EPSC Abstracts
Vol. 12, EPSC2018-764, 2018
European Planetary Science Congress 2018
© Author(s) 2018

PRIME – A concept for passive radar investigation of Jupiter's moon Io

G. Steinbrügge[1,4], L. Fanara[1], D. Haack[1], M. Hamm[1], A. Heffels[1], **M. Maurice**[1], A. Nikolaou[1], Y. Rosas Ortiz[1], I. Varatharajan[1], D. Schroeder[2], K. Zikidis[3], H. Hussmann[1], T. Spohn[1]

[1]German Aerospace Center, Institute of Planetary Research, Berlin, Germany [2]Department of Geophysics, Stanford University, Stanford, CA, USA, [3]Department of Aeronautical Sciences, Hellenic Air Force Academy, Dekelia Air Base, Greece, [4]Institute for Geophysics, University of Texas at Austin, Austin, TX, USA

The Passive Radar Io Magma Explorer (PRIME) is a concept study to investigate the most active body in our Solar System with a low budget approach. Radar sounders have been successfully used on the Moon, on Mars and will also be represented aboard NASA's upcoming Europa Clipper mission by REASON [1] and aboard ESA's Jupiter Icy Moon Explorer (JUICE) by RIME [2]. However, despite their high scientific value, active radars usually have significant power consumption and suffer from radio noise; therefore operation might be limited to anti-Jovian sounding. For sub-Jovian operation, the concept of passive radar sounding has been previously suggested in the context of Ganymede and Europa [3,4,5]. PRIME would employ this concept exploiting the intense radio noise emissions of Jupiter at frequencies below 40 MHz [6]. The large distance to Sun and Earth, as well as the harsh Jovian environment make Io an extraordinarily difficult target when considering a low mass and low power approach. PRIME is intended in the frame of a flyby mission with limited deltaV budget in a highly inclined and eccentric orbit to avoid Jupiter's main radiation belts. PRIME aims at answering questions about the physical state of Io, the presence of a global subsurface magma ocean [7] and local magma reservoirs as well as the crustal thickness and state. It might also obtain important constraints on the thermal distribution of Io's interior by studying the sulfur cycle within Io's mantle and crust as well as distinguish between different tidal heating models by getting latitude dependent profiles. Io, being part of the Laplace resonance but not covered by the current mission concepts of Clipper and JUICE focusing on the icy moons, is a crucial target to obtain a comprehensive view on the Jovian system and its evolution. PRIME aims at filling this gap. The major science goals could be accomplished with a sequence of few flybys at high inclination and high velocity. We investigate the instrument concept in terms of signal to noise ratio and potential penetration depth as a function of various crustal parameters.

References

[1] Blankenship, D. et al. 2009, Europa, The University of Arizona Press [2] Bruzzone L. et al. 2013, *IEEE* International Geoscience and Remote Sensing Symposium - IGARSS, Melbourne, VIC [3] Hartogh P., and Ilyushin Y.A., 2015, Planet. and Space Sci. 130 [4] Romero-Wolf A., 2015, Icarus 248 [5] Schroeder D. et al., 2016, Planet and Space Sci. 134, [6] Cecconi B. et al. 2012, Planet. Space Sci., 61 [7] Khurana, K. et al. 2011, Science 332