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Habitability: From solar system planets to Earth-like exoplanets

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For understanding the principles that generated Earth's long-time habitable environment compared with other terrestrial Solar System planets like Venus and Mars and terrestrial exoplanets inside the habitable zones of late-type stars, one has to understand the evolutionary influence of the solar/stellar radiation and particle environment to the atmosphere and surface. Because the spectral type of the star plays a major role in the photochemistry and evolution of planetary atmospheres and their water inventories must be understood within the context of the evolving stellar energy and particle fluxes. An only stable and dense enough atmosphere, which allows water to be liquid over geological time periods and protects the planetary surface from hostile radiation, will allow the evolution of surface life and Earth-like biospheres. Such long-time habitable environments are ideal cases of course, but life may have also originated in other habitats in the young Solar System. Such habitats could have been the environments of early Venus and Mars, subsurface (during formation maybe surface) oceans of icy satellites like in Europa, Titan, Encleadus, in hydrocarbon lakes of Titan, etc. Therefore, studies related to habitability and comparative planetology in the Solar System are essential for precursor studies dedicated to the investigation of habitability of terrestrial exoplanets. With comparative planetology one means the investigation on how different planetary systems and their individual planets - and particularly Earth-like ones - are formed, how they evolve in their radiation and particle interaction with their host stars under different circumstances, how often they give rise to conditions that could in principle be benevolent enough for the origin of life to occur, and even whether life as we know it could have arisen on any world in Earth's neighborhood. The presentation will point out the synergy of these studies and latest theoretical models currently applied for Solar System planets to terrestrial exoplanet atmospheres,

which will be characterized by terrestrial planet finding missions like Darwin.