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Development of a balloon-borne telescope for observation of planets

Makoto Taguchi^{1*}, Yasuhiro Shoji², Yuji Sakamoto², Kazuya Yoshida², Yukihiro Takahashi³,
Atsushi Yoshimura¹, Tomoya Ohnishi², Steve Battazzo²

¹College of Science, Rikkyo University, ²Tohoku University, ³Hokkaido University

A balloon-borne telescope system has been developed for remote sensing of planetary atmospheres and plasmas from the polar stratosphere. In this 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 a Sun sensor. The gondola can float in the stratosphere for periods in excess of 1 week. A pointing stability of 0.1 arcsec(rms) will be achieved by the cooperative operation of the following three-stage pointing devices: a gondola-attitude control system, two-axis telescope gimbals for coarse guiding, and a tip/tilt mirror mount for guiding error correction. The first target for the system is Venus. Wind vectors in the Venusian upper atmosphere will be derived from the tracking of cloud patterns observed in the ultraviolet and near-infrared regions.

The first experiment of the balloon-borne telescope system was conducted on June 3, 2009 at TARF in Taikicho, Hokkaido. As reported in the SGEPPS fall meeting the first experiment was far from full-success, however, we have confirmed validity of azimuthal angle control of the gondola, free gondola attitude in the stratosphere, sensitivity setting of the star sensor, performance of the power supply and function of the video monitor system. We are preparing the next experiment scheduled in 2011 at TARF. The performance of the balloon-borne telescope The purpose of the experiment is performance test of the balloon-borne telescope system and demonstration of multi-planet observation. The onboard computer will be replaced by a more robust and reliable system using an FPGA. In the late summer in 2011 Mercury, Venus, Mars and Jupiter will be in the morning sky, and we will try to sequentially observe these planets at different wavelengths.