, what may also find important relationships for calculating the surface segment of the ellipse corresponding to its angle. This also is consistent and corresponds to the circulation movement. Which also involves moves from the radius of this angle in proportion to the movement of the body. Coming from the fact that the orientation and that the velocity is circumferential in relation to also the product vector.

This possibly could also mean that while Einstein's theory of relativity, is correct, it also applies to other variable orbits as we see for most of the planetary/sun orbit relationships in our own solar system. That is; except for Mercury and how it likely also has an irregular retrograde orbit around our own sun as well. Einstein's theory may have similar applications regarding this in other star systems and their exoplanets in the universe as well.

However, when the concept of Mercury's partial irregular movements are taken into consideration what conclusion can be drawn from the paper [1] by Gregory and Fischer, (2010) involving: "Theoretical Celestial Mechanics"?

The discussion derived from the theoretical proposals drawn from that paper conclude that planet, planetary bodies, exoplanets in other star systems and likely much of other astronomical phenomenon in our own solar system and other star systems propose that the these terms can be calculated eccentricity using the gradual approach , and for the known value of the eccentricity of the Earth.

However what this paper does not also take into consideration is, that the known value than is calculated within an equation and the accuracy of these equations may be projected to an accuracy within five decimal places. Being z equal to 0.0167112.

This may also be expressed in the elliptical eccentricity orbit of a either a planet in our solar system and/or an exoplanet in another solar system.

Research papers have to relate to and promote new hypotheses and theories based upon previous research . Therefore when considering the eccentricity of planetary motion and bodies in our own solar system, this is best expressed in being able to relate the new theory to curent/ recent discoveries where the previous current scientific thinking in a one tailed hypotheses can be improved upon in a new two tailed theory which presents and demonstrates new

evidence in either astronomy, or in cosmology. Therefore, bibliographical references on recent discoveries that have been made are essential in comapring current knowledge on palnetary motion comapred to the theories expressed and translated into English text in this paper, and/or to express in deeper detail in this author's orginal paper as an additional bibliographical reference in this paper as well. In which a URL reference at the end of the conclusion of this paper will be provided to refer to the original paper published on this subject in Serbian and limited English in like manner.

Such as is also expressed in the bibliographical reference in the paper by Gregory and Fisher [2] by P.C. Gregory, (2011). Whereas although he refers to and discusses the planetary motion in the Gliese 581 star system and its exoplanets, the point is that there are also similarities to the irregular path seen in the palnet Mercury in our solar system in some respects as this paper also discussed to a limted respect in application to the Gliese-581 star system as well. Gregory, (2011) also expresses the importance of the possibilities of not only circular orbital eccentricities as some other researchers and scientists believe may be the only orbital situation for the exoplanets in the Gliese 581 star system. This duplicates many similarities as is also seen in our solar system when it comes to the irregular movements/motions of Mercury as well. So, the theory of this paper may transcend past the boudaries of our own solar system according the Gregory, (2011) paper. However, he also explores the possibilities in his 2010 paper that elliptical eccentricities possibly could apply in the Gliese 581 star system as well.

However, in his second research paper [2] Bayesian Re-Analysis of the Gliese-581 Exoplanet System, Gregory, (2011), again discusses in greater depth as to whether or not only circular orbits could apply to the Gliese-581 star system and to its exoplanets, but he also specifically discusses if not only circular orbits and elliptical orbits could also apply in the Gliese-581 star system as well. Including the fact that if this could happen in the Gliese-581 star system it is a possibility it could happen not only in other star systems, but the evidence is clear of this happening in our own solar system with the irregular movements of the planet Mercury.

In Figure 1, is relevant to the center of rotation on that an elliptical orbit of a planet, planetary body, and/or exoplanet rotates around this center of its mass, which would be its parent star/sun. Secondly, in theory a proposed other alternative elliptical orbits affecting a that planet, planetary body, and/or exoplanetary orbits could follow around a center point of mass, in

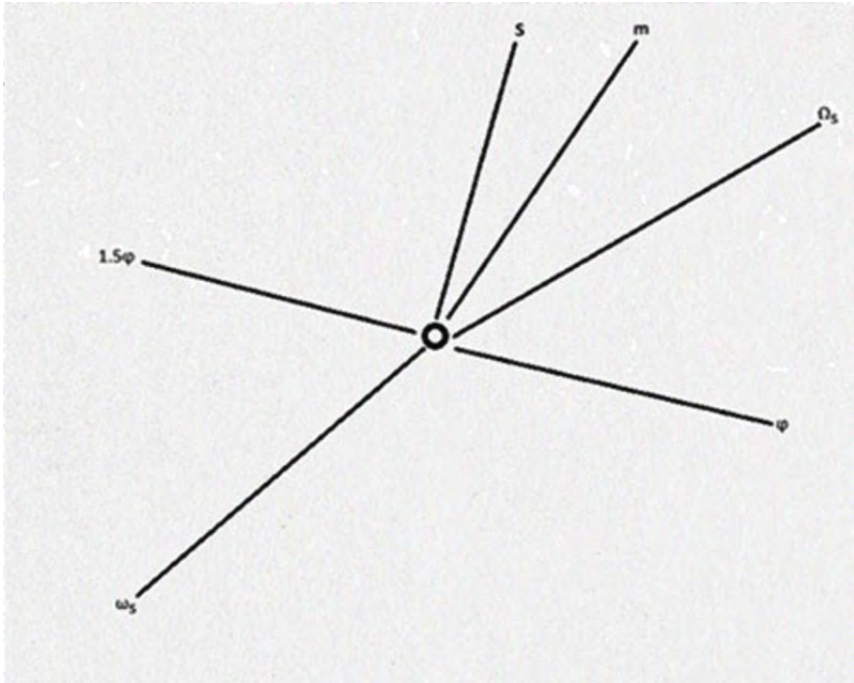

Figure 1: **Planetary Motion (Source: Author)**

similar ways how the planet Mercury revolves in orbit around Earth's sun. Another example has to do with an exoplanet about the size of Saturn discovered in 2003 and in 2006 a brown dwarf star was also discovered to have very oblong and irregular egg shaped like elliptical eccentric orbits in a star system 33 light years from Earth known as: "HD 3651".

5 Conclusion

In conclusion from the standpoints of theoretical cosmology, astronomy, and astrophysics, this paper has considered that current known thinking stipulates that some current formulas for astronomical applications pertaining to the orbital rotational paths of either planets, planetary bodies, and satellites that have to do with any and all other astronomical phenomenon in Earth's solar system and/or in other star systems primarily should have only circular orbital paths to the movement and application in the universe. However, because in earth's own solar system the planet mercury is unlike any other planetary orbital rotational path as a planet around the sun that this paper proposed and contended that if such irregular movements according to the retrograde orbital path of Mercury exists in Earth's solar system

where mankind also lives, than such like retrograde elliptical orbital paths could exist else where in other star systems with the exoplanets as well.

Therefore, this paper has presented an demonstrated not only theoretical mathematical equations that propose and offer additional explanations that both circular and elliptical retrograde orbits more likely than not exist not only pertaining to the planet Mercury in not only Earth's solar system, but in also other star systems as well. Therefore, the current mode of understanding that circular orbit are not the only orbits that exist not only in earth's solar system and not only other star systems in the our Milky way galaxy, but most like throughout the entire universe instead.

5.1 Exceptions to this paper

The original paper was written in both the Serbian and English languages. However, there are some Serbian mathematical formula symbols in the Serbian language that will not allow some of these mathematical formulas to be translated into English with the correct interpretations. Therefore, a full interpretation of the author's original paper and mathematical formulas cannot be fully interpreted into the ultimate goal of my the author's research and work. Which in theory the author the author's original paper in theory has a goal of correcting Kepler's laws, and perhaps that which is also related to the theory of relativity. In theoretical terminology that specifically relates to, and explains and describes the irregular movement not only concerning Mercury, but also all the planets (less than that of the Mercury). Therefore, in this paper although an English translation is made to explain as best as possible how the author's original theories may be better understood in English, this paper does not an cannot fully express in the English language how the author's theories original paper makes these theories and mathematical formula equations fully known.

5.2 Observation

The author also does not delete/ eliminate any of the Serbian language explanations and/or descriptions from the original paper sketches, illustrations, or diagrams, so that the full interpretation of both the author's theories and mathematical formula equations do not invalidate real understandings and insights into the evidence.

5.3 Important Reference to Full Original Paper

You may find the original version of this paper in both the Serbian and English languages at http://www.stewart-research-consulting.com/2-cosmology.html.

5.4 Acknowledgements

The author this paper would like to thank any and all researchers in the sciences of theoretics, cosmology, astronomy, astrophysics, and in physics for all of their tireless research throughout the years. For without such research papers like this one would not have been possible.

5.5 Financial Statement

The author for this paper would also like to thank Stewart Research for helping to also financially make this paper a reality, and providing some of the research funds for the implementation of such a paper as well,a nd for this paper's translation into English text to explain this authors original paper as much as currently possible.

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THE (POSSIBLE) CONFIRMATION OF THE FIRST EXO-OCEANS

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Abstract

Current capabilities of telescopy and imaging at best are capable of imaging another solar system. Only a few images exist of exoplanets that have been imaged in another star system. Current aforementioned technologies are incapable of not only not being able to view and image exoplanets up close, but it is next to impossible to attain extreme close up images of the potential exoplanet's surface. Since current technological capabilities are lacking in these astronomical investigations new technologies are needed in order to not only image other extra-solar systems, but to also image their potential exoplanets up close. In order to determine exoplanets had one or more oceans on it's surface. The "IMMI/EXO-SCOPE Technologies" have been used to draw a possible map, find one or more oceans on Gliese 581d and make theoretical assumptions of the oceanographic conditions.

Key words: Oceanography, Astro-oceanography, Astrophysics, Gliese 581d

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1 Introduction

1998 was The International Oceans Year, in 2008 the ONU established June 8th as a World Ocean Day, and August 2012 the scientific team , leaded by Dr. Ronald Stewart, agreed that there was just not one possible ocean, but many more oceans upon the exoplanet's surface known as Gliese 581d in the constellation of Libra.

Plagiarizing Dr. Joshua Lederberg [3], who first used the "exo-" prefix in an academic paper: "The imminence of interplanetary traffic calls for systematic criticism of the theoretical basis and operational methods of exo-oceanography, the initial search for and continual investigation of water bodies it might encounter". Besides the difficulty to confirm an ocean using specular reflection, the IMMI Technology in a elegant way give us images that corroborate the oceans hypothesis that some researchers have about the surface of Gliese 581d.

IMMI is the acronym for (Infinite Microscopic - Macroscopic-Imaging) and EXO-SCOPE is the acronym for (Exoplanetary-Telescope), each is a separate technology and piece of technological hardware. Invented and developed by one of the fellow co-authors of this scientific paper, Dr. Ronald Stewart. A look at http://www.stewart-research-consulting.com provides much deeper comprehensive instructional detail how these two technologies work.

Besides the difficulty to confirm an ocean using specular reflection [1] the IMMI Technology [5] in an elegant way gave us images that corroborate the oceans hypothesis that some researchers have about Gliese 581d's surface.

2 The Scientific Data of Gliese 581d

The current known scientific data has revised itself and has changed three times since 2007; originally [10] it was thought that Gliese 581d was just outside the edge of the Habitable Zone (HZ), and that it would be too cold to be a candidate to possibly be favorable to some sort of extraterrestrial life. However, Mayor in this paper [4] (who was on the original discovery team), revised its original estimate of the planet's orbital perimeters, finding that it orbits closer to its star than originally believed, concluding that the planet was inside the HZ instead. This was further corroborated by an article by the ESO [2] that Gliese 581d was the lightest exoplanet yet discovered.

In 2011 new findings concluded now that there was a good possibility that even liquid water could exist upon this exoplanet surface, this was further consistent with a Gliese 581d climate study by Wordsworth [11], which gave further new evidence that Gliese 581d was likely covered by a "large and deep ocean". The paper by Wordsworth [11] in the study model also presents and demonstrates that an average estimation the light that Gliese 581d receives from its star has about 30% of the intensity of sunlight on Earth.

However, this model goes on to determine that "if" an atmospheric greenhouse effect was produced on this exoplanet due to the increased infrared (IR) radiation sunlight that would be coming into Gliese 581d, that this could significantly raise planetary temperatures, which would be caused by a Greenhouse effect upon the planet's surface. Volcanic activity could raise this even higher.

In the research paper [7] entitled "Vegetation's Red Edge: A Possible Spectroscopic Bio-signature of Extraterrestrial Plants" refers to the to the leaf reflectance of light between 700 and 750nm wavelength. This paper is uses a concept that light reflectance of vegetation would produce a strong-light reflection variance, that could be used on exoplanets to try to determine if an exoplanet had some form of extraterrestrial vegetational life on it or not; such a futuristic technology would certainly have a considerable amount of scientific worth.

The technology mentioned in Seager's article [7] is feasible. However, Cowan [1] refers in his research to a proposed new future technology and refers to it as: "Specular Reflection", in which it is currently estimated that about ten years into the future will be able to try to find water vapor, ice, or liquid water on a exoplanet. This technology would be based upon being able to use a spectrum of scattered light from a spatially unresolved extra solar terrestrial planet; the light would be reflected off of the exoplanet when it would be in its various moon phases. especially in regard to a concept of "Specular Reflection", which is designed to be used to try to find water vapor, ice, or liquid water on an exoplanet. This technology would be based upon being able to using a spectrum of scattered light from a spatially unresolved extra solar terrestrial planet; the light would be reflected off of the exoplanet when it would be in almost moon type phases.

Seager [7] permeates the concept that a red colored spectrum color variance would be indicative of possible vegetation on an extra solar planet, the use of

this concept in color spectrum identification (not necessarily in this paper) for the detection of some sort of alien vegetation. However, the "red edge" concept is a light variance that has the potential for locating possible vegetation on an exoplanet that would be in a star system as reported in Stewart's paper [8] what is particularly interesting is that when the "red edge" concept according to him is coupled and combined with what Cowan [1] describes in his paper entitled: "Spectrography Specular Reflection Method", could theoretically be used in this extra variance, in finding oceans on an exoplanet as well.

Stewart explained [8] what some of the priorities are when making a survey of another star system; one of these priorities would be to determine if the star system has a HZ. In many cases, known science has already determined the area of space that is not too close to the center of the star system, and not too far away where it would be too cold- to possibly support some form of extraterrestrial form of life.

The IMMI technology has a number of capabilities that could be used for the detection of water vapor in the exoplanets atmosphere, ice, or liquid water that could be upon an exoplanet's surface, these capabilities is entitled "IMMI Blue Dot Exoplanet Technology".

The IMMI technology capability is based upon similar methodologies of near IR band with color spectrum wave variance which is in the spectrum of Earthshine (i.e., the spatially integrated scattered light spectrum of Earth), this is similar to the same technology used in the "Earthshine Project" and observations made from the Apache Point Observatory (New Mexico) to emphasize that time variability is key to detecting weak surface bio signatures such as the vegetation red edge that Seager [7] describes. Whereas the : "IMMI Blue Dot Exoplanet Technology" is based upon the true genius of Dr. Carl Sagan, in his book entitled "Pale Blue Dot: A Vision of the Human Future in Space" [6] Here are two partial quotes from his book affecting the IMMI Blue Dot Exoplanet Technology.

