GLIESE 581D'S OBLIQUITY, NORTH AND SOUTH POLE CONNECTIONS, MAY BE SIMILAR TO TITAN; AFFECTING EXOPLANETARY NEOPROTEROZOIC LIKE WEATHER PATTERN

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Abstract: The question of a neoproterozoic era is raised concerning the potential habitability of Gliese 581d. There may be cause to believe that a high neoproterozoic-like climate on Gliese 581d with also a high probability having climate high obliquity is raised in the context of both exoplanet studies raised in question by other scholarly papers mentioned in this paper and in the references section of this paper as well. Previous papers discuss and provide suitable (e.g. habitability) and paleo climates studies, producing enough new data and evidence to strongly suggest that in all probability Gliese 581d may also have similarities to its north and south poles and that an unusual magnetic field presents and demonstrates evidence for low-latitude glaciation during the neoproterozoic hypothesis. Therefore, because the poles themselves may receive more infrared heat from the Gliese 581 star system red sun coupled with a very high carbon dioxide gaseous based atmosphere with substantial volcanic activity increases the warmth around the equator around especially the equator of Gliese 581d since that is where possible most of the volcanic activity produces masses of heat and a planet wide greenhouse effect. This paper is to study this and the instability at the north and south poles with a sustaining obliquity.

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1 Gliese 581d Exoplanetary Obliquity

Interestingly, Ferreira [9], Armstrong [2], and Laskar [12] verifies and includes Gliese 581d as a suspected exoplanet that may have one or more bodies of water/ oceans upon its surface, and needs to be included into the category of exoplanets that although they may have liquid water on them does not necessarily make them a good candidate for any type of proposed habitability. Whereas Armstrong [2] presents and demonstrates a good discussion and reasons to believe that as is suspected in a range of currently thought possible habitable zone (HZ) related exoplanets that because they have water (like liquid oceans for instance), may give them a better predisposition to be suitable for habitability of some kind.

However, Ferreira [9] makes a case that in many of these exoplanetary supposed alleged earth-like sizes HZ probable exoplanets have a range of obliquities. The reasoning is based both on the range of obliquities of the terrestrial planets of our own Solar System as well as predictions for exoplanets. The obliquity of Mars for example has been shown to vary chaotically, ranging from zero to nearly sixty degrees as explained in Armstrong article [2].

Armstrong [2] continues to explore the impact of obliquity variations on planetary habitability in hypothetical systems with high mutual inclination. Showing that large-amplitude, high-frequency obliquity oscillations on Earth-like exoplanets can suppress the ice-albedo feedback, increasing the outer edge of the habitable zone. Arrange of modeling exoplanetary computer models formulated exploration to hypothetical systems consisting of a solar-mass star, an Earth-mass-like exoplanet. In this case which with similarities could also incorporate Gliese 581d as well into the modeling hypotheses. Calculated differences in the outer edge of the habitable zone for planets with rapid obliquity variations, were also taken into consideration. Calculates [2] two primary factors as to why obliquity affects the potential for any habitability. Which are:

1. The full planetary spin and orbit; and
2. The eccentricity and obliquity fixed at their average values. According to Laskar [12] recovered previous results that higher values of fixed

obliquity and eccentricity expand the habitable zone, but also found that obliquity oscillations further expand habitable orbits in all cases.

However, Touma [22], Carpenter [4], and Shapiro [17] contend that exoplanet obliquity affects the HZ equation based upon such long term assessments and observations in the distorted and destabilized obliquity of for example both mars and Venus. in our own solar system. Whereas Carter [5], Correia [6], Cunha [7], Ferreira [10] [8], and Lewis [13] contend that exoplanetary habitability including exoplanets like Gliese 581d obliquity will be affected by gravitational tides and thermal atmospheric tides, core-mantle friction,and because of other disturbances like collisions with other planets.

