Comparison of temperature and density diagnostics in the coronae of α Centauri and the Sun

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1. Data analysis

The Medium Wavelength (MW, 140 - 380 Å) spectrum of α Centauri, observed by the Extreme Ultraviolet Explorer (EUVE) spectrometer, summing the three pointed observations (May 29-31, May 31-June 1, June 7-8, 1993), is analysed. Line fluxes were obtained with gaussian best-fits.

Given the low resolution of the EUVE MW channel (≈ 1 Å), a comparison is performed with the very high spectral resolution (≈10,000) observation of an active region (AR) on the Sun, obtained by the Solar EUV Rocket Telescope and Spectrograph (SERTS) on 1989 May 5 (Thomas and Neupert, 1994), that covered the same spectral region.

The line ratios of Fe XIII lines (203.83 Å and 202.04 Å) and Fe XIV lines (219.14 Å and 211.32 Å) are used to evaluate the electron density.

A differential emission measure (DEM) analysis of the solar and stellar data is performed, following the integral inversion technique developed by Monsignori Fossi and Landini (1991) using updated atomic data (Monsignori Fossi and Landini, 1996). More than 50 density insensitive lines of various elements, excluding the blends, were used to deduce the solar DEM and the element abundances. This represent an improvement, compared with the results of Brickhouse et al. (1995) that used only iron lines, and with Monsignori Fossi et al. (1994).

The synthetic solar and α Cen spectra are calculated using the DEM distributions.

2. Conclusions

The solar AR and the α Cen corona present similar emission lines, typical of the same coronal temperatures (10^5 - 10^7 K), and close density values ($N_e \approx 4 \times 10^9 \text{ cm}^{-3}$ and $N_e \approx 1.6 \times 10^9 \text{ cm}^{-3}$ respectively). The element abundances of Feldman et al. (1992), slightly corrected, were found proper to reproduce the two observations.
Figure 1. a) Emission measure integrated over $\Delta \log T = 0.1$ as function of the temperature for the SERTS-89 active region. Full line refers to the present analysis, dashed line to the Brickhouse et al. (1995) analysis. The errorbars take into account only the uncertainties attributed to intensity measurements. b) Differential emission measure distribution for the SERTS-89 active region and for the corona of $\alpha$ Cen observed by EUVE. Dotted line refers to $\alpha$ Cen, full line to the SERTS-89 active region (Thomas and Neupert, 1994).

The evaluated DEM distributions are in rather good agreement with those of the previous analyses, e.g. Brickhouse et al. (1995) for the solar AR, and Mewe et al. (1995) for $\alpha$ Cen, in spite of the different techniques used to solve the integral inversion problem.

The comparison of observed and calculated line intensities for the SERTS-89 spectrum confirms the identifications given by Thomas and Neupert (1994), although some of the lines are not in agreement. The $\alpha$ Cen synthetic spectrum well represent the intensities of the principal lines.

References

Thomas R.J. and W.M. Neupert: 1994, AJSS, 91, 461