

## **Critique on the two-tiered approach to assessing the habitability of exoplanets.**

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### **Abstract:**

In 2011, Dirk Schulze-Makuch came up with Earth Similarity Index and Planetary Habitability Index to categorize planets and moons within our solar system as well as the newly discovered exo-planets based on their potential habitability [1]. We think that this model is based on liberal assumptions and might not serve its purpose too. One of the major issues with the model is assuming origin of life in a non-aqueous solvent. We currently have only one example of life on Earth and have hardly understood it yet. We only know what life does to some extent and what conditions are required for it to thrive on a planet like Earth. The major objective of the exo-planet search is to find the second example of life and especially of an independent origin. The search for life as an endeavour has major economic implications and it cannot be based on speculations. It will make much more sense to go to a planet or a moon, which has favourable conditions, required for origin and sustenance of Earth-like life. Planets and moons where we can find exotic life should not be our priority as of now. We can definitely create a separate catalogue of exo-planets, which might have an alien biochemistry or exotic life form and we should look for them only after we have found a life in Earth-like conditions on a different planet or a moon.

The model also neglects the role of Water in the energetics of life as well as in generating the magnetic field on Earth. The current model of Earth dynamo relies heavily on the presence of large amount of Water, Solidification of Core and Plate tectonics [2]. We have no clue about how other solvents will affect the magnetic dynamo of an Earth-like exo-planet. The Planetary habitability model of Dirk Schulze-Makuch et. al. loses its validity because it has two contradicting requirements i.e a presence of magnetic field and absence of water which might be a necessity for the field itself. The model also neglects the fact the life on moons like Enceladus and Europa can exist without any atmosphere and magnetic field within the sub-surface ocean. The low score given to Europa and omission of Enceladus over Titan raises red flag over the validity of this habitability model. I am not against the use of creative thinking and a broader approach towards the search for extra-terrestrial life but we should consider exploring an exotic form of life only after we completely understand the model of life on Earth or if we have any experimental support for a life based on non-aqueous solvent.

### **References:**

1. Dirk Schulze-Makuch; et al. (Dec 2011). "A Two-Tiered Approach to Assessing the Habitability of Exoplanets". *Astrobiology*. 11 (10): 1041–1052.
2. Lammer, H., Bredehöft, J. H. , Coustenis, A., Khodachenko, M. L., Kaltenecker, L., Grasset, O. Prieur, D., Raulin, F., Ehrenfreund, P., Yamauchi, M., Wahlund, J.-E., Grießmeier, J.-M., Stangl, G., Cockell, C. S., Kulikov, Yu. N., Grenfell, J. L. and Rauer, H. 2009. What makes a planet habitable? *Astronomy and Astrophysics Review* 17:181-249.

