Alignment and Calibration of an Airborne Infrared Spectrometer

The airborne infrared spectrometer (AIR-Spec) will measure the coronal plasma emission lines in the infrared at high spatial and spectral resolution. These results will enhance our understanding of the coronal dynamics and improve solar forecasting models. To measure the infrared coronal emission lines, the airborne system will fly on the NSF/NCAR High-Performance Instrumented Airborne Platform for Environmental Research (HIAPER) during the total solar eclipse in August 2017. The flight path was calculated to maximize the observation time. A detailed analysis of our flight path will be reported.

The optical system consists of a fast steering mirror, telescope, grating spectrometer, and slit-jaw imager. Light from the sun is directed into the f/15 telescope by a fast steering mirror. The telescope focuses the light on the slitjaw and the remaining light enters the grating spectrometer through the slit. The poster will include a discussion of the alignment procedures for the telescope and spectrograph. All of the spectrometer optics are cooled to cryogenic temperatures, which complicates the alignment process. After the telescope and spectrometer are aligned independently, the telescope needs to be precisely aligned to the spectrometer. Several alignment methods were used to ensure that the telescope is focused at the slitjaw and normal to the spectrometer.

In addition to the optical alignment, there are a few calibrations to complete: 1) flat field, 2) spectral, and 3) radiometric. The flat field gives us a measure of the pixel to pixel variations. The spectral calibration is used to determine the conversion factor between wavelength and pixel. The radiometric calibration is used to map the camera output to radiance. All these calibrations are necessary for processing our data from the solar eclipse. We will report on our methods and results for the optical alignment and calibration for AIR-Spec. AIR-Spec is supported by NSF and Smithsonian Institution through the Major Research Instrumentation program. This work is supported by the NSF-REU solar physics program at SAO, grant number AGS-1560313.