



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

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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 (Blankenship et al. 2009) and aboard ESA’s Jupiter Icy Moon Explorer (JUICE) by RIME (Bruzzone et al. 2013). 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 (Romero-Wolf 2015, Schroeder et al. 2016, Hartogh and Ilyushin 2016). PRIME would employ this concept exploiting the intense radio noise emissions of Jupiter at frequencies below 40 MHz (Cecconi et al. 2012). 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 delta V 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 (Khurana et al. 2011) and local magma reservoirs as well as the crustal thickness and state. 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. We investigate the instrument concept in terms of signal to noise ratio and potential penetration depth as a function of various crustal parameters.

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