Contribution ID: **80** Type: **Contributed**

Fermi and Swift Observations of GRB 190114C: Tracing the Evolution of High-Energy Emission from Prompt to Afterglow

Thursday, 15 April 2021 07:15 (15 minutes)

We report on the observations by Fermi and Swift of gamma-ray burst (GRB) 190114C detected at very high energy by MAGIC. The prompt gamma-ray emission was detected by the Fermi/GBM, the Fermi/LAT, and the Swift/BAT and the long-lived afterglow emission was subsequently observed by the GBM, LAT, Swift/XRT, and Swift/UVOT. The early-time observations reveal multiple emission components that evolve independently, with a delayed power-law component that exhibits significant spectral attenuation above 40 MeV in the first few seconds of the burst, which enables us to estimate the initial bulk Lorentz factor. This power-law component transitions to a harder spectrum that is consistent with the afterglow emission observed by the XRT at later times. As a result, we are able to observe the transition from internal shock to external shock dominated emission. We find that the temporal and spectral evolution of the broadband afterglow emission can be well modeled as synchrotron emission from a forward shock propagating into a wind-like circumstellar environment. Considering the onset of the afterglow component, we estimate the maximum synchrotron energy as a function of time. We find that even in the LAT energy range, there exist high-energy photons that are in tension with the theoretical maximum energy that can be achieved through synchrotron emission.

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Session Classification: Exploring the Cosmos: GRB-2

Track Classification: Gamma-ray Bursts