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Title

ISRU electric propulsion in the Neptune vicinity

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Abstract

Development of In Situ Resource Utilization (ISRU) type Electric Propulsion (EP) necessitates a robust modeling, taking into account the differences of the harvested propellant according to the flying region and monitoring its physicochemical state and ionization inside the Electric Thruster (ET), together with a robust and detailed diagnostics of the chosen ET type. The addressed propellants have been extended lately to the atmospheric components of the main Solar System bodies [1]. Thus, the emerging ISRU-EP disruptive technology is able nowadays to support ambitious space missions concerning all over the Solar System.

Missions involving gas giants but also notably ice giants, could obtain substantial support by using ISRU technology [2]. A mission using the ISRU-EP technology has been proposed by DEDALOS Ltd, aiming the study of Neptune and of its vicinity (including notably its moon Triton) [3]. The necessary modeling and diagnostics support have been described in detail in [4].

An adequate Power Processing Unit (PPU) becomes mandatory in case of ISRU-EP in the Neptune vicinity. In fact, in this region (about 30 a.u. distance) the power obtained from the capture of the Sun radiation is practically insufficient, with nuclear energy source becoming necessary. The type of the latter will define the obtained energy amount and the lifetime of the energy source. A convenient propellant tank could also be considered, if a study of the Triton and of the local rings is addressed.

The well-known dedicated Hydrogen/Helium Detailed Global Model (HHeDGM) for the modeling of the ET harvesting the Neptune atmosphere [4] is used, giving simultaneously the theoretical line intensities of its main constituents. Calculation of the latter is needed in order to obtain Optical Emission Spectroscopy diagnostics.

References

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