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High Energy Emission Observed by RHESSI

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Observations of solar flares in X-rays and gamma-rays provide the most direct information about the hottest plasma and energetic electrons and ions accelerated in flares. The Ramaty High Energy Solar Spectroscopic Imager (RHESSI) has observed over 18000 solar flares in X-rays and gamma-rays since its launch in February of 2002. RHESSI observes the full Sun at photon energies from as low as 3 keV to as high as 17 MeV with a spectral resolution on the order of 1 keV. It also provides images in arbitrary bands within this energy range with spatial resolution as good as 3 seconds of arc. Full images are typically produced every 4 seconds, although higher time resolution is possible. This unprecedented combination of spatial, spectral, and temporal resolution, spectral range and flexibility has led to fundamental advances in our understanding of flares. I will show RHESSI and coordinated observations that confirm coronal magnetic reconnection models for eruptive flares and coronal mass ejections, but also present new puzzles for these models. I will demonstrate how the analysis of RHESSI spectra has led to a better determination of the energy flux and total energy in accelerated electrons, and of the energy in the hot, thermal flare plasma. I will discuss how these energies compare with each other and with the energy contained in other flare-related phenomena such as interplanetary particles and coronal mass ejections.