Fe Kα Emission from X-ray Reflection: Predictions for Gamma-Ray Burst Models

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Abstract

The recent discovery of Fe Kα line features in the X-ray afterglows of several γ-ray bursts (GRBs), particularly the *Chandra* observation of GRB 991216, may provide important constraints on the immediate environment of the burst and hence on progenitor models. The large Fe Kα equivalent widths inferred from the X-ray observations favor models in which the line is produced when the primary X-ray emission from the source strikes Thomson-thick material and Compton scatters into our line of sight. We present such reflection spectra here, computed in a fully self-consistent manner, and discuss the range of ionization parameters that may be relevant to different models of GRBs. We argue that the presence of a strong hydrogen-like Kα line is unlikely because Fe XXVI photons are likely to be resonantly trapped and removed from the line core by Compton scattering. In contrast, a strong narrow emission line from He-like Fe XXV is prominent in the model spectra. We briefly discuss how these constraints may affect the line energy determination in GRB 991216.

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