

## What Do the SEP events and the Associated High-Energy Flares of 2012 March 7 Can Tell Us About Long Duration Gamma-Ray Flares?

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Two X-class flares occurred on 2012 March 7, an X5.3 and an X1.1. The earlier X5 flare gathered much attention, initiating a powerful and fast CME from the eastern hemisphere. The “forgotten” X1 flare featured a much smaller CME from the same active region one hour later. However, extended high-energy gamma emission was present for almost the entire day of 2012 March 7. We have resolved the gamma emission into two separate, but overlapping extended occurrences, being from the two sequential X-class flares. Somewhat surprisingly, we find that the later X1 event was twice as prolific in gamma emission, mostly due to its duration, despite being much weaker in soft x rays. Additionally, several independent researchers have attributed all the SEPs on that day and the next five to the first CME. We conclude that the entirety of the gamma emission emanated from particle precipitation from the footpoints of two separate quasi-static large-scale (of order 1 solar radius) coronal loops and not from either of the associated CMEs accelerating the high-energy particles. Using constraints from ancillary data, we discuss the difficulties having SEPs produce the gamma rays at the Sun and we estimate the bounds in parameter space of the static loop sizes and embedded turbulence necessary to accelerate protons and ions to high energies producing the observed gamma emission.

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