The X–ray Spectra of Flares from AB Doradus

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AB Doradus is a rapidly–rotating K0 dwarf star at 15 pc. It is very active, and has flared during nearly all X–ray observations. ASCA obtained a 40 ksec pointing on AB Dor in 1993 November during which it initially showed a steady quiescent level of emission at 7 $\times 10^{29}$ ergs s^{-1} Hz^{-1}. In the second half of the observation, a series of flares took place (Fig. 1, bottom panel).

The count rates in these data are high enough to carry out time-resolved spectroscopy of the flares. Figure 1 (top two panels) also shows the results of 2 `meka`–component model fits to the data from SIS0 and GIS3, using the quiescent spectrum of AB Dor as a background in each case (amounting to reductions of 1.4 cts s^{-1} and 0.5 cts s^{-1} for the SIS0 and GIS3 spectra, respectively). Data are binned into 900-second spectra, which gives several thousand counts at the flare peaks and adequate statistics in the flare decay periods. Abundances were fixed at the values determined from the analysis of the quiescent ASCA and EUVE spectra (Mewe et al., this volume).

We see that the flare produces a pronounced hot component but little change in the amount of cool material present. The emission measure of the hot component tracks the total count rate well, far more so than does the EM of the cool component. The temperature of the cool component remains at $\sim$ 0.6 keV during the flares, similar to the temperature of the cool component in the quiescent spectrum (Mewe et al., this volume), which seems peculiar. The hot component peaks at around 4 keV, which is typical of previously–observed values. It is hotter than usual for evaporated heated chromospheric material in solar flares (2 keV), and is closer to the temperature of the "superhot" component identified in some solar flares. The total emission measure in the corona increases in these events and the additional material presumably comes from chromospheric evaporation. The temperature of the hot component decays slowly relative to the decay of the emission measure.

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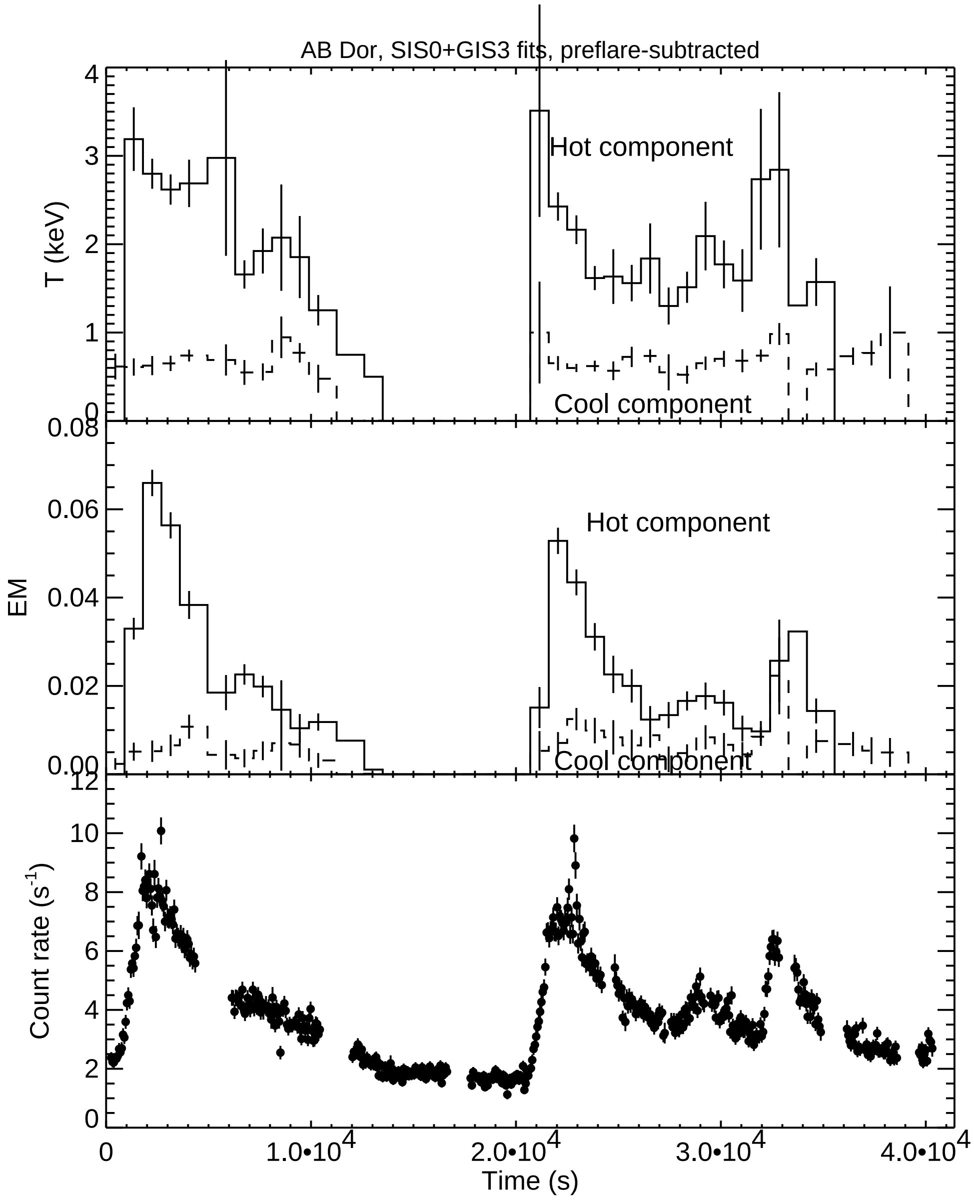

Figure 1. Two–component fits to preflare–subtracted spectra from the SIS0 and GIS3 detectors (fit simultaneously). The top panel shows the temperatures of the two components and the second panel the emission measures as a function of time. The bottom panel shows the count rate history in 32 s bins using counts from both detectors combined (0.4 – 12 keV).