

will introduce the BITSE mission and discuss recent progress.

### [7 NGSC-02] Optical Design, Test, and alignment of BITSE

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NASA and Korea Astronomy and Space Science Institute (KASI) have been collaborated to develop the Space solar coronagraph instrument to detect the solar wind speed and corona temperature. As an intermediate stage, BITSE is the Balloon-Borne instrument to prove our proposed technical method which uses a polarized light in 4 different bandwidth wavelengths. In the presentation, the optical design based on the requirements, tests and alignment process for integrating the system are discussed.

### [7 NGSC-03] BITSE Instrument

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BITSE is a balloon mission, which is a solar coronagraph to measure speed and temperature of the solar wind using 4 different wavelength filters and an pixelated polarization camera. KASI and NASA jointly designed, developed, and tested the solar coronagraph. Mainly KASI developed an imaging system and a control system, and NASA developed an optical system and mechanical structures. We mount the BITSE on Wallops Arc-Second Pointer (WASP) of Wallops Flight Facility, and launch it with a 39 mcf balloon of Columbia Scientific Balloon Facility. We will introduce the overall system of the BITSE.

### [7 NGSC-04] BITSE Filter Wheel Assembly using a Piezo-ceramic module

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Space applications of the motion have been served with DC motors for decades. But their functionality with a gearbox and lubricants and their weights are always an issue for its application. A piezo-motor has an advantage on the direct driving with higher accuracy, smaller size, and no-EMI. We use the piezo-motor to rotate a filter wheel directly in a balloon-borne coronagraph launched on September 2019. The piezo-motor works well in a temperature range from -10 to 40 Celsius with high reliability and high positioning / tilt accuracy (~0.1degree) with a photo-encoder. We verify its functionality for 7 days. In this talk, we report the design, test processes of the filter wheel including its balloon flight result.

### [7 NGSC-05] Development of the Command and Data Handling System and Flight Software of BITSE

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BITSE is a project of balloon-borne experiments for a next-generation solar coronagraph developed by a collaboration with KASI and NASA. The coronagraph is built to observe the linearly polarized brightness of solar corona with a polarization camera, a filter wheel, and an aperture door. For the observation, the coronagraph is supported by the power distribution unit (PDU), a pointing system WASP (Wallops Arc-Second Pointer), telemetry & telecommand system SIP (Support Instrument Package) which are developed at NASA's Goddard Space Flight Center, Wallops Flight Facility, and Columbia Scientific Balloon Facility. The BITSE Command and Data Handling (C&DH) system used a cost-off-the-shelf electronics to process all data sent and received by the coronagraph, including the support system operation by RS232/422, USB3, Ethernet, and digital and analog signals. The flight software is developed using the core Flight System (cFS) which is a reusable software framework and set of reusable software applications which take advantage of a rich heritage of successful space