"The Earth is the only world known so far to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment the Earth is where we make our stand. ... It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me,

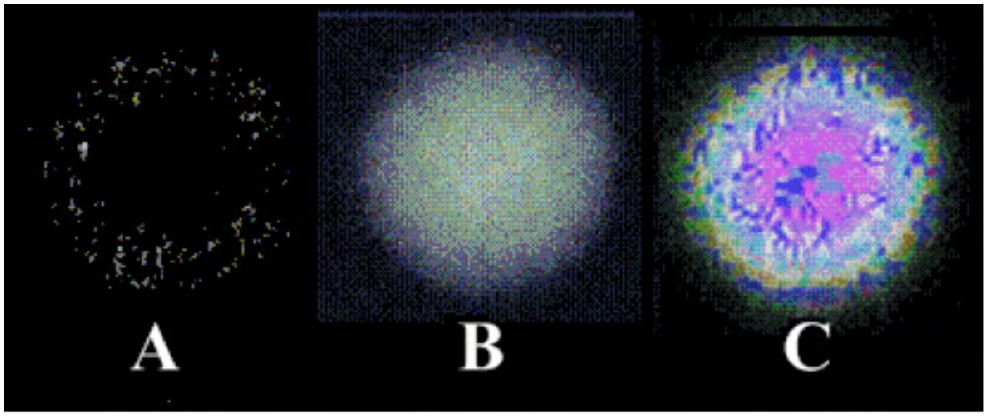

Figure 1: **Views of Gliese 581d (Used with permission of Ronald Stewart)**

it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known".(Carl Sagan)

The IMMI capability uses similar spectroscopic features, these allow time-varying, sharp spectral features at variable light variance wave-lengths to be identified using a color coded system. The blue dot recognition method of course would not guarantee that just because an exoplanet had a blue tint to it's atmosphere or to the planet itself that it would be evidence of any kind of water in any form. The blue could be an indicator of an exoplanet also having a considerable amount of methane in its atmosphere in like manner, however, this could also be an indicator of some form of water.

There are three different indicators that are available when using the "IMMI Blue Dot Exoplanet Technology" to detect water vapor, ice, or liquid water upon an exoplanet's surface [9]:

1. It uses the "Blue Dot" appearance of the earth in first ascertaining that if an exoplanet is blue in color as well that it also could water vapor in the atmosphere, ice and/or water on it's surface in the form of ocean, or even a combination of all the factors, at Gliese 581d we can observe this indicator at Figure 1-B.

2. A second indicator that the exoplanet may also have water vapor, ice, or bodies of water upon it, based upon the fact that the atmosphere of the exoplanet could be exhibiting a bluish-blue like spiked and sinuous

band of a charged plasma glow of Aurora Like or atmospheric activity due to excitation of atomic oxygen in the upper atmosphere, at Gliese 581d we can observe this indicator at Figure 1-A.

3. A third indicator is the optional capability is the "IMMI Blue Dot Spectrography Specular Reflection Capability", this capability takes uses a similar capability to a most recent technological approach known as "Specular Reflection", at Gliese 581d we can observe this indicator at Figure 1-C.

On Earth, bodies of water tend to be bluish because they reflect blue skylight. The sky appears blue because of molecular Raleigh scattering of sunlight by the atmosphere, the seas and oceans appears blue from the sky because the absorption (yellow and red) of the sunlight by the water. However, seen from the space earth is blue because our planet has 75% the surface covered by water. It is believed that Gliese 581d would not have a distinguished "Blue Tint" like earth unless it had presented both as ice, and the blue intensity of the seas and oceans depends on disperse particles indicating the oceans depths. Using the IMMI technology therefore allows an analysis of the multi-frequency images, which than give us a possible configuration of this exoplanet's theoretical characteristics.

3 The IMMI Data of Gliese 581d

Longitude and Latitude measurements for earth are necessary in order to establish locations both as far as land masses, coast lines, and other identifying geographical features are concerned on both land and sea.

Using the same fundamental concepts in application allow this to be applied to what will be a geographic grid applied to an exoplanet (Figure 2). Of course these exoplanet longitudes and latitudes will look much different since the potential landmasses on Gliese 581d are very different than what would seen and applied to the earth in all of the north, south, east, west, and these boundary lines applicable to the equator as well.

Figure 3 is an aerial view about 750m above the exoplanet's surface captivated with the IMMI technology; the position is approximately 46°N 046°E. Although, the ice land formations seen in Figure 3 are not exactly like the Ice Mountain islands as seen on earth this is completely understandable. Why? Because this exoplanet is outside the confines of earth's solar system, what

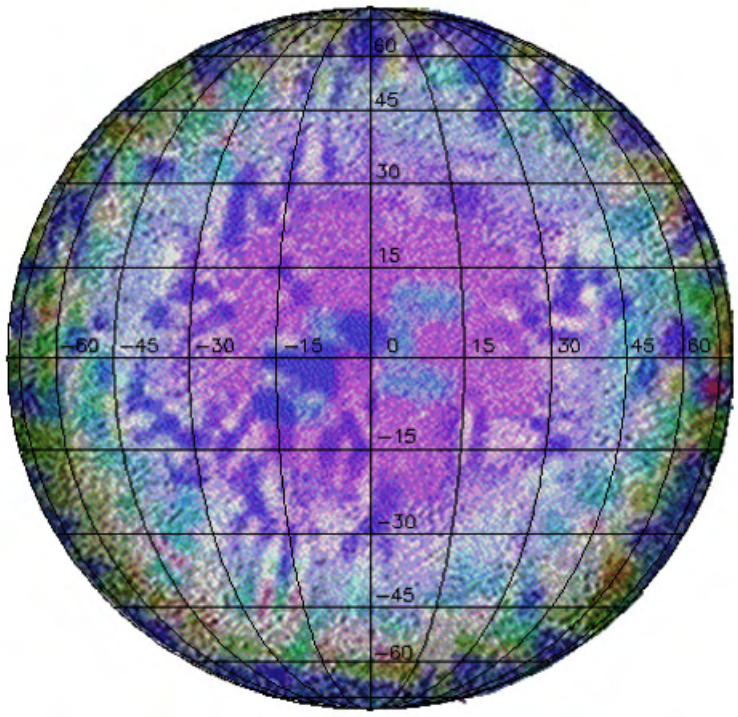

Figure 2: **View of Gliese 581d with a geographic grid (Used with permission of Ronald Stewart)**

is rather seen in the image to the right are what look more like the type of topography known on earth as "Sea Cliff Ice Capped Ice Shelves". Which also have an appearance as would be seen on earth in what is also known as "Fjord-Like-Ice capped Sea Cliffs".

Again the blue area in Figure 3 has a similar color to the waters as would also be seen in some oceans that have terrain where fjord sea cliffs also exist on earth. Which is a similar color like other oceans on earth around these ice cap sea cliffs. The abstract flat look to the terrain is estimated because of the gravitational forces on this exoplanet, which are at least 2.27 times (or greater) than on earth. This type of terrain also has similarities to similar terrain composed of ice and would also be seen in some regions in the upper parts of the northern polar regions on Earth.

Stewart [8] reports that Gliese 581d in "climate only" has similarities to earth's past Neoproterozoic to Paleoproterozoic (transitional snowball like

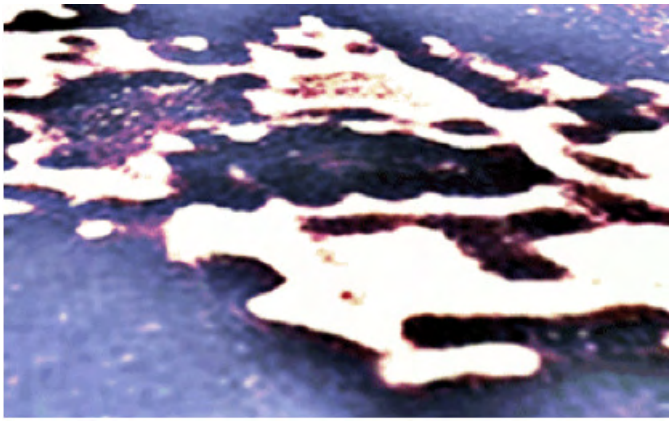

Figure 3: **A Gliese 581d sea cliff ice capped ice shelves (Used with permission of Ronald Stewart)**

earth) as it most likely existed millions of years ago[1].

The analysis of many observations in the images of the surface of Gliese 581d show very intensely active oceanic conditions and wave activity, a climate would have to be present for the oceans to be active as they most likely are. Observations in images and videos determine that there are likely a hundred seas and at least a dozen oceans upon the surface of Gliese 581 d. There are likely hundreds of small bodies of water on land and each is a separate body of water without obvious connections, the melting ice basins maybe make the largest group of bodies of water.

When analyzing these facts and observations from the astronomical sense, concerning the exoplanet's albedo, the ratio of the light reflected by a planet or satellite to that received by it, is only about one-third or a little more than on earth. However, from an imaging standpoint the dark blue areas on this exoplanet are big deep bodies of water, or in the last analysis, Oceans.

The review and analysis of the IMMI images allow us to draw a possible configuration of Gliese 581d (Figure 4) showing a lot of water bodies and land masses, more IMMI images are needed to make a whole planisphere. There have been many numerous observations made of not only Gliese 581d as not only an exoplanet itself, but especially of it's surface from a number

[1]Note: It needs to be made perfectly clear, that this scientific paper is only likening these conditions these conditions "in climate; not the biological means that are associated with such descriptions".

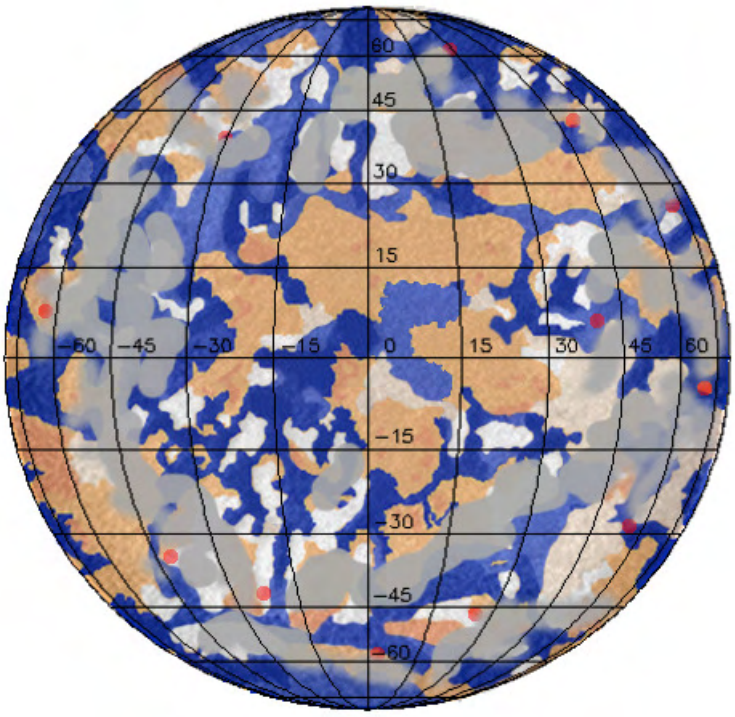

Figure 4: **Possible Configuration of Gliese 581d with a geographic grid. Legend: orange - land; light orange - icy-land or dirty ice shelf under land or water; white - ice shelf under land or water or clouds; light blue - shallow water, icy-water or land with melting water; dark blue - water; gray - volcanic clouds; red - active volcanoes**

of different scientific disciplines and sub-disciplines. In which in all of these instances because there are numerous similarities to striking similarities as to oceanic conditions seen and studied on earth, that when comparing earth oceanic conditions to those of Gliese 581d, all of these many consistent similarities indicate similar conditions when compared to each other. Further analysis of Gliese 581d when compared to earth also exhibits similarities as would be seen on earth pertaining to known large fresh water lakes and salt water seas and oceans exist; in this myriad of bodies of water there is also a place for acidic and alkaline water, but the volcanic activity would point to acidic water.

However, in and around these many oceans are fjord-shaped cliffs where it has been observed that the tops of these cliffs have many ice caps on them. So much of what is observed is really interesting, and has many similarities to

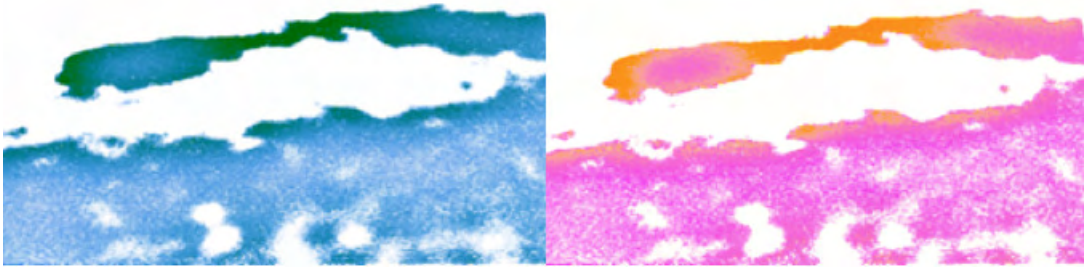

Figure 5: **An image showing water action, with a splash on the left, a current from right to left and the "bay areas" with water with different temperature (more cold) than offshore, around 12°N 003°E (Used with permission of Ronald Stewart)**

the kinds of research done in far northern in Norway, regarding a (Snowball Earth) and is representative of what is seen on Gliese581d.

The oceanic currents, flowing with the tides, maintain the distribution of heat and chemicals at Gliese 581d, assuming that a permanent cycle was established. The salinity of the larger bodies of water (seas and oceans) is estimate in 30% to 60% lower than Earth, with a circulation determinate by the rotation, involving the moons and the wind cells of this exoplanet.

Stewart [9] presents and demonstrates in his paper several different locations that in some ways are similar to what is seen on earth in the land formations and coastlines as seen on earth.

However, such seas and oceans on Gliese 581d may be dominated by a short range of temperatures, because the topology there seems like streams and big rivers flows. Due to concentrations of chemical components and the high precipitation, there is possible a existence of differentiation vertically in the masses of large water, but the horizontal differentiation is proved by Figure 5. Under the circumstances, Gliese 581d likely has many kilometers of melting ice on the rockish surface, too. Basically there are 12 astronomical components in a tide on Earth; there are cycles of tides with 12m of variation and points entitled amphidromic with tide of 0.0m. The tides on Gliese 581d possibly will be predominant semi-diurnal (about 20 earth hours) because the possible lock of the small satellites combination with Gliese 581d's largest moon, as and their amplitudes are around 0.15m.

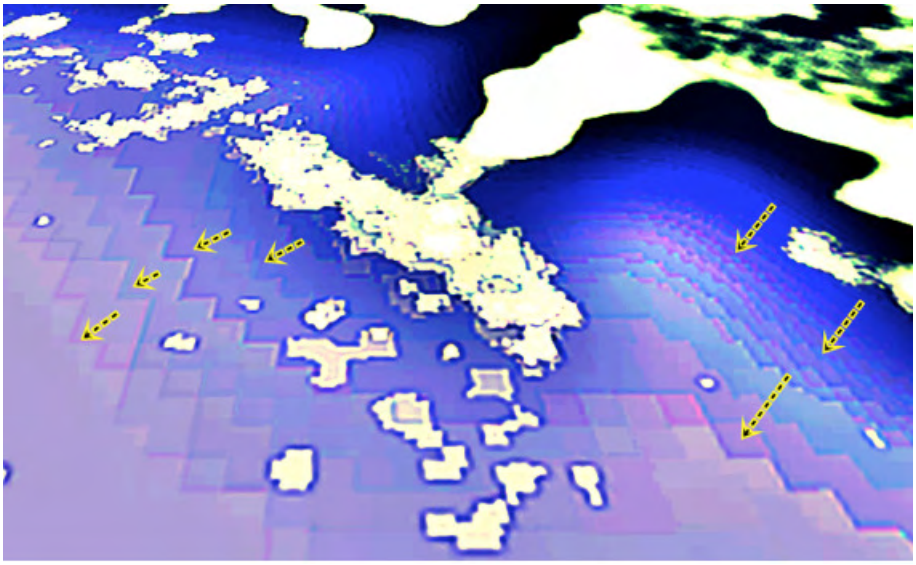

Figure 6: **An image showing wave fronts and the diffraction of the wave crests because the local slope (Used with permission of Ronald Stewart)**

Figure 6 points to a twelve hundred foot mean depth of its continental shelf's and the wind wave influence on the bottom is not sensed till one thousand feet depth on Gliese581d as opposed to deeper part of its oceans. So, it could be just one event as well our last one, however the observational consensus in this exploration is that the near IR images indicate a narrow continental shelf.

