

Scientific Observations during Cruising and Rendezvous Phases of the Solar Power Sail

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Following successful demonstration of deep space solar sail technique by IKAROS, the solar power sail is a deep space probe with hybrid propulsion of solar photon sail and ion engine system that will enable Japan to reach out deep interplanetary space beyond the main asteroid belt. For over the last decade, we have been investigating interdisciplinary space science areas that will benefit respective scientific premises from such a deep space observation platform mainly during its cruising phase. They include: (1) infrared astronomy to observe the first generation stars as the IR cosmic background radiation being discriminated from the foreground scattering of zodiacal light due to (2) cosmic dust, which at the same time hit a large cross section of the solar sail membrane dust detector, concentrating inside the main asteroid belt, and (3) gamma-ray astronomy to identify burst sources by taking advantage of an extremely long baseline with the terrestrial observatories as counterparts. Recently, the mission design has extended from cruising and fly-by only to rendezvous and sample return options from Jovian Trojan asteroids, en route Jovian gravity assist. Then, scientific observation opportunities gain for (4) Jovian magnetosphere interacting with the solar wind, (5) multiple flybys of asteroids at the main belt and the Jovian Trojan region, and (6) semi-intact sampling of both interplanetary dust at 5.2 AU heliocentric distance and surface compositions of a most-likely D-type asteroid in the Trojan clan. We also investigate possible synergy effects among these interdisciplinary observation plans and respective available instruments, such as IR and dust, gamma-ray and solar wind.

Keywords: Solar Power Sail, Infrared Astronomy, Gamma-ray Astronomy, Zodiacal Light Dust, Jovian Magnetosphere, Jovian Trojan Asteroids