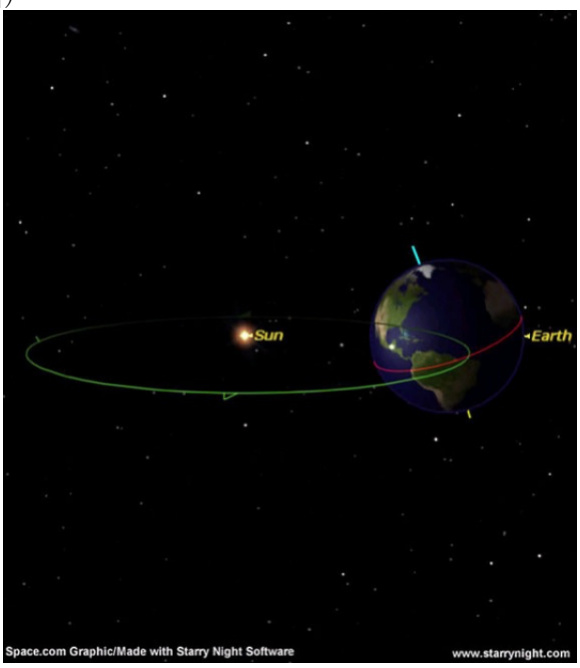
Thus Ferreira[9] and Armstrong [2] provides evidence that for an exoplanet including Gliese 581d to have the greatest possibility of habitability means; that any such like exoplanet capable of habitability would also likely have to have a close proximity of the same tilt on its axis that the earth does to have the greatest chance of conditions prevailing for habitable conditions to even begin to exist. This applies to Gliese 581d in like manner.

The tilt of this exoplanet much more than that of earth also causes a warmer transcending condition along the equator as well. However, this is also where the most frequent volcanic activity occurs as well. Making the probability of Gliese 581d not as suitable for habitability as once thought. Especially with an accumulation of much of the densest part of its atmospheric instability being concentrated up in around it enveloping the entire circumference around the north to south poles. Destabilizing any water/oceans on its surface as well.

2 Gliese 581d Obliquity is a Sensitive Case in Finding the Exact Earth-like Tilt of 23.5° Degrees to Ensue Potential Habitability

Hadhazy [11] depicts the image in Figure 1 and depicts how intricate and exact the earth's obliquity has to be to even support life. In retrospect the article continues to discuss that just because an exoplanet Gliese 581d included has more likely than not possible oceans-in this case caused by the CO_2 red radiation effect with the atmosphere and also take that the primary volcanic action according to Stewart [18] discusses the foundational reasons as to why the obliquity of Gliese 581d may affect its habitability.

Figure 1: The seasons are caused by Earth's tilt. (Source: Starry Night *apud* Hadhazy, A. [11])



Whereas Udry [23], Mayor [14], Wordsworth [25] adhere and lay down principles of research that allow the establishment for most likely dissolved ice based oceans upon the surface of Gliese 581d. However, Stewart [21] includes very detailed discussion and present a wealth of new data and evidence including imaging as well of possibly Gliese 581d itself and also depicts that the influx of infrared radiation into the atmosphere not only comes from its parent red dwarf star Gliese 581 but introduces additional evidence and images on other nearby stars that allow likely three to four times more infrared radiation as a total influx to add to the already various amount of greenhouse gases produced upon the surface of Gliese 581d.

This coupled with greater than known volcanic activity seems to be at it's greatest along the equator of Gliese 581d as well. All of these combined factors with what also Hadrazy [11] brings to light in the aspect that the obliquity is so important as to even the changing of the seasons even when it comes to an exoplanet that just like on earth because everything known about life on a planet has to seasonally change with the obliquity or the chances of an exoplanet having realistic chances of habitability is put into serious question and global temperature moderation.