Thus, larger planets have better conditions to develop high waves, and observation of the size of the narrow width of the continental shelf, would likely strongly suggest a surf zone with 30 to 250m depth and a ocean with 400m would be more than sufficient to create large wind waves. Figure 6 shows a wave front with a length of 780m, celerity of 47m/s, period of 17s, height of 21m generated by a 30m/s wind, in place located approximately 11°N 002°E. The basic geological characteristics are similar to Earth, potentialities by the gravity force and the size of the planet; the circulation (air and water) systems are fully developed.

4 Conclusion

Gliese581d has very strong wind and wave actions causing the impression of an exoplanet that is in a state of continuous inclement weather, all oceanographic conditions would likely be more intense than on earth, similar as to what would be seen on earth during an intense tropical storm on an ongoing continuous basis.

Waves are larger and the coastal currents are more intense because of the topography. Different from earth having two large landmasses, and/or several continents, whereas Gliese 581d has a myriad of land masses that consist of chain-like-interconnected-continental-islands, which affects and causes a different dynamics of the water mass, with possible water circulation under the ice caps.

While other effects, too few at this point to determine what other type of interactive oceanic conditions and dynamics may be present on Gliese 581d, indicates the need for further investigative images and study to help establish and complete a hypothesis. However, it is unquestionable that the existence of oceans and seas are upon this exoplanet in the Gliese 581 star system in its HZ known as Gliese 581d. The author and co-authors of this paper plan more research and papers pertaining to Gliese 581d.

In all of the accumulative previously known and new data, imaging evidence, videos, and other supplemental materials to this research paper, and the many numerous observations made from several or more applicable scientific disciplines and sub-disciplines, it has been determined that all of this data and evidence is consistent. Secondly, all of the data and images observed and studied is also consistent with the laws of physics and empirical laws.

It could also be said that there are many similarities to Gliese 581d as would have also been seen in a snowball-like-earth, but how the characteristics of earth developed compared as a planet, compared to Gliese 581d as seen now are not similar.

Gliese 581d is in the HZ in its system, the estimated average temperature is 20°C, the estimated lowest temperature is around 0°C, have all three indicators of water of the "IMMI Blue Dot Exoplanet Technology" and the images of the surface show interaction ocean-atmosphere with wind generated waves.

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MOXIFLOXACIN HYDROCHLORIDE COMPOUND IMPURITIES MICROSCOPIC IMAGING STUDY

Spaulding, V.E. *

June, 2013

Abstract: The methodology and formula for producing moxifloxacin hydrochloride compounds and having very low levels of impurities are provided in Pharmaceutical US Patent # 20130059880. Which initiates claims that the impurities in and ending result when produced is less than 0.1%, per total volume of this pharmaceutical when in its moxifloxacin tosylate crystal powder form. We contend that moxofloxacin related impurities not only pose some of the already known side affects such as rash, and slight fever, but that these impurities may have other deficiencies, however, may also have unknown other benefits deep within the compound properties as well. However, the problem is that whether it be an optical, electron, and even the world's most powerful Atomic Force Microscope (AFM), they all have limitations in being able to attain deep enough microscopic measurement scale levels, in order to determine what other impurities, deficiencies, and benefits this drug may have. Therefore, a much deeper microscopic imaging study is needed to see if other important discoveries could be made.

Key words: Moxifloxacin, Hydrochloride, Pharmaceutics, Infection.

1 Introduction and Background

The methodology used is to start with a micrograph, depicting a sample of moxifloxacin tosylate crystal powder at approximately 200 μm in diameter. Two microscopic imaging technologies known as IMMI [4] and will attain one

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continuous microscopic imaging view starting at 200 μm, attaining a continuous microscopic imaging video view of much deeper and smaller microscopic measurement scale sizes into this pharmaceutical. Eventually attaining a microscopic measurement scale size of approximately 1.0 nm or smaller. Which will expose this drug at its atomic level or even smaller. The ending result (to one degree or another) will be to find similarities, resemblances, outlines, connections, or microscopic imaging recognition patterns in the drug. Between the known and unknown impurities, deficiencies, and benefits that this pharmaceutical may yet have to offer by the discoveries made within it. Secondly, the video made will take up where this paper leaves off at. Therefore, it is not only important to read this paper to watch the video to it as well.

This paper's foundation is based upon aspects of moxifloxacin is an antibacterial medication used to treat patients with certain types of bacterial infections, such as pneumonia, bronchitis, and also has been an alternative pharmaceutical in the treatment in other types of infections such as *Mycoplasma gentialium*. However, a concise, deeper, comprehensive and detailed micro-imaging study is needed to determine not only attain new data, but to also help scientists, researchers, and the pharmaceutical industry to attain deeper understandings and insights into the compositional aspects of this pharmaceutical. Which would also add new enlightenment as to what additional possible impurities, deficiencies, and benefits this drug may have. This medication is part of a class of drugs called fluroroquinolones, which work by destroying bacterial pathogens in the body. However, as with any drug, side affects may occur as well. Therefore, the intent and purpose of this paper is to discuss some of the side affects caused by this drug, and then introduce the microscopic imaging/video study. Looking at this pharmaceutical starting at a diameter of about 200 μm eventually attain a microscopic measurement of 1.0 nm Which should reveal new data that will provide new data. proving new knowledge, understandings, insights, and enlightenment into this drug never attained before.

2 Headache and Dizziness

Treatment with this antibiotic can cause headache or dizziness in patients, health reports [5] at PDR Health. Which is a, a medical information web site associated with the Physicians' Desktop Reference. Headache pain or sensations of dizziness can affect a patient's ability to remain alert and attentive while at work or school. Patients can manage headache side effects by using an over-the-counter pain medication, such as acetaminophen. During

episodes of dizziness, affected patients should remain seated until the sensation passes in order to prevent injury from tripping or falling down. However, any symptoms should be followed up with a person's physician as soon as possible.

3 Gastrointestinal Upset

After taking a dose of moxifloxacin, patients can develop gastrointestinal side effects. Affected patients can experience stomach discomfort, nausea, vomiting or heartburn, warns at MedlinePlus [5], a health information resource established by the U.S. National Library of Medicine. Additional side effects can include constipation or diarrhea, which may cause abdominal gas or bloating. Gastrointestinal upset symptoms can be uncomfortable and may contribute to a decreased appetite in certain patients. Patients who experience severe diarrhea or notice blood within the stools should contact a medical professional immediately. This side effect can occur up to 2 months after completing treatment and indicates a severe reaction to moxifloxacin.

4 Currently Known Impurity Ratio Per Total Volume

This impurity having the number CAS 721970-37-2 was identified and published for the first time by Dr. Reddy's Laboratories Ltd. [3]. It was observed to be present in amounts above 0.1% in industrially produced moxifloxacin,where it is called Impurity-1.

Second, in the United States Pharmacopedia-India Private Ltd. publication [1], this impurity referred to as Imp-1 was correctly defined as a process impurity. The samples used by USP-India, once again were to carry out the study were provided by Dr. Reddy's Laboratories Ltd. The developed HPLC method allows detecting such impurity in moxifloxacin with a 0.016% delectability limit.

Persons and institution(s) involved in filing US Patent # 20130059880 such as Gottardo [2] also did their own experimentation confirming that the impurities of formula VII is a typical process impurity of moxifloxacin. Its formation appears to be due to the action of hydrofluoric acid, released during the coupling of the two syntons on the methoxy group. Which next releases the methyl carbocation which in turn alkylates a second moxifloxacin

molecule. This impurity is particularly difficult to remove from the product using conventional re-crystallization methods. Therefore, this molecule also needs to be looked for as well.

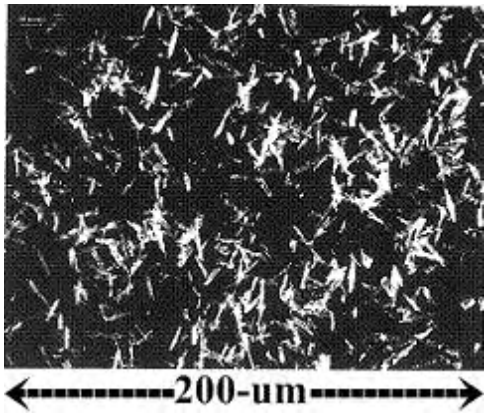

Figure 1: **Visualization of moxifloxacin (Source: Fabbrica Italiana Sintetici S.p.A [2])**

Based upon US Patent # 20130059880 shows an image acquired with an optical microscope of moxifloxacin tosylate crystal powder and indicative impurities at an approximate microscopic measurement scale level of 200 μm (Figure 1).

5 Supplemental Material

Available at: http://www.stewart-research-consulting.com/medical-r–d.html.

6 Acknowledgements

The author of this paper would like to thank all researchers and scientists involved in the study of medical diseases and the pharmaceutical industry. Who for without their research papers like this one would not be possible, and also like to thank the Stewart Research and Consulting for the pharmaceutical video..

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THEORETICAL IMPLICATIONS OF NANO-SCALE QUANTUM GRAVITO-MAGNETISM ON THE NATURE OF OUR STEADY STATE UNIVERSE

Boyd, M.E. *

July, 2013

Abstract: The Big Bang Theory has come in to question because surrounding galaxies accelerate apart faster than predicted by the theory. This has been referred to by some physicists as "inflation theory". Recent discoveries of the presence of gravitational lensing rings observed in the cosmic background of the known observable universe (Figure 1) coupled with the quantum relationship of gravity to electromagnetism (Figure 2) supports the premise for "eternal inflation" upon which some inflation theories are based, undermining the Big Bang Theory's premise that at some time in the distant past a finite temporal event occurred creating the universe of today.

Key words: Gravitational, Einstein Rings, Black Hole, Quantum Time, Big Bang.

1 Highlights

In particle physics, the ADD model, also known as the model with large extra dimensions, offers an alternative scenario to explain the weakness of gravity relative to the other forces. This theory requires that the fields of the standard model are confined to a four-dimensional membrane, while gravity propagates in several additional spatial dimensions that are large compared to the Planck scale.

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This inventor postulates that there exists an equivalent quantum nature to gravity associated with the presence and absence of matter on the spinning disk to the quantum nature in electromagnetism in the semiconductor junction, or a rectifier, as a type electromagnetic spin valve device which is based on the spin of conduction energy band electrons in the semiconductor crystal.

Fourteen defects were fabricated on a "2400 Oe 31.5 mil 95 mm MR disk" using a Focused Ion Beam (FIB). Seven bumps of ≈32 nm height were deposited, and seven pits ≈51 nm deep were etched, on a disk ≈1.27 mm apart on a radius. The US Patent Application # 13595424 [4] is for a Utility Patent on the use of a type device the inventor characterizes as a "mass spin-valve" or "gravitational rectifier" which uses gravitational frame dragging to produce an electric signal and/or associated mechanical force, for general use in surface characterization work and power produced by the presence or the absence of matter on a spinning disk.

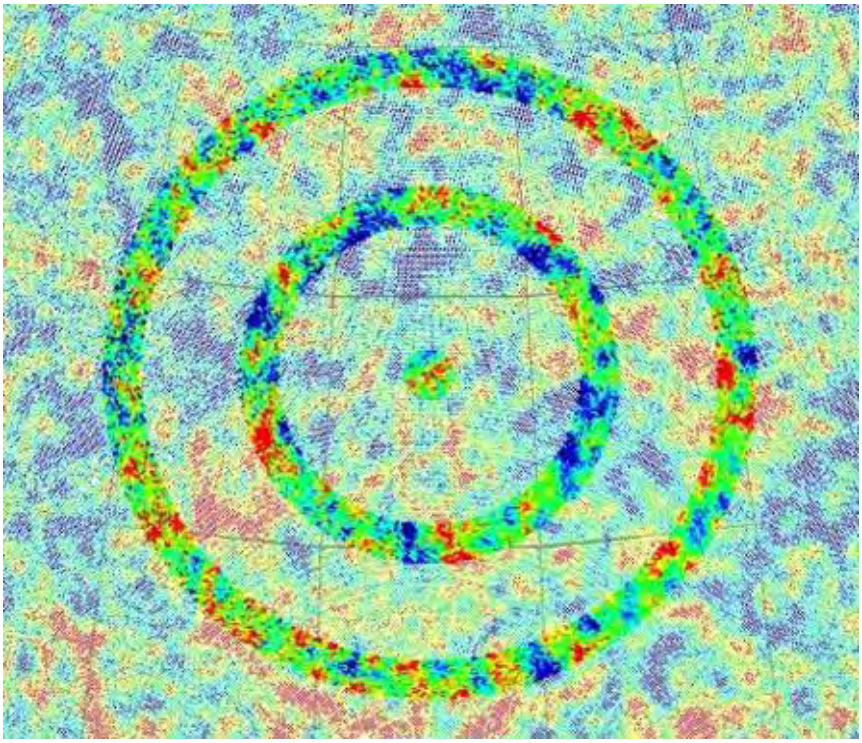

Figure 1: **A map of the cosmic background radiation (CMB) (Source: Gurzadyan and Penrose [8])**

Recently observed gravitational lensing rings in the cosmic background radiation shown in Figure 1 where "the observable effect, in our CMB sky, of families of concentric circles over which the temperature variance is anomalously low, the centre of each such family representing the point of 'I' at which the cluster converges. These centers appear as fairly randomly distributed fixed points in our CMB sky. The analysis of Wilkinson Microwave Background Probe's (WMAP) cosmic microwave background 7 years maps [3] [10] does indeed reveal such concentric circles, of up to 6σ significance" as reported by Gurzadyan and Penrose in 2010 [8]. These concentric rings are predicted by Albert Einstein's theory of general relativity. Instead of light from a source traveling in a straight line in three dimension, it is bent by the presence of a massive body, like a super massive black hole which distorts space-time. An Einstein Ring is a special case of gravitational lensing, caused by the exact alignment of the source, lens and observer. This results from symmetry around the lens, causing a ring-like structure. The size of an Einstein ring is given by the Einstein radius. This author postulates they suggest the presence of a super massive black hole.

In radians, it is:

$$\theta_E = \sqrt{\frac{4GM}{c^2}\frac{d_{LS}}{d_L d_S}} \tag{1}$$

where:
G is the gravitational constant,
M is the mass of the lens,
c is the speed of light,
d_L is the angular diameter distance to the lens,
d_S is the angular diameter distance to the source, and
d_{LS} is the angular diameter distance between the lens and the source.

Note that, over cosmological distances $d_{LS} \neq d_S$ - d_L, in general.

2 Theory of Quantum Gravitation

Einstein's problem was he only understood the universe from the side of electrons not the holes side that dominates it. If you think of empty space as a high density of holes and matter as regions where electron density is higher then you see Einstein Dirac etc..., where blinded by the light produced by

electrons..., that's why they couldn't see the holes in the universe all around them.

Magnetism is a property of electromagnetism produced by electron states in matter; gravity is produced by the mass of the matter which mass comes from the mass of the neutrons and protons of the element of matter as described in the periodic table of the elements of matter.

