

Observation of planets by a circumpolar stratospheric telescope system FUJIN

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Phenomena in the planetary atmospheres and plasmaspheres have been studied by various methods using emissions emitted from there in the spectral regions from radio wave to X-ray. Optical observation of a planet has been performed by a ground-based telescope, a satellite telescope and an orbiter. A balloon-borne telescope is proposed as another platform for optical remote sensing of planets. Since it is floated in the stratosphere at an altitude of about 32 km, fine weather condition, excellent seeing and high transmittance of the atmosphere in the near ultraviolet and infrared regions are expected. Especially a planet can be continuously monitored by a long-period circumpolar flight. For these reasons we have been developing a balloon-borne telescope system FUJIN for planetary observations from the polar stratosphere.

In the FUJIN-1 system a Schmidt-Cassegrain telescope with a 300-mm clear aperture is mounted on a gondola whose attitude is controlled by control moment gyros, an active decoupling motor, and attitude sensors. The gondola can float in the stratosphere for periods longer than 1 week. Pointing stability of 0.1"rms will be achieved by the cooperative operation of the following three-stage pointing mechanisms: a gondola-attitude control system, two axis telescope gimbals for coarse guiding, and a tip/tilt mirror mount for guiding error correction. The optical path is divided to three paths to an ultraviolet camera, an infrared camera and a position-sensitive photomultiplier tube for detection of guiding error. The size of gondola is 1 m by 1 m by 3 m high, and the weight is 784 kg including the weight of ballast of 300 kg.

The FUJIN-1 experiment targeting Venus was scheduled to be conducted in Taikicho in Hokkaido in May/June 2013. The prelaunch ground-test results showed the high attitude control and pointing performance enough for achieving the requirements under low temperature and pressure condition. However the experiment was canceled because of failure in the bus system of the large balloon experiment prior to our one.

The FUJIN-2 gondola is being designed for a future long-duration experiment in Kiruna in Sweden. A Cassegrain telescope with a 400-mm clear aperture has been manufactured for FUJIN-2. A CCD camera installed at a Nasmyth focus position will take multi-wavelength images of planets by selecting on of bandpass filters in a filter turret. The FUJIN-2 experiment will be conducted at ESRANGE in May/June 2015 for a 24 to 48 hours flight.