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Intrinsic magnetic fields – a crucial factor in planetary evolution and habitability

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Abstract

Constantly growing amount of discovered exoplanets (>300 at the moment) provides material for the study of main laws and trends of planetary evolution. This turns the whole field of exo-planetology from an abstract speculative knowledge into the practical science aimed at characterization and understanding of the variety of discovered extraterrestrial worlds. A number of most actual questions on the possible evolutionary paths of planetary systems and, influencing them, key factors is now under continuous tackling. Among these questions a prominent position belongs to the problem of possible habitability of planets inside and outside our Solar System. Answering this question requires a complex study of a variety of internal and external factors which may influence the conditions on a planet in order the life could evolve there. The widely used nowadays definition of a Habitable Zone (HZ) for planets as the space around a star, where the star's luminosity is sufficiently intense to maintain liquid water at the surface of a planet, is too simplified one. In the present talk we discuss the role of a host star's activity and the intrinsic magnetic field of a planet with respect to their influence on mass loss processes of close-in gas giants and a definition of a HZ for the terrestrial-type exoplanets. The stellar X-ray/EUV radiation and the stellar wind result in ionization, heating, chemical modification, and slow erosion of the planetary upper atmospheres throughout their lifetime. The closer the planet is to the star, the more efficient are these processes, and therefore, the more important becomes the magnetic protection of a planet as a potential habitat. Different ways for planetary magnetic dipole moment estimation, based on existing magnetic dynamo scaling laws as well as on the recent measurements of hot atomic hydrogen clouds around close-in 'Hot Jupiters' are considered, and the predictions of these estimations are compared to each other.

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