

RADIATION ENVIRONMENTS AFFECTING ASTROBIOLOGICAL POTENTIAL IN THE EXTRATERRESTRIAL SOLAR SYSTEM. John F. Cooper, Heliospheric Physics Laboratory, Code 672, NASA Goddard Space Flight Center, Greenbelt, Maryland 20771 (John.F.Cooper@nasa.gov)

Introduction: The astrobiological potential for pre-biotic and biological chemistry beyond the Earth is highly affected by the diverse solar UV, hot plasma, energetic particle, and galactic cosmic ray environments among the other bodies of the solar system. But the relationship of radiation to astrobiological potential is not straightforward, since high radiation intensities and cumulative dosages do not necessarily correspond to low potential for pre-biotic chemical evolution and present habitability. The most highly irradiated and potentially habitable, body in the solar system, Europa, may benefit from accumulation of radiolytic oxidants in the upper ice crust as a chemical energy source for life in the subsurface ocean. Radiolytic oxidants could also impact the astrobiological potential of Enceladus. But perhaps excessive oxidation could instead indicate low potential, since organics might not survive? Surface irradiation could also impact detectability of organics emerging to the sensible surface accessible to remote and in-situ measurements. The Titan surface is well-shielded from cosmic ray irradiation by its thick atmosphere, but Saturn magnetospheric oxygen and cosmic ray irradiation could have significant roles in Titan pre-biotic chemistry. Heliospheric and local interstellar irradiation of comets, Centaurs, Kuiper Belt, and Oort Cloud objects could have driven pre-biotic chemical evolution on these bodies which could then have driven biological evolution on impacted solar system worlds, including but not limited to Earth. This presentation addresses the question of how these radiation environments differ among the non-terrestrial worlds of interest in the solar system.

Radiation Environments: For the planetary magnetospheric environments of Europa, Enceladus, Titan, and beyond, much of the relevant radiation data have already been published and are reviewed here. The NASA Virtual Energetic Particle Observatory (VEPO, <http://vepo.gsfc.nasa.gov/>) provides an easily accessible data base of heliospheric energetic particle and cosmic ray flux spectra which can be utilized to build models of the interplanetary radiation environments from missions such as Pioneer 10&11, Voyager 1&2, and Ulysses out to Jupiter and far beyond. A long historical record is also available for heliospheric radiation measurements in the inner solar system, as might be relevant to icy poles of Mercury and the Moon, asteroids, and to Mars. Examples of such data are reviewed for application to astrobiological potential studies of radiation impacts on these worlds.