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On the origin of very high-energy gamma-rays from GRBs

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Recently, very high-energy photons above 100 GeV were reported to be detected from GRB 190114C and GRB 180720B at, respectively, 100−1000 s and 10 hr after the burst. We model the available broadband data of both GRBs with the synchrotron plus synchrotron self-Compton (SSC) emission of the afterglow shocks. We find that the sub-TeV emission of GRB 180720B can be interpreted as the SSC emission from afterglow shocks expanding in a constant-density circumburst medium. The SSC emission of GRB 190114C dominates over the synchrotron component from GeV energies at ~100 s, which can explain the possible hard spectrum of the GeV emission at this time. The extrapolated flux of this SSC component to sub-TeV energies can explain the highsignificance detection of GRB 190114C by the MAGIC telescope. The parameter values (such as the circumburst density and shock microphysical parameters) in the modeling are not unusual for both gamma-ray bursts, implying that the detection of sub-TeV photons from these two bursts should be attributed to their large burst energies and low redshifts.

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