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Radio astronomy segments of prospective planetary science and exploration missions

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Over its entire history, the exploration of space is closely linked with the developments of radio astronomy. Recent rapid developments in radio astronomy will provide a basis for new applications in space and planetary science and exploration. These include Planetary Radio Astronomy and Doppler Experiments (PRIDE) aimed at an ultra-precise characterisation of vector-states of planetary probes and other deep space craft. PRIDE measurements will address a broad range of science topics from fundamental physics to dynamics of atmosphere to evaluation of habitability of interiors of various bodies of the Solar System. Another challenging task for ultra-sensitive radio astronomy facilities, such as the Square Kilometre Array (SKA), is a Direct-to-Earth (DtE) delivery of science data from planetary probes via low-power and low-gain on-board transmission systems. In both PRIDE and DtE applications, SKA and its pathfinders will be indispensible due to their frequency agility, superior sensitivity and signal processing capabilities.

In this presentation we will review the current status of radio astronomy segments of several planetary science and exploration missions. This will include the missions scheduled for launch during the implementation phase of SKA, employing, in particular the European VLBI Network (EVN) and its SKA pathfinder, e-EVN. The latter is a novel technological development of the VLBI network enabling real-time delivery to and processing of broad-band data at the dedicated processing centre. These new capabilities of Earth-based radio astronomy facilities are especially relevant to prospective ESA and NASA missions to outer planets, the Europa Jupiter System Mission (EJSM-Laplace) and Titan Atmosphere Explorer (TAE) with the target launch dates around 2020 and later. Several scientific topics of these missions can be best addressed with a wide-field SKA as an Earth-based PRIDE and DtE facility.