Table 1: Particle mass

Name	**Mass**
proton	1.6726 x 10^{-27} kg
neutron	1.6749 x 10^{-27} kg
electron	0.00091x10^{-27} kg

The mass of a neutron is greater than the mass of a proton because the neutron contains a proton, contains an electron with some subatomic particles.

Neutron stars are collapsed matter leaving only neutrons at the atomic scale that makes up the neutron star and black holes are nearly identical but made of protons [holes] instead.

Black holes are black not because light doesn't escape but because black holes are made of holes [collapsed protons] where light is not present because there are no electrons to absorb the light for re-emission of the light.

Holes are the mechanism for quantum tunneling in the semiconductor; as well as superconductivity. To understand how "holes" work it is useful to examine the Hall effect in semiconductors. The Hall effect is due to the nature of the current in a conductor. Current consists of the movement of many small charge carriers, typically electrons, holes, what are called mobile ions or all three. When a magnetic field is present that is not parallel to the direction of motion of moving charges, these charges experience a force, called the Lorentz force. When such a magnetic field is absent, the charges follow approximately straight, 'line of sight' paths between collisions with impurities, phonons, etc. However, when a magnetic field with a perpendicular component is applied, their paths between collisions are curved so that

moving charges accumulate on one face of the material. This leaves equal and opposite charges exposed on the other face, where there is a scarcity of mobile charges. The result is an asymmetric distribution of charge density across the Hall element that is perpendicular to both the 'line of sight' path and the applied magnetic field. The separation of charge establishes an electric field that opposes the migration of further charge, so a steady electrical potential is established for as long as the charge is flowing.

In the classical view, there are only electrons moving in the same average direction both in the case of electron or hole conductivity. This cannot explain the opposite sign of the Hall effect observed. One very important feature of the Hall effect is that it differentiates between positive charges moving in one direction and negative charges moving in the opposite. The Hall effect offered the first real proof that electric currents in metals are carried by moving electrons, not by protons. The Hall effect also showed that in some substances (especially p-type semiconductors), it is more appropriate to think of the current as positive "holes" moving rather than negative electrons.

Theoretical physicists Arkani-Hamed, Dimopoulos and Dvali pointed [2], out that prior to now, gravity had not been measured below a distance of about a millimeter. They whose model is known as ADD, suggest that there could be extra dimensions as large as a millimeter in diameter. In particle physics, the ADD model, also known as the model with large extra dimensions [1], offers an alternative scenario to explain the weakness of gravity relative to the other forces. This theory requires that the fields of the standard model are confined to a four-dimensional membrane, while gravity propagates in several additional spatial dimensions that are large compared to the Planck scale.

Theoretical physics typically treats the Planck scale as the highest energy scale and all dimensional parameters are measured in terms of the Planck scale. In models of large extra dimensions the fundamental scale is much lower than the Planck scale. This occurs because the power law of gravity changes. For example, assuming r is the distance between the gravitational induction sensor and the spinning disk; when there are two extra dimensions of size d, the power law of gravity is $1/r^4$ for objects with $r \ll d$ and $1/r^2$ for objects with $r \gg d$. This relationship suggests if we want the Planck scale to be equal to the next accelerator energy (1 TeV) we should take d approximately 1mm.

As suggested by ADD, gravity could be just as strong as the other forces but only felt strongly at short distances. Scientists funded by the European Space Agency have measured the gravitational equivalent of a magnetic field for the first time in a laboratory. Just as a moving electrical charge creates a magnetic field, so a moving mass generates a gravitomagnetic field. According to Einstein's Theory of General Relativity, the effect is virtually negligible. However Tajmar [11] have measured the effect in a laboratory. Their experiment involves a ring of superconducting material rotating up to 6,500 times a minute. The volume Pit & Bump Volume is expressed again in the mathematical equation that would be the theoretical mechanisms for the influx possible for a black hole. Which may be expressed by equation (1).

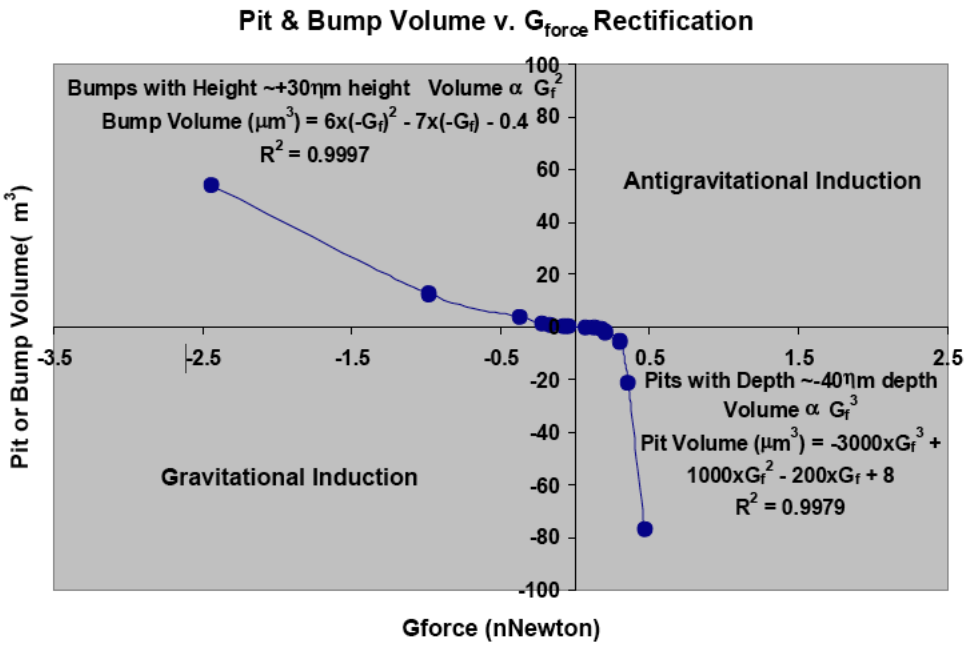

Figure 2: **Gravitational induction equivalent of the semiconductor rectifier (Source: Author)**

This author postulates that there exists an equivalent quantum nature to gravity associated with the presence and absence of matter on the spinning disk to the quantum nature in electromagnetism in the semiconductor junction (or a rectifier) as a type electromagnetic spin valve device which is based on the spin of conduction energy band electrons in the semiconductor crystal. Figure 2 shows the gravitational induction equivalent of the semiconductor; as a gravitational rectifier in the mass spin valve device; whereby

the downward gravitational induction force (N type donor gravitons) is produced by additional mass; equivalent to the electrons in the semiconductor rectifier; and the upward gravitational induction force (P type acceptor anti-gravitons) is produced by the absence of mass, equivalent to "holes" in the semiconductor rectifier.

3 The Gravitational Rectifier or Mass Spin-valve

On Earth's surface, a mass of 1 kg exerts a force of approximately 9.81 N. 1 N is the force of Earth's gravity on a mass of about 102 g (1/9.81 kg) of force down, or 1.0 kgf (1 kgf = 9.80665 N). It is shown that the presence or the absence of matter on a spinning disk's surface creates gravity-induction on the spinning disk that can be measured as a mechanical force signal from piezoelectric Glide head and also as an induced electrical signal on a GMR head. What is needed is a device to harness an electric signal and/or associated mechanical force for general use for work, and power, produced by the presence or the absence of matter on the spinning disk.

In the computer hard drive industry quality control for high density recording requires that the computer's hard disk surface be free of defects larger than 1 μm x 1 μm in area or better. Current methods for characterizing defects of this size are limited by slow metrology techniques such as Atomic Force Microscopy (AFM) or faster techniques like Piezoelectric (PZT) Glide. Another faster defect detection technique that uses spin stands such as magnetic certification testers that detect missing pulses at high frequency write and read rates (i.e. a hard disk certifier).

An atomic force microscope image from a 10 μm x 10 μm area pit is shown in Figure 3 a). A magnetic force microscope image of a written track from a typical hard disk is shown in Figure 3 b). An MR read back signal from a magnetically erased disk and a certification missing pulse test reading for the same 10 μm x 10 μm area pit are shown in Figure 3 c) and d) respectively.

Fourteen defects were fabricated on a "2400 Oe 31.5 mil 95 mm MR disk" using a Focused Ion Beam (FIB). Seven bumps of $\approx$32 nm height were deposited, and seven pits $\approx$51 nm deep were etched, on a disk $\approx$1.27 mm apart on a radius, as shown in Figure 4.

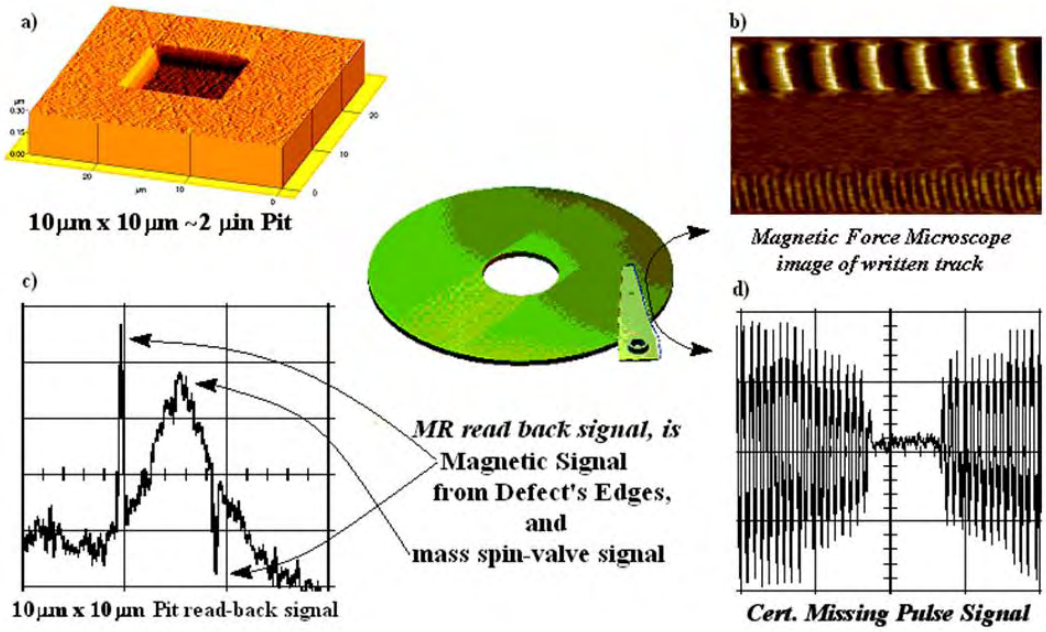

Figure 3: **10 μm x 10 μm area pit views an signals (Source: Author)**

The "mass spin-valve" or "gravitational rectifier" [4] which uses gravitational frame dragging to produce an electric signal and/or associated mechanical force, for general use in surface characterization work and power produced by the presence or the absence of matter on a spinning disk. The results from a prototype Nano-features disk (Figure 4) are shown in Table 1.

Figure 5 shows that for a 10 μm x 10 μm $\approx$32 nm bump measured with an AFM produces a characteristic PZT Glide signal (measured at linear velocity = 22.6 m/s) of the downward force of the bump on the downward facing head slider and a characteristic MR magnetic modulation signal plus MS signal of a bump (labeled as non-contact MS-valve signal).

Figure 6 shows that for 10 μm x 10 μm $\approx$51 nm deep pit measured with an AFM produce a PZT Glide signal (measured at linear velocity = 22.6 m/s) and the characteristic MR magnetic modulation signal plus MS signal of a pit.

Figure 7 shows that 10 μm x 10 μm bump defect exhibits two electromagnetic signals due to electromagnetic induction created by the edges of

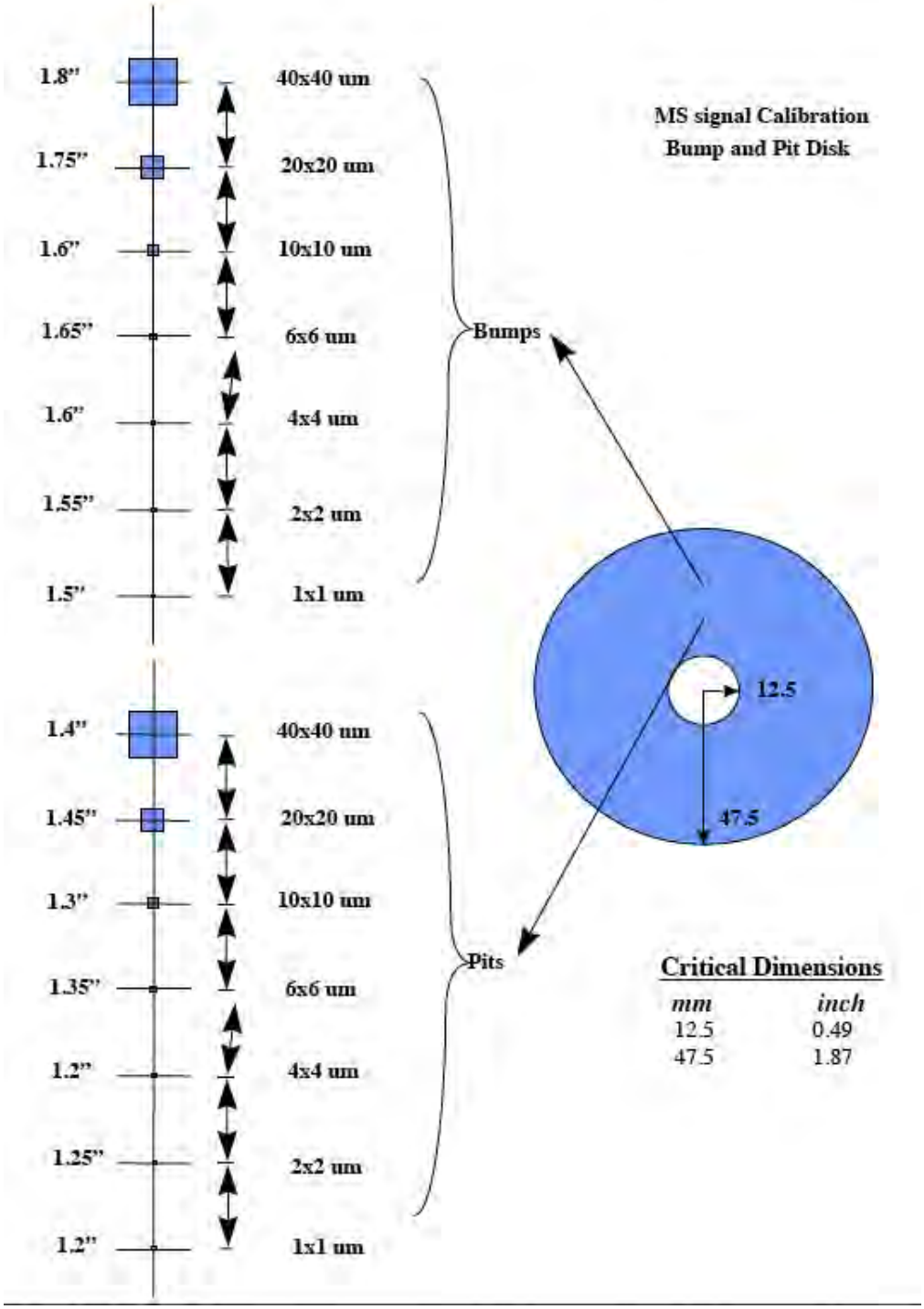

Figure 4: **Types of fabricated defects (Source: Author)**

Table 2 - Nano-feature's design and measured performance parameters

Design Width (μm)	Defect Type	AFM Width (μm)	AFM Height or Depth (μin/ nm)	MR Modulation Pulse Delay (μSec)	MR Modulation Delay x Velocity(μm)	MR mass spin-valve Signal Maximum Ampl(Vp) Anti-G_{Force} nNewtons)	MR mass spin-valve Signal Minimum Ampl(Vp) G_{Force} nNewtons)	Expected normal Gravity Force Bump Volume x 19.3g/cm^3 density of W (−nNewtons)
40	Bump	40.9	1.27/32.3	3.23	41.021	NA	-2	-0.00010630
20	Bump	20.2	1.22/31	1.6	20.3	NA	-0.805	-0.00002489
10	Bump	10.9	1.27/32.3	0.858	10.8966	NA	-0.304	-0.00000755
6	Bump	6.56	1.22/31	0.518	6.5786	NA	-0.185	-0.00000262
4	Bump	4.76	1.24/31.5	0.38	4.826	NA	-0.14	-0.00000140
2	Bump	2.8	1.04/26.4	0.218	2.7686	NA	-0.065	-0.00000041
1	Bump	2.4	1.05/26.7	0.19	2.413	NA	-0.04	-0.00000030
40	Pit	42.2	1.7/43.2	3.31	42.037	0.378	NA	NA
20	Pit	20.4	1.99/50.5	1.59	20.193	0.287	NA	NA
10	Pit	10.3	2.02/51.3	0.814	10.3378	0.245	NA	NA
6	Pit	6.28	1.92/48.8	0.498	6.3246	0.163	NA	NA
4	Pit	4.25	1.59/40.4	0.34	4.318	0.141	NA	NA
2	Pit	2.4	1.65/41.9	0.208	2.6416	0.102	NA	NA
1	Pit	1.28	1.86/47.2	0.104	1.3208	0.055	NA	NA

the bump defect following Maxwell's right hand rule and also exhibits the gravitational induction signal of 0.304 V, or 0.304 nN of negative magnetic force (measured at linear velocity = 12.7 m/s) .

