SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (4)

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BALLOON OBSERVATION PLATFORM FOR PLANETARY SCIENCE

Abstract

In 2014 three Oort Cloud comets – C/2013 A1 (Siding Spring), C/2014 E2 (Jacques), and C/2012 K1 (PanSTARRS) – were each making their first apparition in the inner solar system. This unusual event provided an exciting opportunity to determine the composition and nature of these pristine cometary nuclei and thus gain an understanding of the condensation and evolution of primitive materials in the early solar system. The Balloon Observation Platform for Planetary Science (BOPPS) was developed in less than eight months under the leadership of NASA Glenn Research Center (GRC) and executed by the Johns Hopkins University Applied Physics Laboratory (APL) and the Southwest Research Institute (SwRI). BOPPS flew from Fort Sumner, New Mexico on September 26, 2014 and obtained the first ever images of Oort Cloud comets from a stratospheric balloon observatory using a 0.8 meter aperture telescope, a pointing system that achieved one arcsecond pointing stability, and an imaging instrument suite covering the near ultraviolet to mid infra-red. The Oort Cloud is a distant repository of material little changed since the formation of the solar system. Oort Cloud comets are pristine, icy bodies that have never been heated by passing close to the Sun and therefore provide insight into the composition of the early solar system. The Oort Cloud is a distant reservoir of dormant bodies located approximately 10,000 to 50,000 AU from the Sun. Compositional studies of Oort Cloud comets, when they fortuitously visit the inner solar system, provide important opportunities to address how these comets formed. The BOPPS instrument suite consisted of the BOPPS IR Camera (BIRC), developed by APL, that operated over nine narrow bands from 0.6 to 5.0 m and the Ultraviolet/Visible (UVVis) optical imaging system, developed by SwRI, that operated from 0.3 to 0.85 m, and included a fine-steering mirror. The BIRC measured the ratio of CO2 to H2O emissions from the coma as a vital diagnostic of the comet's origins

while the UVVis observed at the wavelength of the OH emission. In addition the minor planet Ceres was also observed as a secondary objective to demonstrate the ability to detect and characterize the extent of hydration on airless bodies. This paper provides a description of the BOPPS mission, announces its scientific findings, describes the platform's use on upcoming missions, and outlines the characteristics that can be customized to meet the needs of the high altitude research community to support additional future missions.