Gamma-Ray Burst Spectral Diagnostics for GLAST

Matthew G. Baring

One of the principal results obtained by the EGRET experiment aboard the Compton Gamma-Ray Observatory was the detection of several gamma-ray bursts (GRBs) above 100 MeV. The broad-band spectra obtained for these bursts gave no indication of any spectral attenuation that might preclude detection of bursts at higher energies. With the discovery of optical afterglows and counterparts to bursts in the last few years, enabling the determination of significant redshifts for these sources, it is anticipated that profound spectral attenuation will arise in the GLAST energy band of 30 MeV–300 GeV for many if not most bursts. An important goal will be to discriminate between such extrinsic absorption, due to the cosmic infra-red background, and that which arises internally in GRBs. This paper explores the expectations for the spectral properties in the GLAST band for bursts, in particular how attenuation of photons by pair creation internal to the source modifies the spectrum to produce distinctive signatures. The energy of spectral breaks and the associated spectral indices provide valuable information that can constrain the bulk Lorentz factor of the GRB outflow at a given time. Moreover, distinct temporal behavior is present for internal attenuation, and is easily distinguished from extrinsic absorption. These characteristics define palpable observational goals for both the GLAST mission and ground-based \v{C}erenkov telescopes, and strongly impact the observability of bursts above 1 GeV.