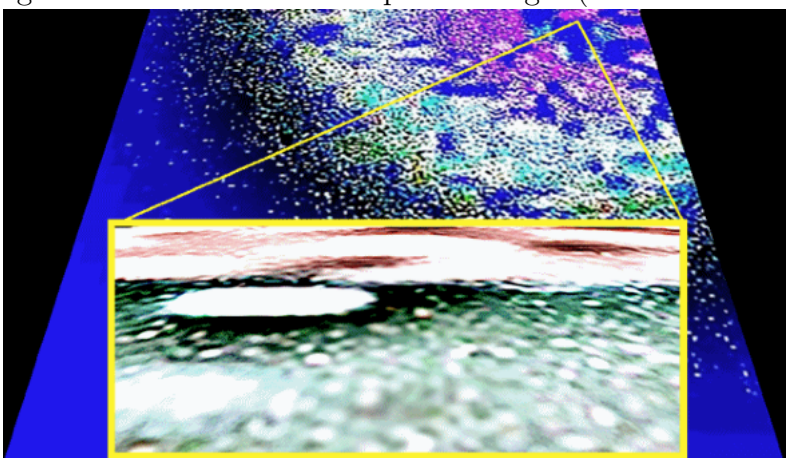
Above and beyond this the systems are so inter balanced and depend upon one another that the delicate issues and balances are further discussed and intensely examined in Stewart [21] and Aguiar [1] examines the oceanic conditions and how they are related to over all atmospheric, climate, and constant un stabilized conditions of this exoplanet as well. Whereas Stewart [19] provides an in depth examination of how all of the intricate systems of such factors depend upon each other to make an exoplanet truly as earth-like as possible in order to maintain its candidacy of being an exoplanet with habitability possibilities. However, the supplemental material 1-6 go into additional examination that the space restrictions in a paper cannot provide to learn more about Gliese 581d.

However, the supplemental material 7-9, is in total agreement with Hadhazy [11] that not only the very intense gravitational conditions of Gliese 581d also allows and forces it to have no doubt a low obliquity of 0.4-0.8 or less. Therefore, as provided and shown in figure 2 the atmospheric conditions of Gliese 581d is also not only causing this exoplanet to be more like a neoproterozoic like (snowball earth) but that as Hadhazy [11] and supplemental material 7-9 are also consistent that the possibility that there may be a closer by Gliese 581g exoplanet as well that the gravitation pull of these two exoplanets comparatively as close to each other as they are causing this exoplanet to be its warmest at the equator with likely a tremendous amount of volcanic activity.

Whereas as shown in Figure 2 explains the disruptive intense erratic accumulation of the primary part of this exoplanet's atmosphere concentrated in the total circumference circle around the entire planet from its north to south poles as well. These factors as aforementioned certainly affect pall of these gravitational interactions of planets eventually erode a planet's axial tilt. The findings do not bode well for planets residing in the habitable, zones around red dwarf stars smaller than the sun.

Figure 2 show the background from other space is a possibly alleged image of Gliese 581d. The area in which the enlarged extreme close up of this part of the surface of Gliese 581d depicted within the yellow rectangle is where the approximate equator is located and red tinged landmass in the background depicts more of a dryer Geomorphological condition of no ice present as appears much everywhere else on these other fjord like vertical cliff shelf landmasses. The green depicts like the warmer greener colored ocean with a break up more of the ice because of warmer conditions along

Figure 2: Gliese 581d near equator image. (Source: Author)



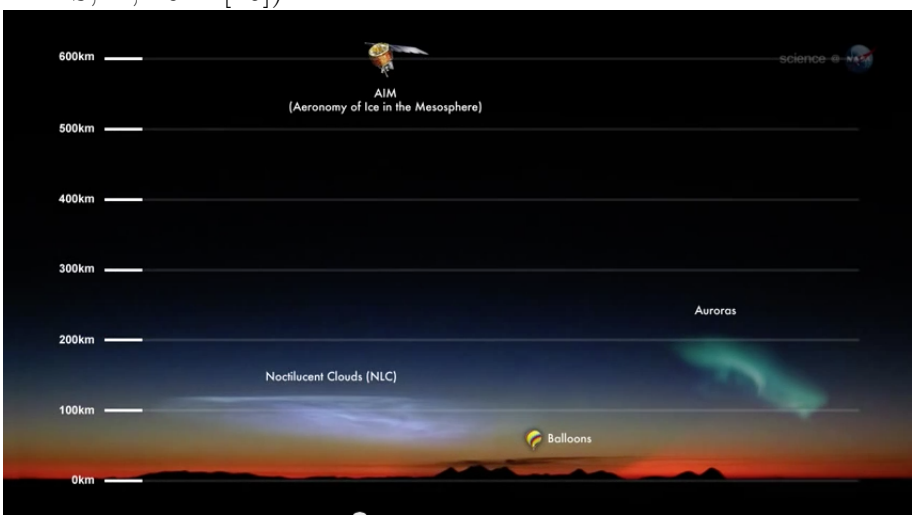
the equator.

