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,

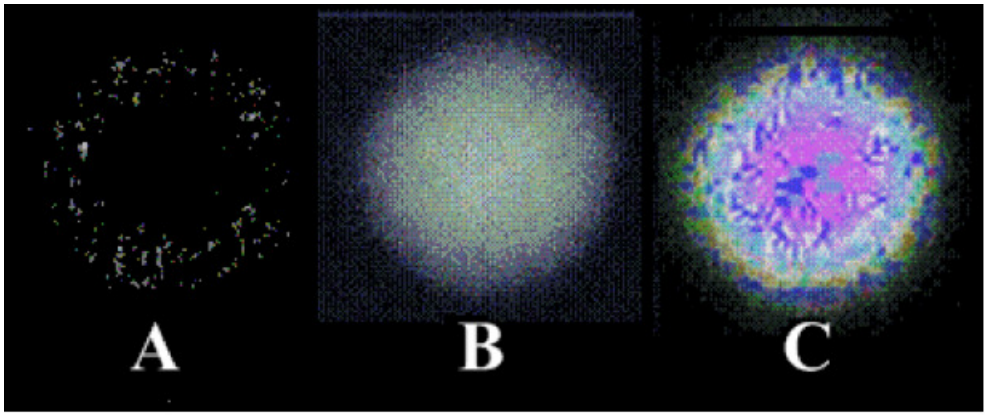

Figure 1: **Views of Gliese 581d (Used with permission of Ronald Stewart)**

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

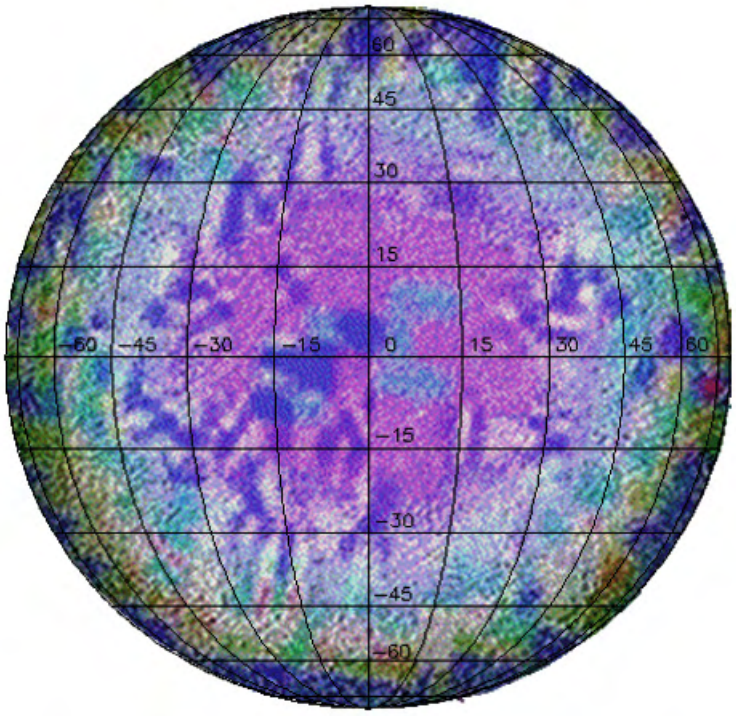

Figure 2: **View of Gliese 581d with a geographic grid (Used with permission of Ronald Stewart)**

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

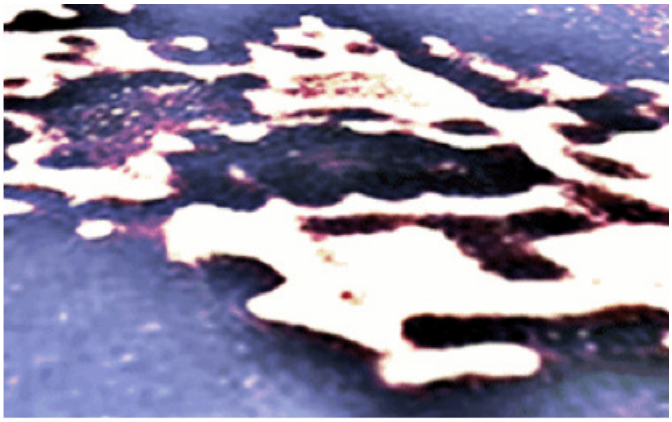

Figure 3: **A Gliese 581d sea cliff ice capped ice shelves (Used with permission of Ronald Stewart)**

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".

