



# PHYSICS COLLOQUIUM

## Particle Acceleration and Explosive Energy Release by the Sun



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Host: Prager

**Abstract:** The Sun is the most energetic natural particle accelerator in the solar system, generating ions up to 10s of GeV and electrons to 100s of MeV, in both large solar flares and fast coronal mass ejections. Large solar flares are the most powerful explosions in the solar system, releasing up to  $\sim 10^{32}$  ergs in 100-1000 s, with  $> \sim 10$ -50% of this energy in accelerated particles. I will present observations from the RHESSI (Ramaty High Resolution Solar Spectroscopic Imager) spacecraft of the hard X-ray (HXR)/gamma-ray continuum and gamma-ray line emission produced by the accelerated electrons and ions, respectively, showing that the process of magnetic reconnection is key for flare energy release and particle acceleration. I will also present direct in situ space observations showing that magnetic reconnection and related particle acceleration also occurs in the Earth's magnetosphere, at Mars, in the solar wind, and, very likely, in cosmic explosions. These measurements, together with recent results from laboratory plasma experiments, theory, and simulations, have led to significant progress in understanding these ubiquitous phenomena.

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