However in the blue are as is observed in the image the greatest concentration of this exoplanets atmosphere seems to be concentrated in around the total circumference circle of the entire planet from its north to south poles. These factors as aforementioned certainly affect all of these gravitational interactions of this exoplanet and its axial tilt. The findings do not bode well for this exoplanets habitability factor.

3 North and South Poles of Gliese 581d May Communicate With Each Other; Determining the Extent of How Much of It's Neoproterozoic Like Planetary Conditions Affects Its Atmosphere and Entire Weather Systems

In 2007 NASA's AIM spacecraft was launched to study night-shining, or noctilucent clouds, which form more than 50 miles (83 kilometers) above the Earth's surface, in a layer known as the mesosphere. The clouds, which glow electric blue after dusk or before dawn, are composed of water ice crystals that collect on "meteor smoke," the dust stripped from meteors as they streak through the atmosphere.

Figure 3: Noctilucente and Aurora position in the atmosphere. (Source: PHILLIPS, T, 2014 [16])



While studying these clouds (Figure 3), the researchers were surprised to discover these teleconnections. Winds in the Northern Hemisphere's stratosphere, the second layer of the Earth's atmosphere, were affecting the Southern Hemisphere mesosphere, the layer above the stratosphere, a few weeks later.

In like manner similar conditions may also be taking pace within out own solar system and the communication of Gliese 581d's north and south poles may also be taking place much as discussed in Hdadhazy article [11]. In like manner this could also be taking place on Titan as well.

4 The Obliquity of Titan in Comparison With Gliese 581d May be a Factor to Consider of Both Having Similarities Obliquities

Hadhazy[11], Bills & Nimmo [3] and NRAO [15] articles explains that he obliquity of Titan is small, but certainly non-zero, and may be used to place constraints on Titan's internal structure. The measured gravity coefficients of Titan imply that it is non-hydrostatic and thus the normal Radau approach to determining internal structure cannot be applied.

However, if the obliquity is assumed to be tidally damped (that is, in a Cassini state) then combining the obliquity with the measured gravity coefficients allows Titan's moment of inertia to be determined without invoking hydrostatic equilibrium. For polar moment values in the range , tidally-damped obliquity values result. If the inferred moment value exceeds 0.4, this strongly suggests the presence of a near-surface ice shell decoupled from the interior, probably by a subsurface ocean.

Figure 4: ALMA image of the distribution of the organic molecule HNC in the upper atmosphere of Saturn's moon Titan. (Source: NROA, 2014 [15])

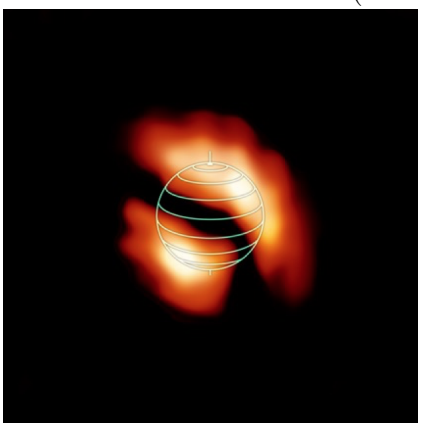
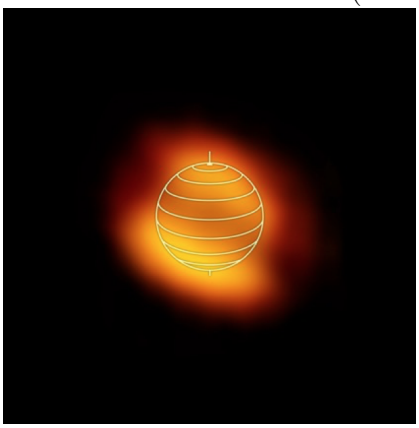
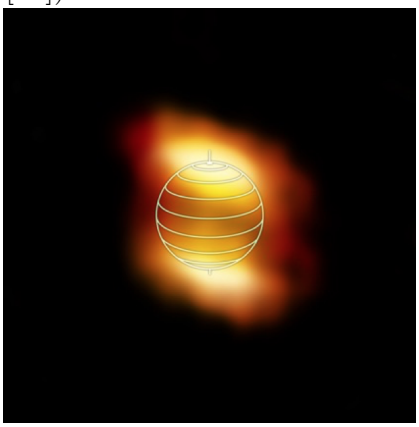


