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HESPERIA studies on the nature of high-energy solar gamma-ray events

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The FERMI/LAT gamma-ray experiment, thanks to its large effective are, observed about 25 solar events with gamma-ray emission above photon energies of 100 MeV. The emission is attributed to pion-decay photons. This implies that the acceleration of protons in the solar corona to energies above 300 MeV is a frequent phenomenon, probably more so than previously thought. In some cases the emission persists over several hours. In the frame of the HESPERIA project, funded by the Horizon 2020 programme of the European Union, we conduct an extensive study on the relationship between these gamma-ray emissions and electromagnetic signatures of accelerated electrons in the corona on the one hand, solar energetic particles (SEPs) detected in space on the other hand. This contribution is to present first results on the sample of 25 gamma-ray events, mainly addressing two subjects: (1) We compare the durations of the gamma-ray emission with the durations of hard X-ray and microwave signatures of electrons in the solar atmosphere, in the attempt to see if long-duration gamma-ray events are accompanied by signatures of long-duration electron acceleration. (2) We show that in each gamma-ray event electrons had rapid access to interplanetary space since the impulsive flare phase. This suggests that particles accelerated during the flare could escape to interplanetary space. We compare the hardness of the proton spectra detected in interplanetary space with the prediction using the properties of the solar microwave bursts.

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