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Rapid Spectral Variability of GRBs. A Puzzle Solved?[1] MIKHAIL MEDVEDEV, University of Kansas — Millisecond spectral variability of prompt GRBs, such as the so-called "tracking behavior" and correlation of the soft photon index α and the observed flux, does not have a satisfactory explanation for some fifteen years. We demonstrate that the spectral variability of GRBs is an inherent property of radiation emitted by electrons from highly anisotropic small- scale magnetic fields, generated at internal shocks. We interpret the flux-α correlation and the tracking pattern as a combined effect of temporal variation of the shock viewing angle and relativistic aberration of an instantaneously illuminated, thin shell. The model predicts that hard (e.g., synchrotron violating, with $\alpha > -2/3$) spectra result from a shock patch close to the line of sight and that they are associated with the onset of a sub-pulse. The spectral softening occurs on the $R/c\Gamma^2$ time-scale. The model also naturally explains why the peak of the distribution of α is at $\alpha \sim -1$. The presence of a low-energy break in the jitter spectrum at oblique angles also explains the appearance of a soft X-ray component in some GRBs. We emphasize that our theory is based solely on the first principles and contains no ad hoc assumptions.

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