ASTROBIOLOGICAL IMPLICATIONS OF ASTROPHYSICAL IONIZING RADIATION ON EXOPLANETARY ATMOSPHERES, SURFACE AND SUBSURFACE ENVIRONMENTS. D. Atri[1], [1]Blue Marble Space Institute of Science, 1001 4th Ave, Suite 3201, Seattle, WA 98154, dimitra@bmsis.org.

Introduction: Stellar photons play a key role in maintaining "habitable" temperature on planets. As we move higher up in the energy spectrum the role of stellar flares, Coronal Mass Ejections (CMEs) and Galactic Cosmic Rays (GCRs) become important. Ionizing radiation from these sources interact with planetary atmospheres and can have favorable and unfavorable effects from an astrobiological perspective. Ionization-induced effects can be summarized as follows: (1) atmospheric photochemistry and biosignatures, (2) atmospheric depletion, (3) potentially damaging UV exposure, (4) charged-particle induced increased surface biological radiation dose, (5) charged-particle induced production of organics, and (6) charged-particle induced radiolysis in subsurface environments with a potential to power "dark" ecosystems [1][2][3].

Numerical Modeling: The effects of ionizing radiation on exoplanets can be better understood by combining state-of-the-art observations from missions such as Kepler and MAVEN with numerical models. I have developed a numerical model based on the widely used GEANT4 Monte Carlo simulation package developed by CERN [4], which is capable of modeling all the effects of ionizing radiation on exoplanets with a variety of atmospheres, magnetic fields and surfaces.

Summary: Astrophysical ionizing radiation can create conditions which can be favorable [3] and unfavorable [1][2] to potential biospheres on exoplanets. I will report results of my simulations to discuss these effects and device strategies for detecting radiolysis-powered ecosystems beyond Earth [3].

References:

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