Figure 8 shows that 40 μm x 40 μm pit defect exhibits two electromagnetic signals due to electromagnetic induction created by the edges of the pit defect and also exhibits the gravitational induction signal of 0.378 V with an equivalent [upward] force of 0.378 x 10^{-9} N produced by 7.69 x 10^{-17} m^3 of missing mass. This novel upward (anti-)gravitational force (Table 1) is not predicted by the ADD model (measured at linear velocity = 12.7 m/s) .

4 Theory of Quantum Time

Regarding the gravitational temporal relation both forms of gravitation experience the same amount of frame dragging as described in Einstein's General Relativity theory; so doesn't that means Time must be the substance between gravitational energy and EM energy that makes up our existence? My summary follows...

Figures 5 and 6 shows the geometry of matter, or lack there of, causes a force field to be produced that I could measure. The reason gravitation is a direct tensor is because it has two components one is the normal gravitational

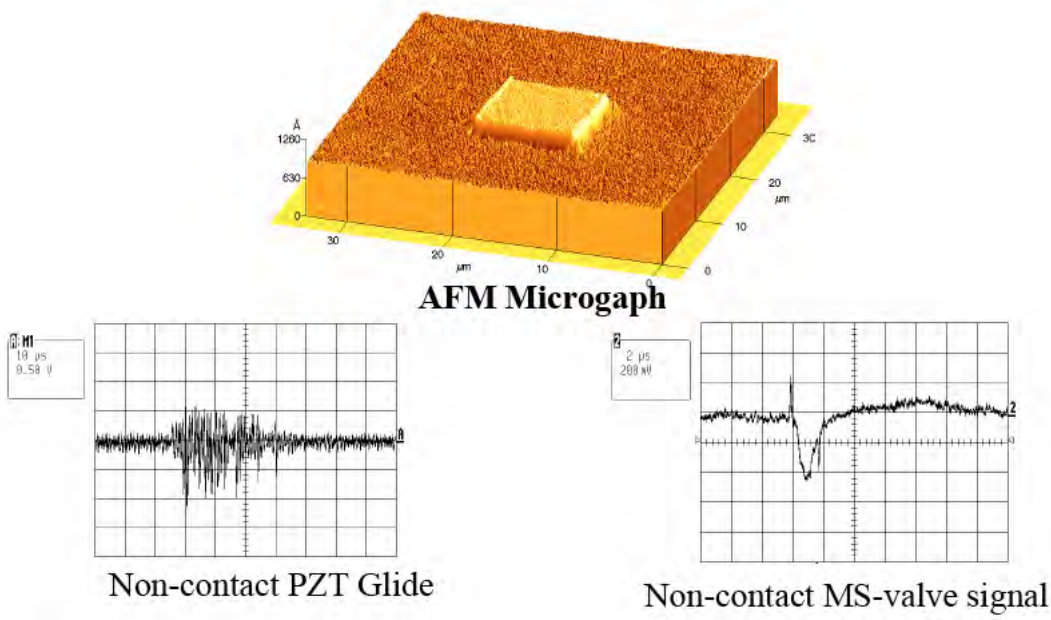

Figure 5: **signal characteristics from reference 10 μm x 10 μm ≈32 nm tall bump defect (Source: Author)**

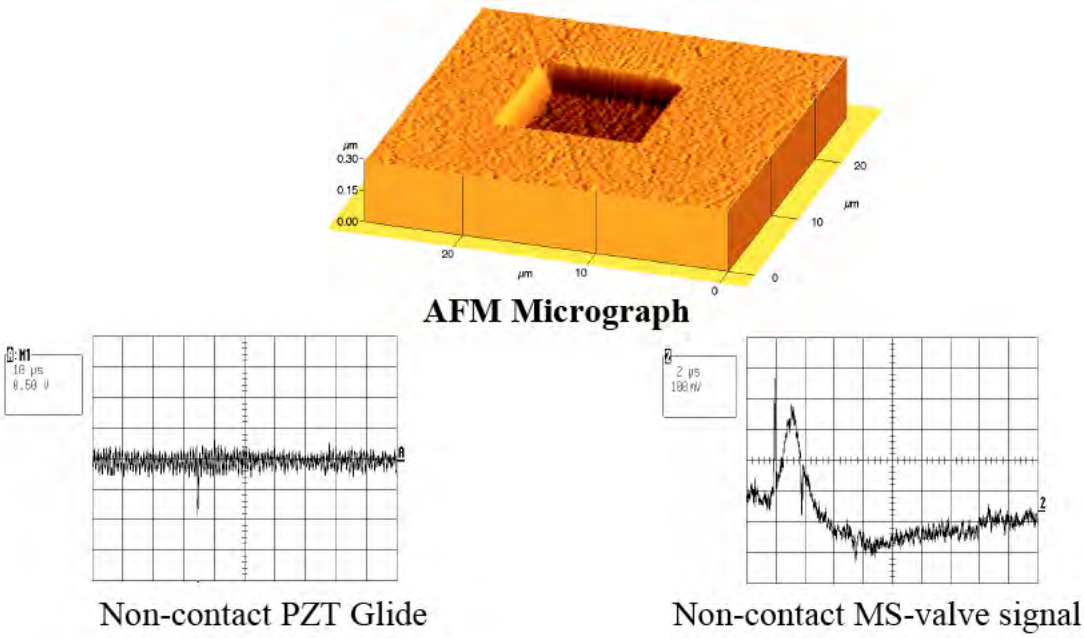

Figure 6: **Signal characteristics from reference 10 μm x 10 μm ≈51 nm deep pit defect (Source: Author)**

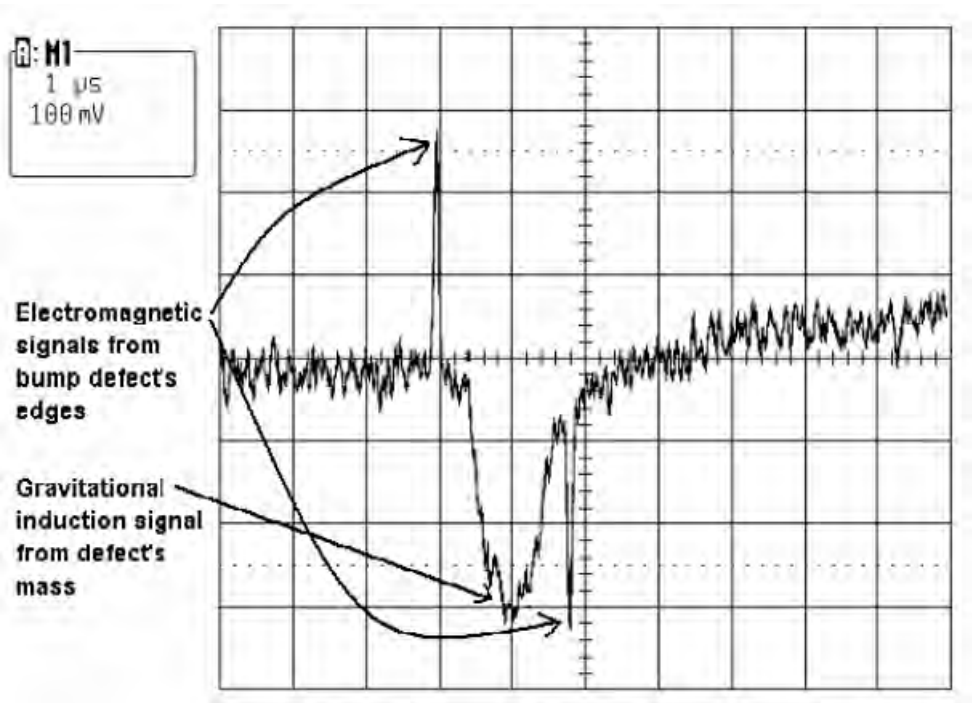

Figure 7: **Typical magnetic induction and gravitational induction characteristic for a 10 μm x 10 μm nano-bump (Source: Author)**

energy produced by the presence of matter's nucleus in the universe and the other what we call repulsive anti-gravity or dark energy is produced by its absence. But the tensor for gravity is much stronger than anti-gravity since the absence of mass produces only about 16% of the magnitude for the same volume (geometry). Some other differences are normal gravity is much stronger below 1 mm from matter than it is above that distance; as is the antigravity force. I found for normal gravity above 1 mm it is consistently linear with distance; while antigravity is $\approx$0. That means the force is $1/r^2$ above 1mm and $1/r^4$ below 1 mm but that means gravity is still linear with distance within both regions of normal gravity space time. Antigravity on the other hand is a third order force repulsive force tensor whose force fields are like that of balloon with their force field's strength being strongest at the membrane of the balloon and weak inside. Regarding the gravitational temporal relation both forms of gravitation experience the same amount of frame dragging as described in Einstein's General Relativity theory; so doesn't that means Time must be the substance between gravitational energy and EM energy that makes up our existence? My summary follows.

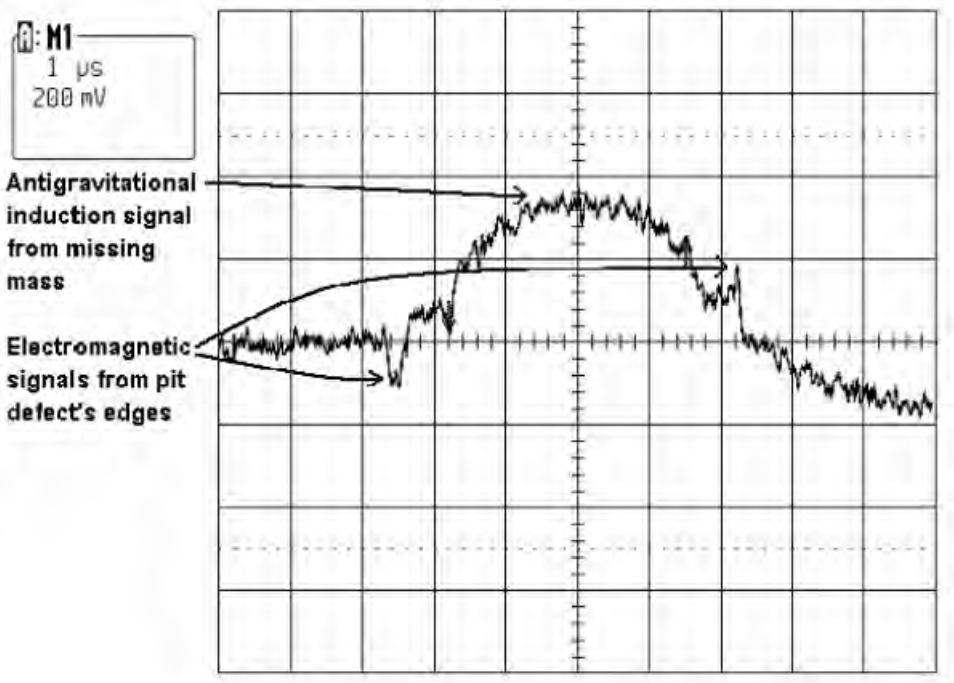

Figure 8: **Typical magnetic induction and gravitational induction characteristic for a 40 μm x 40 μm nano-pit (Source: Author)**

Time must be a substance. That's because gravitational space time is produced by hole states of matter and electromagnetism (EM or light) is produced by electron states of matter. QM is built on EM space time; not gravitational space time. However Special Relativity is built on EM space time while General Relativity is built on gravitational space time.

The manifold of events in spacetime are a "substance" which exists independently of the matter within it...Special Relativity and General Relativity created a conundrum for Einstein that he tried to resolve unsuccessfully to unit the two theory in to one grand unified field theory. My discovery is that while the speed of light is constant that's not true for gravitation. It can be slower in speed and faster too. Einstein focused to much on the speed of light and not enough on the "holes" all around him. That's where the gravitation is. That "electromagnetism is in spacetime A" let's call that space-time "[EM] space-time", and this is what Einstein's "Zur Elektrodynamik bewegter Körper" [5] ("On the Electrodynamics of Moving Bodies") described which reconciles Maxwell's equations for electricity and magnetism with the laws of mechanics, by introducing major changes to mechanics close

to the speed of light. This later became known as Einstein's special theory of relativity (SR) [6] [7] That "gravitation is in spacetime B" let's call that space-time "[G]space-time" and this is what Einstein's General relativity (GR) describes. According to general relativity [9] , the observed gravitational attraction between masses results from the "warping of space and time by those masses". When I write about this "manifold of events in spacetime are a "substance" which exists independently of the matter within it" this "manifold of events in spacetime" is this property that makes Time; as we measure it; the emergent [positive arrow of time]. Therefore time is a vector which direction depends on your position in our universe which is created by a change of energy states between gravitation to electromagnetism; and visa versa.

