

A study of cruising-phase sciences using Solar Power Sail

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The Solar Power Sail is a Japanese candidate deep-space probe that will be powered by hybrid propulsion of solar photon acceleration and ion engines. The main scientific objectives are studies of Trojan asteroids in the Jovian L4 or L5 regions. The long distance and period from the launch to the swing-by at Jupiter will give us a good opportunity to explore the solar system between the Earth and the Jupiter, and to execute long-period, long-baseline observation for astronomy. We define the cruising-phase sciences of the Solar Power Sail as the scientific theme that will be explored or observed from the launch to the swing-by at Jupiter. In this paper, we report candidate instruments, as well as individual and integrated sciences of the cruising-phase sciences.

Candidate instruments are as follows.

The Exo-zodiacal Infrared Telescope (EXZIT) is a visible-light and infrared (tentatively 0.4 to 10 micro-meters) offset Gregorian telescope with a 10cm-diameter aperture. The all-aluminum telescope and the Linear Variable Filter (LVF) are based on the Cosmic Infrared Background Experiment (CIBER)-2. EXZIT will observe the zodiacal light from the launch to the main asteroid belt, and then search for the first stars until it approaches to Jupiter.

Arrayed Large-area Dust Detectors in Interplanetary space (ALADDIN) 2 detects interplanetary dust using the Polyvinylidene Fluoride (PVDF) dust sensors installed on the membrane. It is an improved model of ALADDIN that was installed on IKAROS and observed interplanetary dust between the Earth and Venus. ALADDIN2 will detect interplanetary dust between the Earth and Jupiter and compare the distribution with the results of EXZIT. It will observe the dust around the Trojan asteroids after it approaches to the Trojan.

The Magnetometer (MAG) is an improved fluxgate magnetometer model of the Magnetic Field Experiment (MGF) on the Exploration of Energization and Radiation in Geospace (ERG) that will be injected into the orbit on the Earth. Two or four devices will be installed in the tip of the framework of the membrane to provide the resolution on the electron scale for interplanetary plasma turbulence. MAG will measure the interplanetary plasma in the cruising-phase, and it will measure the magnetic fields around the Trojan asteroids after it approaches to the Trojan.

The Gamma-ray Burst Polarimeter (GAP) 2 is an improved model of GAP on IKAROS. GAP2 will monitor gamma-ray burst phenomena to clarify the particle acceleration mechanism and gravitational waves. It will also search for exploding early stars in the early universe, which complements to the infrared first-star search by EXZIT.

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