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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 reconnection-based heating of coronal plasma.

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 for various ions of these elements at different temperatures provides insight into the coronal or chromospheric origins of the heated plasma. X-ray emissions, including spectral lines and continuum, provide the most direct signatures of hot coronal plasma.

STEAM uses miniaturized commercial soft and hard X-ray spectrometers to measure individual incident photons and their energies. Combined, the detectors will capture a broad range of X-ray emissions from 0.5 to 30 keV, with spectral resolutions of <0.2 & <1 keV FWHM in soft and hard X-rays, respectively, providing a comprehensive look at thermal plasma evolution.

STEAM is a student payload hosted on one of the PUNCH Small Explorer spacecraft with an expected launch in mid-2023 and nominal 2-year mission life. STEAM’s spectral observations of solar flares and quiescent active regions in soft and hard X-rays during the rise phase of solar cycle 25 will aid in measuring physical parameters to help constrain potential coronal heating mechanisms and will provide the source regions of solar wind outflows that PUNCH will observe. Together, these two missions will provide a better understanding of the processes between the corona and heliosphere. We will present the STEAM science motivation, design, current progress, and future outlook.

Presentation file
gabriela-galarraga-aug2021.pdf
YouTube link
https://youtu.be/HkPJ6zqZZAg?t=2692
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