



Moonraker - an Enceladus Multiple Flyby Mission Submitted to the ESA 2021 M-class Call

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Context: Enceladus, an icy moon of Saturn, possesses an internal water ocean and geysers expelling ocean material into space. Cassini investigations indicated the ocean could be habitable and has a complex interaction with the rocky core. Further investigation of the composition of the plume formed by the geysers is necessary to fully understand the ocean, its possible habitability, and what it tells us about Enceladus' origin.

Mission profile: Moonraker has been proposed as an ESA M-class mission designed to orbit Saturn and perform multiple flybys of Enceladus, focusing on traversals of the plume. Moonraker consists of an ESA-built platform, with strong heritage from JUICE (and Mars Sample Return for solar power), and carrying a suite of instruments dedicated to plume and surface analysis. The nominal Moonraker mission includes a 23-flyby segment, with the possibility of expanding the mission with additional similar segments, depending on available resources.

Objectives and expected impact: Moonraker is devoted to the investigation of i) the habitability conditions of present-day Enceladus and its internal ocean, ii) the mechanisms at play for the communication between the internal ocean and the surface of the South Polar Terrain, and iii) the formation conditions of the moon in the context of the formation of the Saturnian system.

Moonraker, thanks to state-of-the-art instruments that represent a vast improvement over Cassini's payload, would quantify the abundance of key species in the plume, isotopic ratios, and physical parameters of the plume and the surface. Such a mission would allow to solve the standing questions left by Cassini on the aforementioned topics as well as pave the way for a possible future lander mission.

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