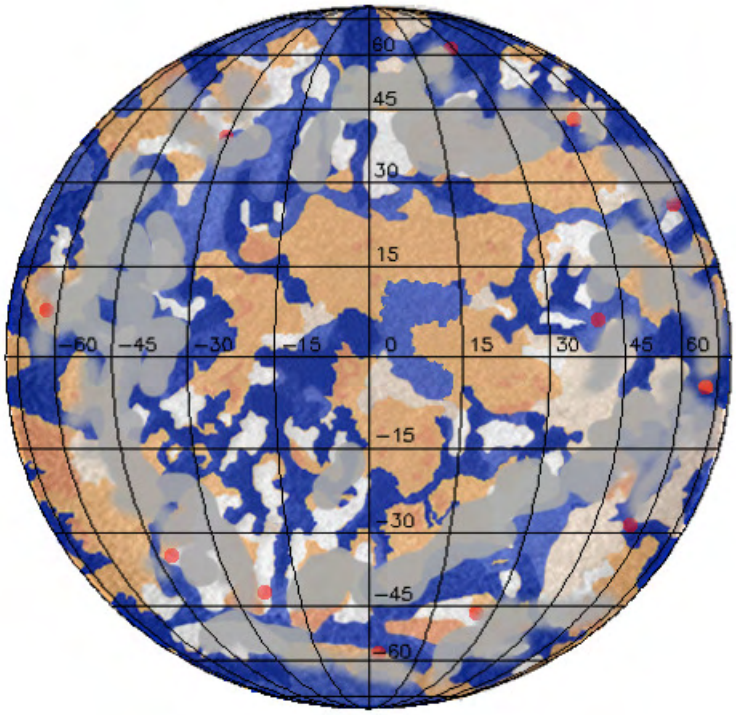

Figure 4: **Possible Configuration of Gliese 581d with a geographic grid. Legend: orange - land; light orange - icy-land or dirty ice shelf under land or water; white - ice shelf under land or water or clouds; light blue - shallow water, icy-water or land with melting water; dark blue - water; gray -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

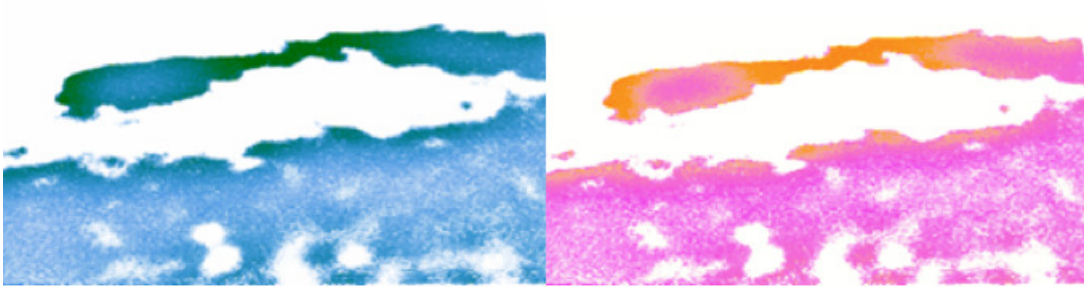

Figure 5: **An image showing water action, with a splash on the left, a current from right to left and the "bay areas" with water with different temperature (more cold) than offshore, around 12°N 003°E (Used with permission of Ronald Stewart)**

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.

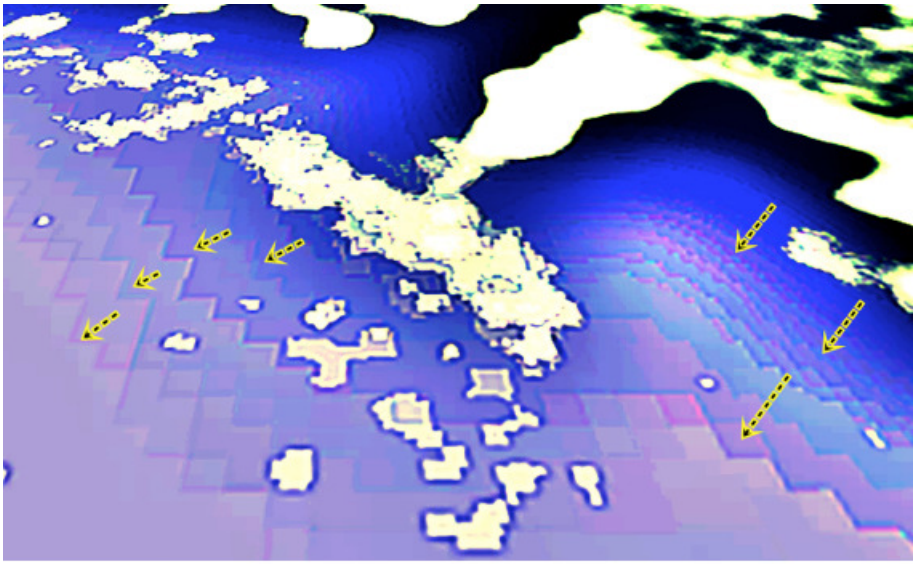

Figure 6: **An image showing wave fronts and the diffraction of the wave crests because the local slope (Used with permission of Ronald Stewart)**

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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