SOFT-SPECTRUM GAMMA-RAY BURSTS

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1. Introduction

A "typical" gamma to ray burst (GRB), when observed over the ~30 keV to 1 MeV range, has a 1-10 s duration and a spectrum describable in terms of a several-hundred-keV exponential function. However, KONUS data (1) indicate that some GRBs may belong to a separate class of short (~0.1 s), soft (kT < 50 keV) events. This result has been questioned because the KONUS experiments, with only 4 s spectral time resolution and a lack of information below ~30 keV, are not particularly well-suited for the detection and study of these bursts. The UC Berkeley/Los Alamos Solar X-Ray Spectrometer/GRB experiment (2) on the International Cometary Explorer (ICE), with nearly continuous coverage of ~one-sixth of the sky down to 5 keV at 0.5 s resolution, is better designed for such a task. Using ICE data, we have confirmed that soft-spectrum events do indeed exist, apparently with properties that set them apart from the general GRB population. Results from the ICE experiment are presented below.

2. Results

The spectrum of one such event, GB790107, has been measured over the 5 - 200 keV range. Above ~30 keV the spectrum is much steeper than that of any other GRB observed by ICE. It is characterized by a 15 to 30 keV e-folding energy, depending on the exact model chosen for the spectral fit. However, at lower energies the spectrum becomes much flatter, indicating some kind of low-energy absorption or cutoff.

We have searched the ICE data record for additional soft-spectrum events, using published lists of short events (1,3,4,5) as well as an arbitrary net 70-day ICE data block. Our null result leads to the following conclusions: (i) Nearly all of the known short events have hard spectra, and are probably normal GRBs at one extreme of the duration distribution. (ii) Since the ICE experiment always has good coverage of the Galactic Center region, soft-spectrum events are not highly concentrated in that direction. (iii) Long-duration (>1 s) soft-spectrum events are either rare or nonexistent.

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