Contribution ID: **544** Type: **Invited talk in the parallel session**

Bayesian Time-resolved Spectroscopy of Multipulse GRBs: Variations of Emission Properties among Pulses

Tuesday, July 6, 2021 11:00 AM (30 minutes)

Gamma-ray bursts (GRBs) are highly variable and exhibit strong spectral evolution. In particular, the emission properties vary from pulse to pulse in multipulse bursts. Here we present a time-resolved Bayesian spectral analysis of a compilation of GRB pulses observed by the Fermi/Gamma-ray Burst Monitor. The pulses are selected to have at least four time bins with a high statistical significance, which ensures that the spectral fits are well determined and spectral correlations can be established. The sample consists of 39 bursts, 117 pulses, and 1228 spectra. We confirm the general trend that pulses become softer over time, with mainly the low-energy power-law index α becoming smaller. A few exceptions to this trend exist, with the hardest pulse occurring at late times. The first pulse in a burst is clearly different from the later pulses; three-fourths of them violate the synchrotron line of death, while around half of them significantly prefer photospheric emission. These fractions decrease for subsequent pulses. We also find that in two-thirds of the pulses, the spectral parameters (α and peak energy) track the light- curve variations. This is a larger fraction compared to what is found in previous samples. In conclusion, emission compatible with the GRB photosphere is typically found close to the trigger time, while the chance of detecting synchrotron emission is greatest at late times. This allows for the coexistence of emission mechanisms at late times.

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Session Classification: Photospheric Emission in GRBs

Track Classification: Fast Transients: Photospheric Emission in GRBs