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Potential Habitats for Exotic Life Within the Life Supporting Zone

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Questions like „Are we alone in the universe?", "How unique is Earth as a planet?" or "How unique is water-based life in the universe?" still are nowhere near of being answered. In recent years, discussions on these topics are more and more influenced by questions whether water is really the only possible solvent, or which conditions are necessary for life to evolve in planetary habitats. A change in our present geocentric mindset on the existence of life is required, in order to address these new questions [see also 1].
In May 2009 a new research platform at the University of Vienna was initiated in order to contribute to the solution of these questions. One task is to find essential biomarkers relevant to the problem of the detection of exotic life. In this context exotic life means: life, which is not necessarily based on a double bond between carbon and oxygen (C=O) and not on water as the only possible solvent. At present little is known about metabolistic systems, which are not based on C=O or on metabolisms which are operative in alternative solvents and a high effort of future laboratory work is necessary to open this window for looking for exotic life.
To address the whole spectrum of life the concept of a general life supporting zone is introduced in order to extend the classical habitable zone (which is based on liquid water on a planetary surface, [2]). The life supporting zone of a planetary system is composed of different single "habitable zones" for the liquid phases of specific solvents and composites between water and other solvents. Besides exoplanetary systems which seem to be the most promising place for exotic life in our present understanding, some potential places could also exist within our Solar System and habitats like the subsurface of Enceladus, liquid ethane/methane lakes on Titan or habitable niches in the Venus atmosphere will also be taken into account. A preliminary list of appropriate solvents and their abundances in the Solar System and beyond have been compiled.
Dynamical investigations (related to the interior of superearths), but also heat transport regimes and potential cycles with exotic solvents as well as tidal heating processes and their influence on the thermal regime of the planets will help to define the regions of potential exotic life more precisely. Atmospheric and subsurface cycles which can take place in such habitats as well as cloud and droplet formation with and without cloud nuclei cores will further extend our knowledge on mechanisms relevant for the stability of these systems. Finally the question of suitable biomarkers, which can enable the observation of exotic habitats and their potential life forms will be considered in the research platform. In this context a special topic is also the bandwidth of photosynthesis: how is the influence of different atmospheric gases and what are the environment conditions for the chemical reactions of photosynthesis?
First preliminary results for the life supporting zones of selected planetary systems will be presented.

References:
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