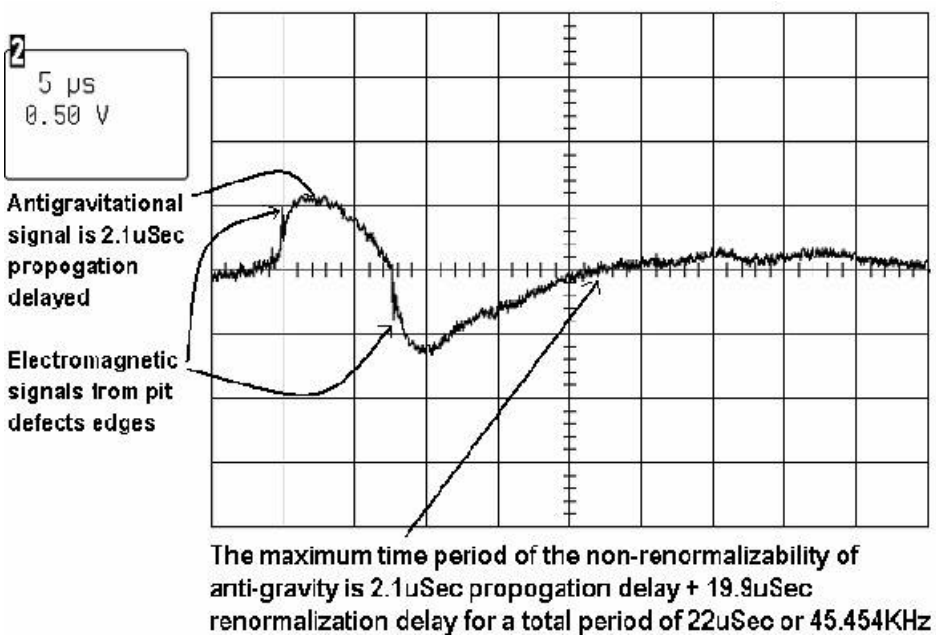

Figure 9: **Time band gap between gravity and electromagnetism in the mass spin-valve device (Source: Author)**

Figure 9 shows that in our local universe; the time band gap between gravity and electromagnetism; is about 22 μs. In this region time stops due to the non-renormalizability of gravity. Based on empirical measurements (Figure 9) this inventor postulates that time itself exists in two simultaneous space-time continuum; one based on electro-magnetism, and one based on gravity. The Wall of Planck only applies in the electromagnetic "energy" universe; not the one based on gravity. In the gravity universe; "mass-energy", or

gravity has the semiconductor quantum property called "tunneling" where mass-energy of opposite "spins" exist simultaneously quantum entangled on both sides of the tunnel; i.e.; a super massive black hole at the center of our know universe. Therefore time has a "band-gap"; much like the semiconductor again; where that time band-gap depends on the object's "mass-energy" plus "electromagnetic energy"; which is location relative to the super massive black hole.

5 The postulates for the known gravitational and electromagnetic universe

While special relativity constrains objects in the universe from moving faster than the speed of electromagnetism with respect to each other, there is no such constraint in general relativity due to the effects of gravity. An expanding universe generally has a cosmological horizon, and like a black hole's event horizon, this marks the boundary to the part of the universe that the observer can see. From this point of view where the observable universe is a spherical volume; space is expanding very fast to cover huge volumes, where new regions come into view during the normal expansion phase; in the spherical volume universe point of view; are exactly the same regions which were pushed out of the horizon during inflation; and so they are at nearly the same temperature and curvature because they come from the same little portion of space, i.e., the Big Bang. From our view our cosmological horizon is still at the big bang and inflation is still going on in a thin skin; where due to the non-renormalizability of gravity; time is nearly stopped. This has been called eternal inflation where eternal inflation supports the hypothesis for the Big Bang theory. In theories of eternal inflation, the inflationary phase of the universe's expansion lasts forever in at least some regions of the universe.

This author postulates that there exist two different universal structures; one based on the spin of the presence or absence of matter's nucleus, i.e., proton spin, or a gravitational space time continuum, and another based on electron spin, i.e., an electromagnetic space time continuum. In such a theory there exists a two sided gravitational space time continuum; where both sides of this gravitational universe are quantum entangled through a super massive black hole at the center of the observable universe; with two independent electromagnetic universes.

The fact that the gravity force has been measured to be as strong as the electromagnetic forces; below one millimeter distance, and gravity propagates at a slower speed than electromagnetism; implies, the universe is steady-state and the electromagnetic image of the cosmic background shown in Figure 1 suggests that fact. The observed rings are visible because there are two sides to the universe that are quantum entangled through the force of gravity; our normal 4-D universe with x, y, z, and time (Planck's Universe which follows the Standard Model); and another dimensional domain for gravity where gravity propagates in several additional spatial dimensions that are large compared to the Planck scale, i.e. the ADD Universe.

With a two sided universe our 4-D universe exists in a parabolic universe where depending on your position relative to the super massive black hole at the center of the universe (the focal point) you will be accelerating or decelerating; where at our position the relationship of mass to normal gravity is described by the relationship (additional mass) bump volume, in [μm^3], is equal to:

$$V_{bump} = 6(-G_f)^2 - 7(-G_f) - 0.4 \tag{2}$$

where G_f is the "negative" attractive force of Gravity which is a parabolic function which has two mathematically real factors (Figure 2). Assuming the Gravitational induction force (-G_f) is variable x and the volume of additional mass is y. Solving for y = 0, by simplifying the equation gives two real factors x_1 and x_2; where x_1 = 1.221255 and x_2 = -0.054589.

In the anti-universe quantum entangled through the force of gravity as measured from our 4-D universe; where repulsive "+" anti-gravity exists in hyperbolic space with one real part and two imaginary factors, relative to us, described by the relationship (missing mass) pit volume, in [μm^3], is equal to:

$$V_{pit} = -3000{G_f}^3 + 1000{G_f}^2 - 200G_f + 8 \tag{3}$$

Assuming the anti-gravitational induction force (G_f) is variable x and the volume of missing mass is y, then y = -3000x^3 + 1000x^2 - 200x + 8, assuming y = 0 the roots are : x_1 = 0.0510251 x_2 = 0.141154 + 0.179826i x_3 = 0.141154 - 0.179826i.

6 Conclusion

Recent discoveries of the presence of gravitational lensing rings observed in the cosmic background coupled with a new understanding of the relationship of gravity to electromagnetism suggest the existence of an eternal inflation gravitational universe decoupled from our local electromagnetic universe and that the Big Bang Theory is just plain wrong.

6.1 Acknowledgements

I would like to thank Gedeon Heinrich, Heiner Sussner, Blasius Brezoczky, George Burt, Dave Ferry, Veronica Munro, Brian-Tinh Vu, and Mike Rogowski for their support in the initial research and subsequent co-authoring by Xipung Xo of the paper "MR glide inspection for hard disk defect detection", Proc. SPIE 3619, 53 (1999); http://dx.doi.org/10.1117/12.343712 without which the authors subsequent patent application and this paper would not be possible.

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BOMBARDMENT OF METEORS FOR THE LAST 3.8 BILLION YEARS

Samadi, A. *

June, 2013

Abstract: In a twenty-four hour period of time millions of meteors fall into the earth's atmosphere anywhere from a meteor the size of a grain of sand and other larger than a basketball. Every so often a meteor about the size of a small car comes through Earth's atmosphere as well. There is no reason to believe that the amount of planetesimals and debris remaining from the initial formation of the solar system would be lower then than it is now, therefore there most likely would have been a much higher frequency of bombardment of the Earth from this debris in the form of meteorites at that time. Indeed, scientists refer to this period from about 4.1 to 3.8 billion years ago. This paper is to discuss this subject and show that there is reason to believe that meteor bombardment upon the Earth is less upon the Earth now than it was 4.1 to 3.8 billion years ago.

Key words: Meteors, Meteoroids, Lunar Meteor Strikes.

1 Background

Late heavy bombardment (LHB), is clearly evidenced on the surface of our moon. Dating from lunar soil samples brought back by Apollo astronauts give a clear indication of the LHB [4]. By inference, the LHB also must have contributed a large number of meteorites to the Earth and its atmosphere as well. Since many meteorites burn up in the atmosphere, there would be a large influx of material from the meteorites, contributing to the change of the Earth's atmospheric composition due to the introduction of a wide variety of extraterrestrial material. Additionally, the increase of gases from the

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vaporization of this meteoric material would increase the density of the atmosphere, contributing H_2O, which is the primary component of greenhouse gases.

Since CO_2 would also be forming from Earth's volcanic activity during this time, a steady increase in the atmospheric density and pressure would contribute to the rising temperature levels worldwide, brought about by the greenhouse effect. Some scientists believe that comets may have struck the Earth during this time as well. Although there is no direct evidence that this has occurred, there is indirect evidence that the Tunguska event in Siberia, 1908 may have been an air burst from an inbound comet. As solid bodies composed mainly of frozen gases, one of the primary components being H_2O, this would have also contributed to the addition of atmospheric water vapor.

Comets with a radius of 50 km would contain roughly 5.26 x 10^5 km^3 of solidified gases, which would of course vaporize and expand upon impact with the Earth's atmosphere. This then poses the question: Which occurs most often- comets actually striking the Earth, or meteorites striking the Earth? Stewart [3] poses and discusses an alternative answer to meteors and meteorites striking the earth. Which is also consistent and agrees with NASA's Jet Propulsion Laboratory, approximately 100 t material lands on Earth every day [1]), mostly in the form of small particles and dust. NASA's Asteroid and Comet Watch program, states, emph"Every day, Earth is bombarded with more than 100 t of dust and sand-sized particles. About once a year, an automobile-sized asteroid hits Earth's atmosphere, creates an impressive fireball, and burns up before reaching the surface."

NASA has placed cameras in many places on a world wide basis to exactly get to the truth as to how much meteoroid, meteors, and meteorites are hitting Earth's atmosphere every day. As Figure 1 above shows where the long white streak is seen is a large meteor coming through Earth's atmosphere, which as dense as Earth's atmosphere is now, this meteor will burn up 3.0-4.0 billion years ago it would have made an impact explosion upon Earth's surface.

By inference, the LHB also must have contributed a large number of meteorites to the Earth and its atmosphere as well. Since many meteorites burn up in the atmosphere, there would have been a large influx of material from the meteorites, contributing to the change of the Earth's atmospheric

Figure 1: **A Southern Delta Aquarid fireball streaks over one of the network cameras in July 2010 (Source: NASA [1])**

composition due to the introduction of a wide variety of extraterrestrial material. Especially in an infinite amount, since Earth's atmosphere was much thinner. Additionally, the increase of gases from the vaporization of this meteoric material would increase the density of the atmosphere, contributing H_2O, which is the primary component of greenhouse gases. Since CO_2 would also be forming from Earth's volcanic activity during this time, a steady increase in the atmospheric density and pressure would contribute to the rising temperature levels worldwide, brought about by the greenhouse effect. Some scientists believe that comets may have struck the Earth during this time as well.

Although there is no direct evidence that this has occurred, some scientists and researchers believe that there is indirect evidence that the Tunguska event in Siberia, 1908 may have been an air burst from an inbound comet. As solid bodies composed mainly of frozen gases, one of the primary components being H_2O, this would have also contributed to the addition of atmospheric water vapor. A comet with a radius of 50 km would contain roughly 5.26 x 10^5 km^3 of solidified gases, vaporizing and expand upon impact with the Earth's

atmosphere. This then poses the question: Which occurs most often- comets actually striking the Earth, or meteorites striking the Earth? According to NASA's Jet Propulsion Laboratory [1], approximately 100 t material lands on Earth every day, mostly in the form of small particles and dust. Consistent with Short and French [2] as well.

2 Evidence

In relation than to the recent large The Chelyabinsk Russia Meteoroid Impact in Chelyabinsk, Russia would seem to give considerable evidence, that instead of a comet blast occurring in Siberia in 1908, that in all likelihood, it was due to a large meteoroid that impacted Siberia instead. By what has been discussed in this paper because of the amount of meteors and meteorites that strike the earth's atmosphere literally millions of time per day in a twenty-four hour period of time, it would make more scientific sense, and deductably logical that when the Earth has just formed and its atmosphere was either very thin or did not exist at all, that the earth was impacted with much more intense severity from meteors and/ or meteorites in much greater quantities per twenty-four hour period of time 4.1 to 3.8 billion years ago in Earth's infancy, compared to the current day and time in Earth's history.

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HYDRODYNAMIC MODELING ANALYSIS OF THE CIRCULATION OF THE BAY OF FUNDY

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June, 2013

Abstract: The purposes of the Bay of Fundy Simulations are or background information for a field trip to Acadia University in Wolfville, NS dealing with different aspects of the Bay of Fundy. To apply the Introgllvht Water Quality and Hydrodynamic model [1] to a large enough water body for which the Coriolis acceleration could be significant. To examine how the Introgllvht model sets up and performs for another case. (Alpha testing of the model software). The study investigates the following aspects of theBay of Fundy. Its general surface and bottom circulation patterns. The surface distribution of the Saint John and Saint Croix River outflows to show how they might distribute eggs and larvae spawned within their shoreline embayments. The flushing time of water from different locations within the bay to estimate how fast exchange takes place within it and as an indication of possible water quality problems. The study covers: A general description of the processes driving circulation within the Bay, and the data required for setting up a hydrodynamic and transport model of the bay. The tidal, freshwater inflow and bathymetric data available from the internet for setting up the model. Development of the model grid.The model setup Input Data for the simulations Graphical descriptions of the circulation, spreading of the Saint John and Saint Croix Rivers.Surface and bottom water flushing times. The possible role of Coriolis Acceleration. Tides at different locations. Tidal velocities at the mouth for comparison to available data.

Key words: Bay of Fundy, Hydrology, Hydrodynamic Modeling, Oceanography, Tidal Circulation.

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1 Why A Model and The Model Being Used

Why perform numerical hydrodynamic and transport mathematical modeling anyway? Some of the reasons are to be thought about as being a possibility relatively cheaply with the availability of high speed PC computers, and they are fun to do. It is less expensive to do computer simulations of a water body than to collect and interpret an equivalent amount of field data. Simulations can be performed to study features in the bay that do not presently exist such as dredging and channeling, effects of industrial discharges into the bay, effects of changing land use on bay water quality due to surface water runoff. Preliminary simulations can indicate features of the bay that will aid in designing field surveys for specific studies. Simulations can be performed for conditions other than those that have been observed. Examples are the study of the effects of different river inflow rates, different tidal conditions at the mouth and different wind conditions on the bay.

Different kinds of results can be produced by a model that cannot be observed from field data. Examples in this study are the spreading of the Saint John and Saint Croix River discharges using a virtual dye simulation, and estimating flushing times throughout the bay using the same technique. The need for field data should not be discounted even with the availability of modeling. Field data is important to describe the general oceanography of the bay and for verifying model results from simulations run under the conditions of the surveys. Field data is important to study features of the bay that are difficult if not impossible to model, such as fisheries resources and related biota. Modeling, however, can provide information about the bay that can aid in such studies.

2 The Model Being Used

The model being used is a three dimensional numerical hydrodynamic and transport model based on the fundamental relationships of fluid motion. The latter are basically the fluid momentum relationships in each of the two horizontal directions, and the continuity relationships that required fluid mass be conserved while it is flowing. The hydrodynamic or momentum relationships essentially give the fluid velocity field at each location in the model grid.The velocity field is used to transport constituents such as heat (for temperature distributions), salinity, tracer dyes and different water quality constituents. The model and accompanying software is found in the American Society of Civil Engineers publication prepared by Edinger [1], and the organization and

approach to this study follows as closely as possible the Guidelines presented by Stewart [2].

3 Description of Processes And Available Input Data

The physical processes driving the circulation of the Bay of Fundy is circulation is driven by the tides at the mouth the freshwater inflows of the Saint John and Saint Croix River. Surface wind shear Density driven circulation due to salinity and temperature profiles at the mouth. Also, the inflow temperature of the rivers and surface heat exchange. Temperature effects will be neglected in the preliminary study. The above represents the major inputs required to perform the numerical hydrodynamic and transport modeling of the bay. The major data required are the tides at the mouth and the fresh water inflows. Location of nearby tidal stations and current speed data are shown in The current speed data is used for comparison to the model results and is not an input to the model. Available tidal, fresh water inflow and current speed data are presented in the Attachment at the end of this write up. Also given are the values of the major parameters chosen for the Introgllvht simulations.

