



Long-Duration Solar Gamma-ray Flares and High-Energy Solar Energetic Particles: Is there a Connection?



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Little is known about the origin of the high-energy, sustained emission from long-duration gamma-ray solar flares (LDGRFs) identified with past missions and now Fermi. Coronal mass ejection shock waves can accelerate protons into space (SEPs). It was thought that some of those protons can travel back to the Sun to produce long-duration gamma-rays flares (LDGRFs).

What is the science question? Do LDGRFs come from the CME-shock accelerated proton population? Are they just particles that travel back to the Sun instead of out into space as SEPs?

What were your findings? By comparing the number of protons from CMEs shocks (SEPs) in space (using PAMELA and STEREO) with the number of particles required to produce the LDGRF emission we measure coming from the Sun (using FERMI), we were able to demonstrate that there is no significant correlation between the two populations. This means that LDGRF emission is probably not due to protons accelerated at CME-driven shocks that then travel back to the Sun.

What was the impact? Typically, LDGRFs are associated with fast coronal mass ejections (CMEs) and large solar energetic particle (SEP) events. We were able to show that there is no direct connection between energetic protons observed in space and the accelerated proton population producing the high-energy γ -ray emission.

Why does it matter? This gives us new insight into fundamental astrophysical particle acceleration and some of the drivers of extreme space weather. Also, this analysis showed that two astrophysics missions, FERMI and PAMELA provided critical observations to help address a long-standing heliophysics question.

