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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 ˜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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