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Solar-Flare Particle Acceleration And Interaction Studies Using Gamma Rays

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We have developed new common analysis tools to study archival solar-flare gamma-ray data from three satellite spectrometers. These tools are based on a revised set of spectral templates incorporating the latest nuclear line cross sections that are used to fit flare spectra in combination with electron-produced continua. We have applied these tools to study emission from 19 SMM, 1 RHESSI, and 1 Fermi/GBM flares with the commonly used OSPEX Solar SoftWare. Here we discuss the methods used in a representative flare from each of the instruments. These studies can provide power-law spectral indices of the accelerated ions, the accelerated alpha/proton ratios, heavy-ion and ^3He compositions, the abundances of the ambient material in which the ions interact, and the heavy ion/(proton+alpha) ratios in flares. Ion acceleration onto magnetic loops with turbulence is consistent with the observations. We discuss how well the three different detectors provided information on these target parameters. Significant advances in our understanding of solar-flare particle acceleration and interaction are possible with instruments having larger effective area and volume.

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