Contribution ID: **152** Type: **Invited Talk**

Gamm-ray Emission from the Sun

Wednesday 12 October 2022 10:00 (30 minutes)

Sustained gamma-ray emission (SGRE) from the Sun represent emission extending up to a day beyond the impulsive phase of solar flares. SGRE was first identified by Forrest et al. (1985) using data from the Solar Maximum Mission's Gamma-Ray Spectrometer. Only a handful of SGRE events were known over the next thirty years until the advent of the Fermi-Large Area Telescope (LAT). Fermi/LAT has detected more than three-dozen of these events, which help us obtain their statistical properties and their association with solar eruptive events. These events help us understand the origin of >300 MeV protons that interact with the solar chromosphere, produce neutral pions, which decay into the observed gamma-rays. SGRE events are associated with solar flares of X-ray class M and X, large solar energetic particle (SEP) events, interplanetary type II radio bursts, and superfast (>2000 km/s) coronal mass ejections (CMEs). All these eruptive phenomena are related to one another. Energetic CMEs drive shocks that accelerate protons observed as SEPs and electrons resulting in type II bursts. Flares and CMEs are two aspects of energy release in solar magnetic regions. Particles are also accelerated in the flare reconnection region, which is spatially compact. The flare particles are responsible for various impulsive phase emissions including gamma-rays, which have properties different from those of SGREs. Some authors attribute even SGREs to flare-accelerated protons trapped in flare loops, although their close connection to SEPs, type II bursts, and CMEs point to an extended source, viz., the shock driven by CMEs. In this talk, I will review the properties of SGRE events and the associated phenomenon and the current understanding of the emission mechanism.

Track

Solar System

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Session Classification: Plenary 5