4 Model Bathymetry and Grid Setup

Bathymetric data is required to set up the three dimensional computational grid of the model. Detailed digital bathymetric data is not generally available over the internet. It is fairly expensive to obtain in the digital format that is useful for setting up the model grid. A very general picture of the bathymetry in the Gulf of Maine extending into the Bay of Fundy is shown in Figure 1. This, and some spot depth measurements taken from an Atlas were used to approximate the bathymetry. The first step in setting up the model grid was to approximately map the land borders of the bay. The actual locations of land and water are refined when the bathymetric data file is set up. The second step in setting up the model grid was to determine the x and y coordinate locations of the ends of each of the borderlines shown in. A general reference x and y coordinate axis was placed on a larger version of and the coordinate locations of the ends of the lines were measured. For reference the distance across the mouth of the Bay of Fundy grid is about 76.8 km.

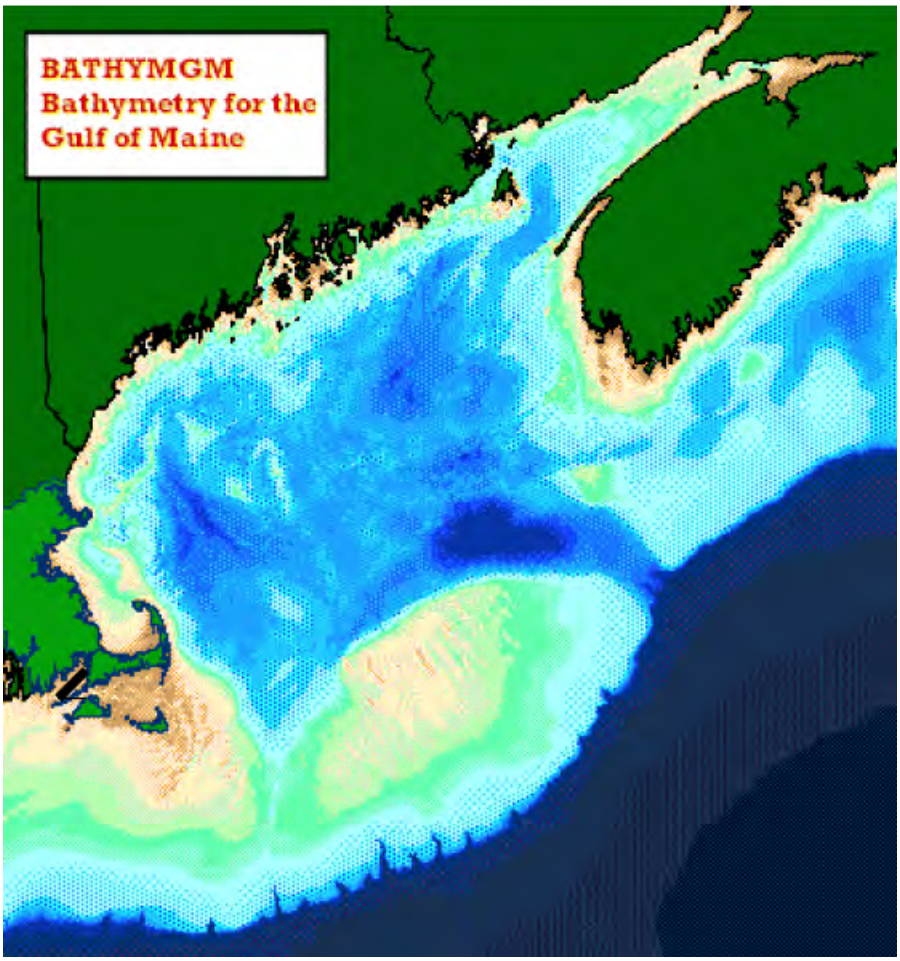

Figure 1: **Color image of bathymetry in Bay of Fundy (Source: Author)**

The third step was to place the x and y coordinates in an Excel spreadsheet so that the borderlines could be mapped onto a grid. Further computations were to divide the x and y coordinate distances by various choices of the model dx and dy to determine how much of the allowed 40 x 40 cell grid of the model could be used to get the most detail. The resulting model grid is shown in Figure 5 when using surface cells of 7.5 km x 7.5 km.

Depths were then located within the center of the model cells within the land boundaries. The depths were chosen to preserve roughly the bathymetry shown in Figure 1. The resulting bathymetric depth file for the model simulations is shown in Table 1. A vertical layer thickness of dz is equal to 2

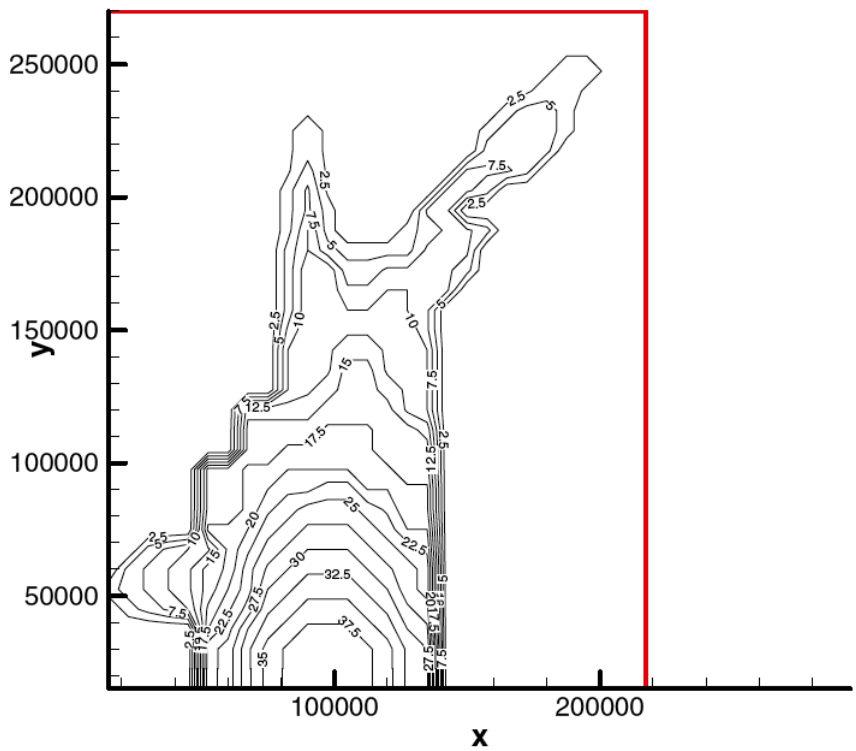

Figure 2: **Mapped model bathymetry from 7.5 km x 7.5 km cell grid. Low tide depths in meters. Model vertical layer thickness is 2 m. (Source: Author)**

m was chosen for the modeling. The resulting bottom bathymetry resulting from the 7.5 km x 7.5 km surface cell resolution and the vertical layer thickness of 2 meters is shown in Figure 2. The grid size and the depths are sufficiently detailed the point of land in the upper eastern arm shown on the previous maps is reproduced in the model bathymetry.

5 Model Input Data

IThe Introgllvht model is designed such that preliminary studies can be performed with little input data. The input data for the model is presented in the project folder entitled "Bay of Fundy Introgllvht Files" which are summarized in section 9 of this report. Various aspects of the input data are examined here primarily to discuss the assumptions made when using the Introgllvht model. The water quality model being used *nwqm* equal to 2, is a dissolved oxygen depression (DOD) model that includes sources for biochem-

ical oxygen demand (BOD), Ammonium, and Organic Nitrogen. However in this case the model is used for another purpose other than modeling DOD.

The reaction and decay rates required for DOD parameters have all been set to zero. The BOD and Ammonium thus become conservative substances and can be used as virtual dye tracers for the Saint John and Saint Croix River inflows. The first inflow shown is the Saint John River median July inflow of 300 m/s and it is located to enter the modeling grid at I equal to 9, J equal to 3, J equal to 8 on the surface. The NH_3 in the discharge is set for a virtual dye concentration of 1,000 μg/l.

There is one tidal boundary across the mouth of the Bay of Fundy extending from I equal to 7 to I equal to 18 at J equal to 2 on the modeling grid. The Introgllvht model uses only a sinusoidal tide. For the Bay of Fundy the mean tide height is set at 2.5 meters, and the tidal amplitude is set at 2.5 meters. The tidal period is set at 12.45 h. The tide at the mouth is taken as an M2 tide with a range of 5 m.

The salinity profile at the mouth of the bay is set to a constant value of 30 ppt. The computations are initialized for a salinity of 5 ppt throughout the bay to allow the salinity induced circulation to spin up during the computations. A constituent is initialized throughout the bay at 100 μg/l of a virtual dye that is used in the computation of flushing and residence times. The external parameters are a Chézy bottom friction coefficient of 35 $m^{1/2}/s$, no wind, and latitude of 44.66^o N. For output only surface and bottom distributions of constituents are examined in the output results tables. However, all the constituents and velocity components are available in the plotting files for graphical output for the surface and the bottom. Time series are extracted for water surface elevations at the mouth of the bay, near the end of the northern arm and part way up the eastern arm. The model simulates at a time step of 120 s over a simulation time of 1,200 hours (50 days).

6 Model Results and Surface Circulation

The tidally averaged surface circulation is at the mouth of the bay, it shows the tidally averaged flow inward over the eastern half of the tidal boundary, and outward over the western half. This coincides with the circulation within the bay being northward along the eastern shore, and southward down the western shore. The tidally averaged current is from east to west at the northern end of the bay. In the western arm, the circulation is again generally

inward along the eastern shore and outward along the western shore. There tends to be a radial circulation in the mouth of the eastern arm where the flow is confined by the point of land.

The surface salinity entering from the tidal boundary, tends to be pushed in further into the bay on the east than on the west. This coincides with the general tidally averaged circulation of inflow along the eastern shore and outflow along the western shore. The inflow of the Saint John River is quite noticeable and is strong enough to be able to deflect the southerly flowing tidally averaged current. These also combine to form a clockwise gyre south of the entrance of the Saint John River inflow. The gyre south of the Saint John River inflow is connected to a longer one that extends almost to the tidal boundary and passes up along the western shoreline across the mouth of the Saint Croix River embayment. Within the Saint Croix River embayment there is another tidally averaged counterclockwise gyre driven by the northerly flow off its mouth.

6.1 Spreading of Saint John River Inflow

The Saint John River inflow was continually injected with a virtual dye such that the discharge concentration would be maintained at 1000 μg/l. The virtual dye release allows examining the dilution of the Saint John River inflow and its densimetric spreading over the surface of the bay. The result of the Saint John River inflow tracer study is shown in Figure 3. The plume isopleths are mapped from tidally averaged dye concentrations. Offshore the Saint John River inflow plume concentration is down to about 5 μg/l indicating that at this location it is diluted about 200:1 (1,000/5). The outward extent of the plume is illustrated by the 2 ug/l contour at which the dilution is 500:1. As the plume spreads outward, due to the fresher water spreading on the denser more saline water, it reaches northward along the shoreline, and somewhat southward of the point of discharge.

6.2 Spreading of the Saint Croix River Inflow

A similar virtual dye release was made into the Saint Croix River inflow. The resulting plume is shown in Figure 4. It shows that the Saint Croix River inflow is diluted to 0.3 μg/l within the confines of its receiving embayment giving a dilution of about 3,000:1 before the mouth of the embayment is reached. Part of the difference from the Saint John River inflow is that the Saint Croix River inflow is one tenth of the former. Proportioning by flows, if the St.Croix River inflow were as large as the Saint JohnRiver inflow, it would

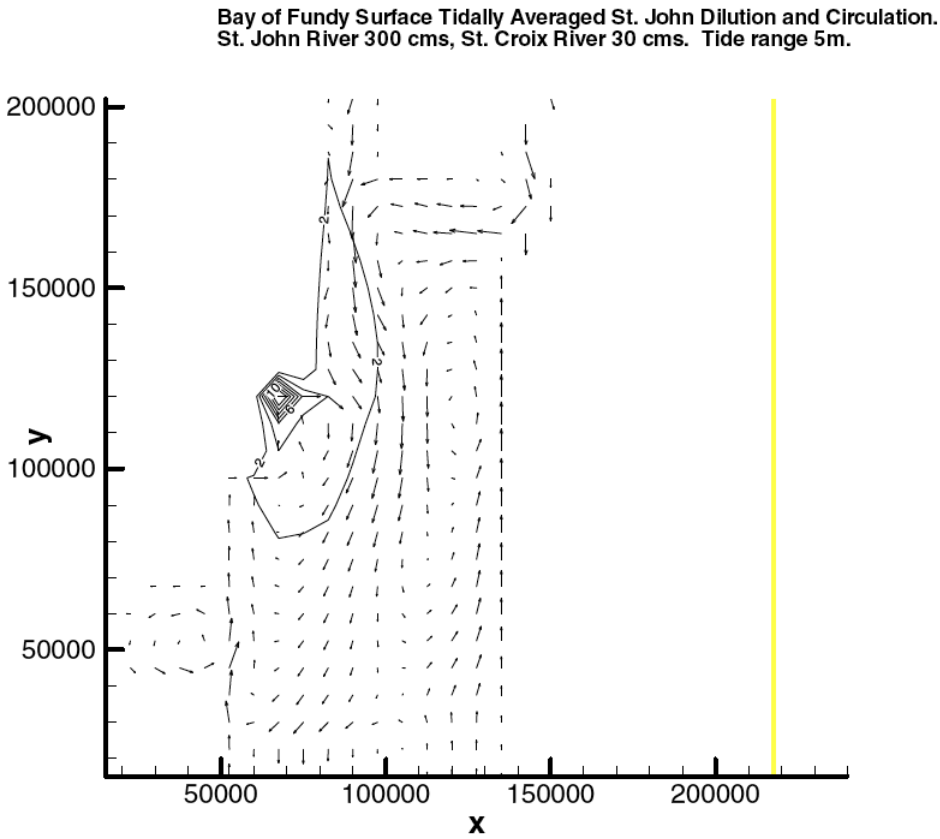

Figure 3: **Dilution and spreading of the Saint John River outflow (Source: Author)**

still probably be diluted to about 300:1 at the mouth of the embayment. This could be checked to greater detail by simulating a larger Saint Croix River inflow.

6.3 Surface Flushing Times of the Bay

The model allows estimating the flushing time at all locations over the computational grid. The flushing time at any location is approximately the time it takes for a parcel of water at that location to leave the bay. The isopleths of surface flushing time are near the mouth of the bay, the flushing time is approximately 3 to 4 days. It increases going up the eastern shoreline reaching about 9 days in the mouth of the eastern arm.

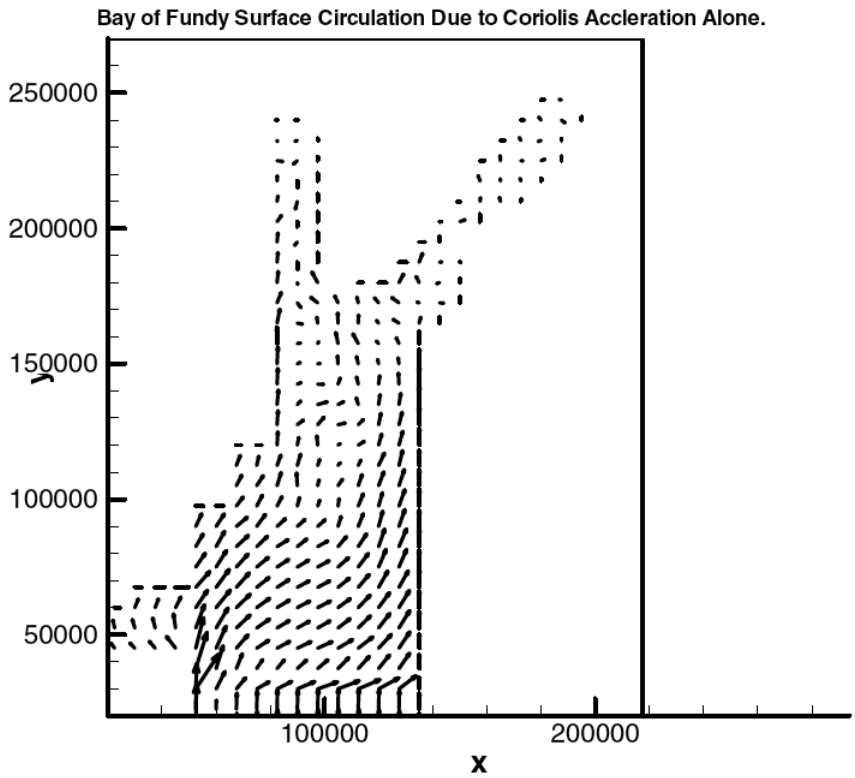

Figure 4: **Dilution and spreading of the Saint Croix River inflow (Source: Author)**

The flushing time is greater at the same latitude along the western shoreline than along the eastern shoreline particularly in the vicinity of the gyres off the entrance of the Saint John River and the long gyre extending south of it. Apparently the gyres play an important role in retaining the water play an important role in retaining the water within the bay along the western shoreline.

