

Future Gamma-Ray Imaging of Solar Eruptive Events

Albert Y. Shih (1)

Robert P. Lin (2,3,4)

Gordon J. Hurford (2)

Nicole A. Duncan (2,3)

Pascal Saint-Hilaire (2)

Hazel M. Bain (2)

(1) NASA Goddard Space Flight Center, Greenbelt, MD 20771

(2) Space Sciences Laboratory, University of California, Berkeley, Berkeley, CA 94720

(3) Department of Physics, University of California, Berkeley, Berkeley, CA 94720

(4) School of Space Research, Kyung Hee University, South Korea

Solar eruptive events, the combination of large solar flares and coronal mass ejections (CMEs), accelerate ions to tens of GeV and electrons to hundreds of MeV. The energy in accelerated particles can be a significant fraction (up to tens of percent) of the released energy and is roughly equipartitioned between ions and electrons. Observations of the gamma-ray signatures produced by these particles interacting with the ambient solar atmosphere probes the distribution and composition of the accelerated population, as well as the atmospheric parameters and abundances of the atmosphere, ultimately revealing information about the underlying physics. Gamma-ray imaging provided by RHESSI showed that the interacting ~ 20 MeV/nucleon ions are confined to flare magnetic loops rather than precipitating from a large CME-associated shock. Furthermore, RHESSI images show a surprising, significant spatial separation between the locations where accelerated ions and electrons are interacting, thus indicating a difference in acceleration or transport processes for the two types of particles. Future gamma-ray imaging observations, with higher sensitivity and greater angular resolution, can investigate more deeply the nature of ion acceleration. The technologies being proven on the Gamma-Ray Imager/Polarimeter for Solar flares (GRIPS), a NASA balloon instrument, are possible approaches for future instrumentation. We discuss the GRIPS instrument and the future of studying this aspect of solar eruptive events.