Gabriela
Galarraga
Colorado Space Grant Consortium at University of Colorado Boulder
Samantha Honan, Colorado Space Grant Consortium at UC Boulder
Amir Caspi, Southwest Research Institute
STEAM team, Colorado Space Grant Consortium at UC Boulder
Oral
(Invited Talk)
The Student Thermal Energetic Activity Module (STEAM) will explore how solar coronal plasmas are heated in flares and active regions by measuring the abundances of elements with low First Ionization Potential (FIP) using soft (0.5-10 keV) and hard (5-30 keV) X-rays to distinguish signatures of magnetic reconnection-based heating mechanisms.

Typically, coronal abundances of low-FIP elements (e.g. Mg, Si, Fe, Ca) are enhanced by a factor of ~4 above chromospheric values. Measuring the abundances of low-FIP elements at different temperatures provides insight into the origins of the heated plasma. X-ray emissions, including spectral lines and continuum, provide the most direct diagnostic signatures of hot coronal plasma.

STEAM will use a pair of hard and soft X-ray spectrometers to measure incident photons and their energies emitted from solar flares and active regions. Combined, the detectors will capture a broad range of X-ray emissions from 0.5 to 30 keV, with spectral resolutions of <0.3 & <1 keV FWHM in soft and hard X-rays respectively, providing a comprehensive look at thermal plasma evolution. STEAM will utilize forward modeling with bremsstrahlung and atomic emission databases to fit physical parameters such as temperature and elemental abundance to observed spectral data. These elemental abundances allow STEAM to infer the origin of plasma for flares and active regions.

STEAM is a student payload hosted on one of the PUNCH’s NFI Small Explorer spacecraft with an expected launch in mid-2025 and 2-year prime mission. STEAM’s spectral observations of solar flares and active regions in soft and hard X-rays during the maximum of solar cycle 25 will measure a wide range of activity to help constrain potential heating mechanisms for coronal plasma. The STEAM team is currently building and testing the flight model. We will present the STEAM science motivation, design, current progress, and future outlook.

Presentation file

22_Cherilynn_Galarraga.pdf

YouTube link

View Video

Meeting homepage

PUNCH 4 Science Meeting

Download to PDF