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Study of GRB light curve decay indices in the afterglow phase

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In this work we study the distribution of temporal power-law decay indices, α , in the Gamma Ray Burst (GRB) afterglow phase, fitted for a sample of 164 long GRBs with known redshifts using a power-law form. These indices are compared to the values of characteristic afterglow luminosity, L_a , the time, T_a^* , and the analogous decay index, α_W , derived with global light curve fitting using the Willingale et al. (2007) model. This model fitting yields similar distributions of α_W to the fitted α , but for several bursts difference between these indices can be significant. Analysis of the (α, L_a) distribution reveals a weak correlation of these quantities. However, we discovered a significant regular trend when studying distribution of GRB α values at the L_a , vs. T_a^* (LT) plane, with a differences of the α parameters below and above the fitted LT correlation line (Dainotti et al. 2008). Study of the presented systematic trend may allow one for constraining the physical models for GRBs. A proposed toy model accounting for this systematics applied to the analyzed GRB distribution results in increasing the LT correlation coefficient.

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