

Synchrotron Radiation Dominates the Extremely Bright GRB 221009A

The brightest gamma-ray burst, GRB 221009A, has spurred numerous theoretical investigations, with particular attention paid to the origins of ultrahigh-energy TeV photons during the prompt phase. However, analyzing the mechanism of radiation of photons in the \sim MeV range has been difficult because the high flux causes pileup and saturation effects in most GRB detectors. In this Letter, we present systematic modeling of the time-resolved spectra of the GRB using unsaturated data obtained from the Fermi Gamma-ray Burst Monitor (precursor) and SATEch-01/GECAM-C (main emission and flare). Our approach incorporates the synchrotron radiation model, which assumes an expanding emission region with relativistic speed and a global magnetic field that decays with radius, and successfully fits such a model to the observational data. Our results indicate that the spectra of the burst are fully in accordance with a synchrotron origin from relativistic electrons accelerated at a large emission radius. The lack of thermal emission in the prompt emission spectra supports a Poynting flux-dominated jet composition.

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