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Physics of gamma-ray burst afterglow: implications of H.E.S.S. observations

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Recently, the observational study of gamma-ray bursts (GRBs) in the very-high-energy (VHE) regime has quickly advanced with three successful detections. Currently, the list of published VHE GRBs contains GRB 180720B, GRB 190114C, and GRB 190829A. The fortunate proximity of the last event observed with H.E.S.S. (GRB 190829A occurred at z~0.08) allowed an unexpectedly long signal detection, up to 56 hours after the trigger, and accurate spectral determination in a broad energy interval, spanning between 0.18 and 3.3TeV. The obtained temporal and spectral properties of the VHE emission appeared to be remarkably similar to those seen in the X-ray band with Swift-XRT. However, in frameworks of the standard synchrotron-self-Compton (SSC) scenario such a coherent behavior is expected only during the early period of the afterglow phase, when the forward shock propagates with large bulk Lorentz factor, \(\Gamma>100\). SSC models are able to render VHE spectra compatible with the H.E.S.S. measurements only under extreme assumptions on the properties of the circumburst medium. We discuss the implications of the GRB 190829A detection for afterglow modeling and GRB physics.

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Collaboration

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other Collaboration

Subcategory

Experimental Results

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