Institute for Space Weather Sciences Colloquium

Thursday February 23, 2023, 1pm EST

via Webex Meeting ID: 2621 411 5229, password: isws

Dr. Jenna Samra

Center for Astrophysics (CfA) | Harvard & Smithsonian

High-Altitude Instrumentation for Infrared Observations of the Solar Corona

The solar corona is notable for its million-degree temperatures and its violent eruptions, but we don't understand exactly how coronal heating takes place, and we can't predict precisely when solar activity will occur. Both are controlled by the corona's magnetic field, which is extremely difficult to measure. High-altitude infrared remote sensing is a promising method for coronal magnetometry that is just now beginning to be explored. In this talk, I describe recent insights provided by our new airborne spectrometer and outline our upcoming plans for airborne and balloon-borne spectrometers and magnetometers.

Our instrumentation program began with the development of an Airborne InfraRed Spectrometer (AIR-Spec) to measure infrared coronal emission lines during total solar eclipses. AIR-Spec made its commissioning observation from the NSF/NCAR Gulfstream V research jet during the 2017 eclipse, when it measured all five of its target lines. These magnetically sensitive emission lines are promising candidates for future observations of the coronal magnetic field, and their characterization was an important first step toward developing the next generation of coronal magnetometers. The second AIR-Spec research flight took place during the 2019 eclipse across the southern Pacific. Higher sensitivity and reduced jitter enabled precise measurements of line intensity, plasma density, and plasma temperature up to 0.5 solar radii from the solar limb. In 2020 and 2021, we developed and flight-tested the Airborne Stabilized Platform for InfraRed Experiments (ASPIRE), a new large-aperture solar tracking platform for the Gulfstream V. During the 2024 North American eclipse, ASPIRE will feed the Airborne Coronal Emission Surveyor (ACES), a new imaging Fourier transform spectrometer that will survey the 1-4 micron wavelength band to look for new lines for plasma and magnetic field diagnostics. In parallel with ACES, we are developing a balloon-borne coronagraph and spectropolarimeter that will observe the Sun\ continuously for at least one solar cycle from above Antarctica. The CORonal Spectropolarimeter for Airborne Infrared Research (CORSAIR) will measure the magnetic and thermodynamic evolution of the corona and is a pathfinder for future space missions.

As an astrophysicist at the Center for Astrophysics (CfA) | Harvard & Smithsonian, *Dr. Jenna Samra* develops remote sensing instruments to observe the solar corona and Earth's atmosphere. She leads the CfA's high-altitude infrared coronal instrumentation program, the subject of today's talk. Jenna has also contributed to ECCCO, a set of EUV imagers and spectrographs that was just proposed as a NASA Small Explorer, its predecessor COOL-AID, which will collect spectroscopic data during the Hi-C Flare rocket flight, and MethaneAIR, which makes airborne measurements of atmospheric methane and is a pathfinder for MethaneSAT. Before joining the CfA as a graduate student in 2014, she worked at MIT Lincoln Laboratory on the development of environmental monitoring sensors. Jenna obtained BS and MS degrees in Electrical Engineering from Penn State in 2006 and 2008 and received a PhD in Applied Physics from Harvard University in 2018.