6.4 Bottom Velocities and Flushing of the Bay

The isopleths of flushing times along the bottom of the bay are shown along with the bottom velocity vectors. It shows that the tidally averaged bottom inflow is almost uniform along the tidal boundary and extends inward along both the eastern and western shore. The bottom flow is outward from the Saint John River inflow, but is inward to the Saint Croix River embayment.

These results indicate that most of the dilution water entering bay is probably a bottom inflow. The flushing time isopleths have a shape and times similar to the surface values.

7 Influence of Coriolis Acceleration

The Coriolis acceleration results from the rotation of the earth. A particle of fluid moving in a generally northerly or southerly direction will be deflected in relation to the rotation of the earth. This deflection is clockwise in the northern hemisphere. The effect is named after the French physicist Gaspard de Coriolis, who first analyzed the phenomenon mathematically. Coriolis forces are of considerable importance in determining prevailing winds and ocean currents. The Coriolis acceleration increases with latitude. In order to simulate the effects of the Coriolis acceleration, it is necessary to have a generally northerly current. One way to produce a generally northerly current is to impose a surface wind. For this example, a northerly wind speed of 2 m/s is used. There are no freshwater inflows, no tide and no salinity in this simulation. Also, to demonstrate a full Coriolis complete clock-wise circulation like the Gulf Stream, it would be necessary to have a very wide water body where the circulation is not influence by the shorelines.

The results of the simulation are shown in Figure 5 it can be seen that the northerly current that would be induced by the wind is deflected to the right in a clock-wise manner as would be expected due to Coriolis. However, the flow moving to the right piles up against the eastern shore line and begins to move northward leading to a more complex circulation. The velocities resulting from the Coriolis acceleration and a 2 m/s are very small and would be dominated by the stronger tidal velocities. However, the Coriolis acceleration may play a role in moving water toward the eastern shore and adding to the northern circulation along that shoreline

8 Tides and Velocities

The time series of tides and velocity produced by the model is the primary result that should be compared to observed data. Observed tidal elevations are given for a number of locations up the Bay of Fundy in the Attachment. Time series of tides at different locations within the Bay of Fundy show that the mean tide level and tidal range increase when moving up the bay. The computed mean tidal level increases by about 1.5 m between the mouth and

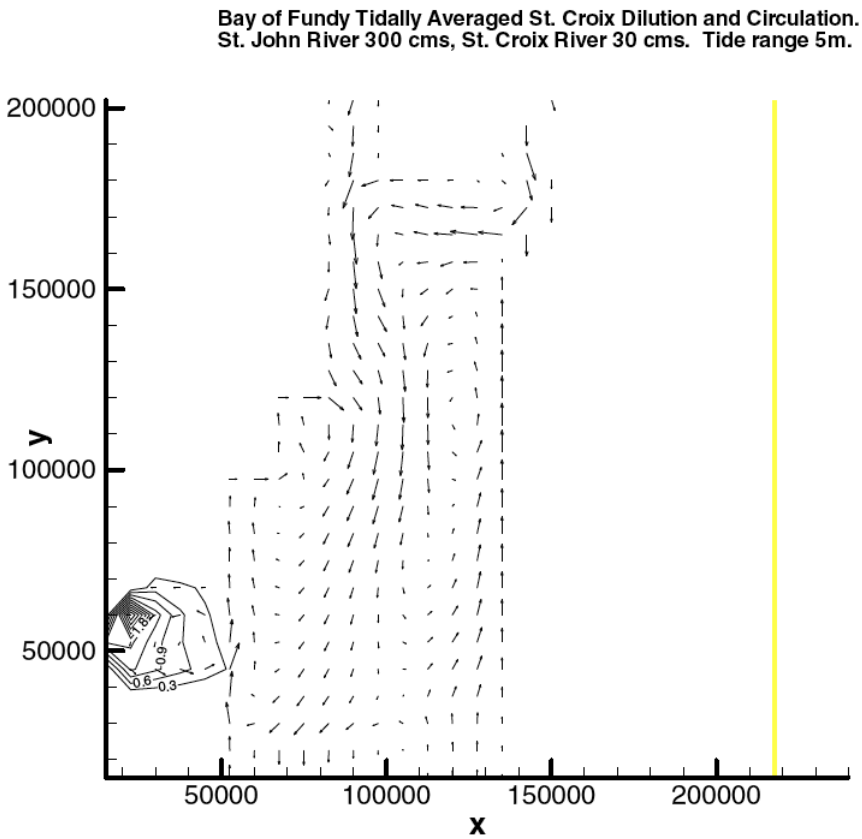

Figure 5: **Circulation with northerly surface wind of 2 m/s and Coriolis acceleration alone. No freshwater inflows, tides or salinity (Source: Author)**

Grindstone Island in the western arm of the bay. The observed data (see attachment) shows an increase in the mean tide level of 2.1 m. Between these two locations, the computed tide range increases by about 2 m while the observations show an increase of about 3 m.

9 Conclusion

The inability to predict exactly the increase in mean tide level and range could be due to local bathymetric features at the Grindstone Island location not included in the model. However, the comparisons are quite good considering the limited detail provided in the model grid. The time series of tidal velocity at the mouth of the bay is shown in Figure 6 it indicates that at this location the current speed reaches a maximum of 2.0 m/s at maximum flood

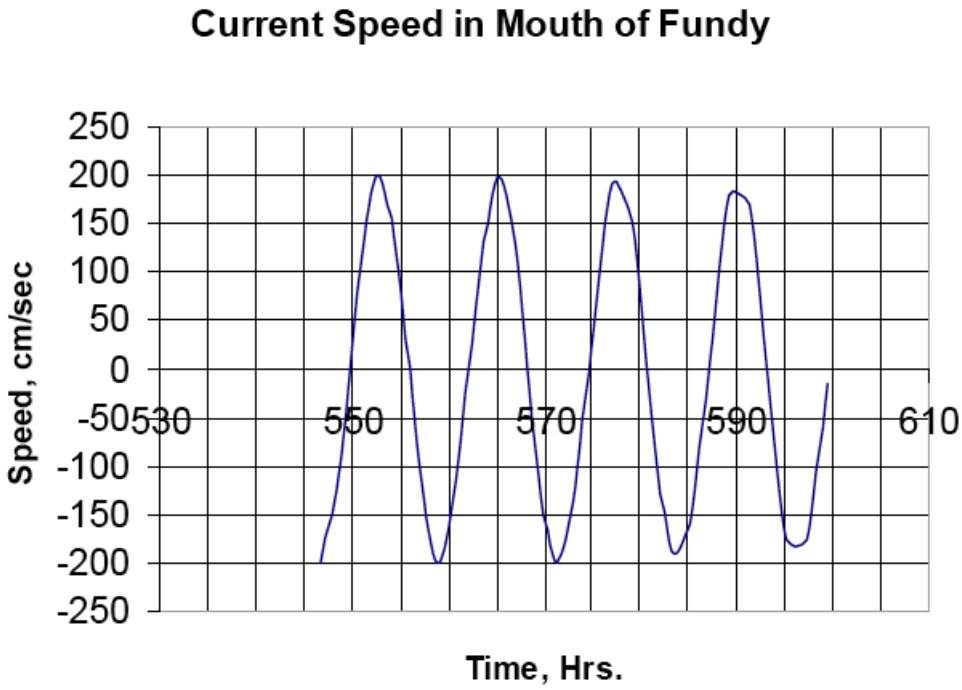

Figure 6: **Current Speed, cm/sec in mouth of Bay of Fundy. NOAA data gives average Current Speed in Grand Manan Channel (Bay of Fundy Entrance) of about 1.28 m/s (2.5 knots) on maximum flood and ebb tide. The above current speeds are based on a tidal range of 5 meters at the mouth of the Bay of Fundy (Source: Author)**

and ebb tide. Data in the attachments give maximum ebb and flood current of about 1.3 m/s (2.5 knots). This difference between observed and computed current speed in the mouth of the bay could be due to overestimating the surface area of the bay in the model grid. This could be due to not having sufficiently accurate maps. Having an incorrect tidal range at the mouth of the bay. This could be due to the tide at the location of the data used is not the same as in the mouth of the Bay of Fundy. Either of these could be examined in greater detail using on site tidal gages with simultaneous wind observations by extending the data base.

9.1 Acknowledgements

The author of this paper would like to extend his thanks to the direction and guidance of Stewart Research for their guidance on this paper.

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SPINY DOGFISH SHARK SECRETION OPENINGS FOR FLUORAPATITE, FLUORIDE CONTENT IN THE ENAMELOID OF THEIR TEETH

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July, 2013

Abstract: In June, 2012 a recent paper the teeth of two different species of sharks the first one known as the Shortfin Mako Shark and the second known as the Tiger Shark teeth were studied and a new discovery was made about the anatomy of their teeth. Part of the new discovery was that a geological fluorapatite single crystal were structurally and chemically characterized. It was also discovered these two shark species had the capability within their gums and teeth had a film on these shark's teeth which consisted of fluorapatite with a fluoride content. Scanning Electron Microscope (SEM) micrographs further presented and demonstrated evidence that the crystals in enameloid were much harder than both kinds of teeth due to the absence of an organic matrix. Although the 2012 paper presented a remarkable discovery what was not addressed in this paper is exactly where did these shark's capability come from to be able to essentially provide a fluoride emission of fluid that not only protects and hardens these shark's teeth, but also acts as a lubricant on their teeth keeping them in perfect condition for attacking their prey.

Key words: Shark, Shark Teeth, Spiny Dogfish Shark, *Squalus acanthias*, Shark Fluoride.

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1 The Spiny Dogfish Shark (*Squalus acanthias*)

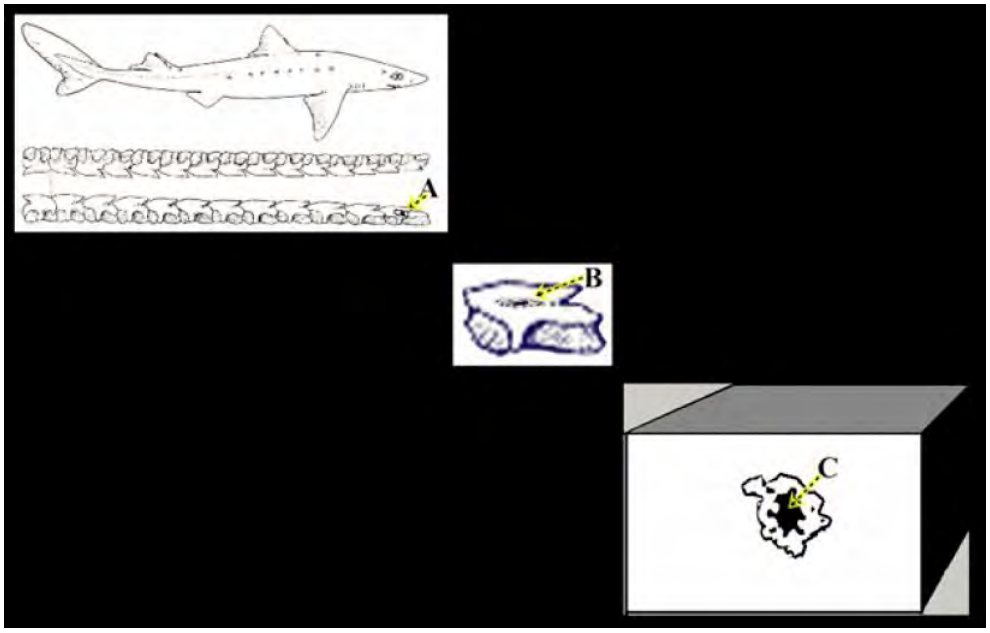

Figure 1: **In the upper top image is of the shark species known as Spiny Dogfish Shark (*Squalus acanthias*). This image was originally presented in the paper of Bigelow and Schroeder [1]. That shows the upper and lower jaw teeth as depicted in (A). Where the yellow arrow points away from (A) to an example tooth of Spiny Dogfish Shark. Where as a horizontal artist rendition is presented and depicted in (B), which is depicted and projected in a larger side view (3D) box, as seen in (C). Which B and C are used as visual aids present and demonstrate how these sporadic secretion openings for the fluroapatitie fluoride content to seep out of on to the shark's teeth. Providing not only a fluoride-like film on their teeth protecting them, but which also provides a lubricant on the sharks teeth as well. The above illustration marked (A) first appeared in Garman [4]. (Source: Author, [1], [4])**

Enax [3] and his team presents the significant discovery in their paper as aforementioned in the abstract of this paper that the Shortfin Mako Shark (*Isurus oxyrinchus*) and the Tiger Shark (*Galeocerdo cuvier*) teeth were studied in 2012. The new anatomical discovery on these two species of shark

characterized that a single geological fluorapatite crystal was structurally and chemically responsible for producing a film on these shark's teeth which consisted of fluorapatite with a fluoride content. The evidence provided in this paper and study were SEM micrographs, which gave evidence that the crystals in enameloid were much harder than both kinds of teeth in both shark species, because of the absence of an organic matrix. However, we have discovered where the fluoride like secreted film comes from. That there are special openings in the Spiny Dogfish Shark (*Squalus acanthias*) teeth where this secretion originates from.

2 Secretion Openings For The Diet of Spiny Dogfish Shark (*Squalus acanthias*)

The authors of this paper also propose that it is not just the Spiny Dogfish Shark species that has these secretion openings in its teeth. We further propose by our study of the aforementioned shark species that the previous shark species Shortfin Mako Shark and the Tiger Shark, have these fluoride-like secretion openings sporadically located in certain teeth within their upper and lower jaw teeth in like manner just like the Spiny Dogfish Shark as discussed and presented in this paper. This is essentially how Enax [3] and his team were able to discover the "Resulting fluoride-like secreted film" on the Shortfin Mako and the Tiger Sharks species teeth. However, we contend having discovered the "cause" from where where this secretion originates. It was further found that for the Shortfin Mako and the Tiger Sharks species film was indigenous diet, as it is with the Spiny Dogfish Shark.

3 Conclusion

By being able to study the Spiny Dogfish Shark (*Squalus acanthias*), it has enabled the author of this paper to make a connection between the fluoride like secretion discovered by Enax [3]) and his team. It has also provided a deeper understanding to the data and sources of additional reference to Steve Kemper studies of different shark species at the Smithsonian Institution. Which also include the studies conducted by Clark [2], Kenney [5], Lemonick [6] and facts and details of sharks history, characteristics, senses, behavior, feeding and sex online references as well.

3.1 Acknowledgements

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