Figure 5: ALMA image of the distribution of the organic molecule HC_3N in the upper atmosphere of Saturn's moon Titan. (Source: NROA, 2014 [15])



In Figure 4 the *denser, brighter concentrations are shown near the moon's north and south poles. Their shifted, off-axis locations were unexpected and*

Figure 6: ALMA image of the distribution of the organic molecule HC_3N at intermediate-to-lower elevations in the atmosphere of Saturn's moon Titan. (Source: NROA, 2014 [15])



could help researchers better understand Titan's complex atmospheric processes. The globe outline represents Titan's orientation at the time of the observations [15].

In Figure 5 *the denser, brighter concentrations are shown near the moon's north and south poles. Their shifted, off-axis locations were unexpected and could help researchers better understand Titan's complex atmospheric processes. The globe outline represents Titan's orientation at the time of the observations* [15].

In Figure 6 *the denser, brighter concentrations are oriented more evenly about the poles than is observed for HC_3N at higher elevations. The globe outline represents Titan's orientation at the time of the observations* [15].

5 Organic Molecules in Titan's Atmosphere Are Intriguingly Skewed; Which May Also be What's Happening on Gliese 581d

While studying the atmosphere on Saturn's moon Titan, scientists discovered intriguing zones of organic molecules unexpectedly shifted away from its north and south poles. These misaligned features seem to defy conventional thinking about Titan's windy atmosphere, which should quickly smear out

such off-axis concentrations. This is an unexpected and potentially groundbreaking discovery. These kinds of east-to-west variations have never been seen before in Titan's atmospheric gases. Explaining their origin presents us with a fascinating new problem.

6 Conclusion

In like manner, the circulatory concentration of atmospheric disturbance as recorded by ALMA on the north-south poles on Titan has similarities to the concentration of the intensified atmosphere in and around Gliese 581d's atmosphere as well. Which is likely according to the new data and evidence presented and demonstrated in this paper is because of Gliese 581d's obliquity. Making it less suitable to be classified as an exoplanet for possible habitibility.

6.1 Acknowledgements

The author of this paper would like to thank any and all scientists and researchers for their contributions to astronomy and astrophysics. For without the knowledge they provide papers like this one would not be possible.

6.2 Supplemental Material

1. 90 Seconds How The IMMI Technology Zooms into Gliese 581d.
   https://www.youtube.com/watch?v=BPGJ21KsW8w
2. Gliese 581d - Extreme Close ups of Its Surface, Part 1.
   https://www.youtube.com/watch?v=_Uo46U0RBMg
3. Gliese 581d - Extreme Close ups of Its Surface, Part 2.
   https://www.youtube.com/watch?v=OviAmHu2nCw
4. Gliese 581d - Extreme Close ups of Its Surface, Part 3.
   https://www.youtube.com/watch?v=hyckDpTRRqw
5. Gliese 581d - Extreme Close ups of Its Surface, Part 4.
   https://www.youtube.com/watch?v=0iDKixBx-nQ
6. Gliese 581d - Extreme Close ups Zooming Down to Its Surface.
   https://www.youtube.com/watch?v=GW6vEtQB4I4
7. Gliese 581g - Extreme Imaging Close ups, Part 1.
   https://www.youtube.com/watch?v=k-QnnSxxhW8

8. Gliese 581g - Extreme Imaging Close ups, Part 2.
   https://www.youtube.com/watch?v=63g23OgWAKU

9. Gliese 581g - Extreme Imaging Close ups, Part 3.
   https://www.youtube.com/watch?v=WrYZL4nXHNk

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