Coronal densities

Figure 1: Time coverage of the nights of 19th/20th, 21st/22nd and 23rd/24th May 2006 with XMM-Newton and VLT/UVES. Exposure times for UVES varied according to seeing conditions from 100 s to 1500 s in the blue arm, resulting in 68, 24 and 89 red spectra and in 16, 5 and 11 blue spectra in the three nights respectively.

Magnetic flux variations

Figure 2: Following the method of Reiners & Basri (2006) we determined the magnetic field of CN Leo from the FeH band located around 1.1 µm in the red UVES spectra. The average magnetic flux varies by ≈ 100 G from 1st to 2nd night and by ≈ 25 G from 2nd to 3rd night.

Flare lightcurves

Figure 3: Lightraces of the giant flare in different spectral bands. The optical lightcurves show an impulsive outburst followed by a secondary peak, while in X-rays the countrate stays constant for about five minutes. The decrease in countrate in the red and blue bands is initially very fast and then slows down, while the decay rate seems to be constant in X-rays and in the U band. Note that the EPIC instruments are affected by pile-up (up to 30% during the flare peak) and the OM lightcurve is corrupted by disproportionate dead-time and coincidence-loss corrections for countrates higher than ≈ 500 cts s⁻¹.

EPIC spectra

Figure 6: XMM EPIC PN spectra covering the initial rise phase, the "plateau" of constant countrate at the flare peak, and the decay phase of the giant flare. The spectra clearly demonstrate the development of the coronal plasma during the flare: The spectrum obtained during the quiescent phase is similar to a previously obtained one from May 2006 (Fuhrmeister et al.). During the flare rise a strong increase in temperature and emission measure compared to the quiescent state is obvious. At flare peak enhanced line emission between 0.6 and 1.1 keV sets in, during the decay phase the emission measure slowly decreases with the temperatures still at high levels.

Figure 7: O vii triplet in RGS1, extracted from the quiescent part of the first X-ray observation (exposure time 20.8 ks, left) and covering the giant flare (1.4 ks, right). In quiescence, the f/i ratio is 2.88 ± 1.53, indicating log n_e > 10 but within the errors still consistent with the low-density limit, while during the flare the density increases to log n_e > 12, as determined by f/i = 0.08 ± 0.15. The short duration of the flare prevents an analysis of density variations during different phases of the flare as performed by Güdel et al., 2002.

References


Figure 8: Continuum enhancement in the UV during the flare, and the development of chromospheric emission lines in the blue part of the spectra during the flare. Outside the flare continuum emission in the blue part of the spectra is almost absent. Note the delay between continuum enhancement and the onset of strong line emission and broadening of the Balmer lines.

Figure 9: Broadening of Hα and continuum enhancement in the red part of the spectra during the initial phase of the flare. Ca ii at 8498 Å, 8542 Å and 8662 Å as well as He i at 6678 Å and 7065 Å are observed in emission during the flare. The quiescent spectrum has been averaged from 7 spectra preceding the flare.