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Investigation of Coronal Mass Ejection Driven Shock in Relation to the Fermi-LAT Long-Duration Solar Flares using Data-driven Global MHD Simulations

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The increasing number of long-duration gamma-ray solar flares >100 MeV observed by Fermi/LAT poses a puzzle on the particle acceleration and transport mechanisms. Since most of the long-duration events are associated with fast coronal mass ejections (CMEs), it is therefore intriguing to understand the role of CMEs and CME-driven shocks in these events. In this study, we perform data-driven, global MHD simulations of the CMEs associated with 8 Fermi-LAT long-duration solar flares. We derive and track the time-varying shock parameters over the area that is magnetically connected to the gamma-ray emission region. The CME-driven shock properties are then compared with the observational quantities of the Fermi-LAT delayed phase emission including peak flux and decay timescale. Our result shows that the simulated shock parameters are well correlated with the characteristics of the delayed phase emission, which suggests the CME-driven shock and shock accelerated particles play an important role in these delayed emission of gamma-ray solar flares.

Track

Solar System

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