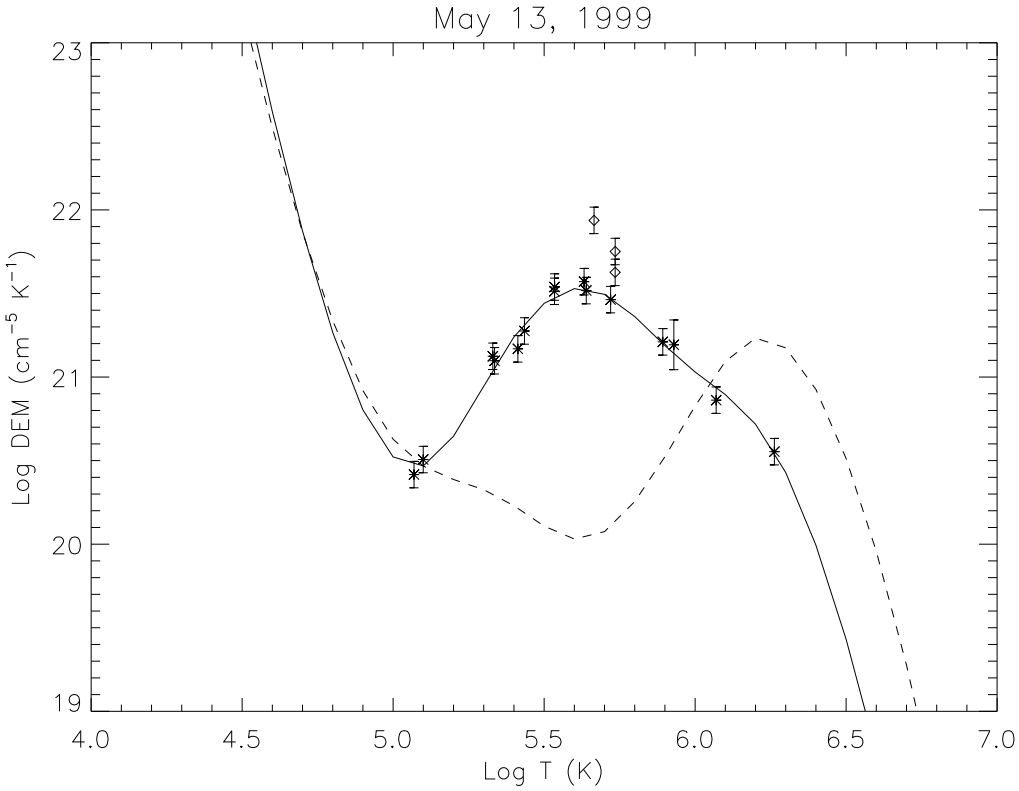
Properties of Sunspot Plume Derived From EUV Spectra



We observed the large sunspot in Active Region 8539 on 1999 May 13 with three instruments (CDS, EIT, MDI) aboard *SOHO*. The spot contained a bright plume easily seen in extreme-ultraviolet (EUV) emission lines from ions formed at temperatures between 1.6×10^5 and 5.0×10^5 K. Here we display logarithmic differential emission measure (log DEM) curves for the sunspot plume (solid) and nearby quiet sun area (dashed). The DEM quantifies how emitting plasma is distributed with temperature. It was derived assuming "coronal" elemental abundances, in which abundances of elements with a low first ionization potential (low-FIP) are enhanced by ~ 4 relative to their photospheric values, while the abundances of high-FIP elements are the same as in the photosphere. Because low-FIP Ca (displayed as diamonds) requires an additional abundance enhancement ~ 2, elemental abundances in the plume appear to be coronal rather than photospheric. The plume's maximum DEM occurs around 4.0×10^5 K (log T = 5.6), and exceeds the quiet sun DEM by more than an order of magnitude at this temperature. Intensity ratios of the O^{+3} (O IV, formed at 1.6×10^5 K) lines at 625.8 and 554.5 Å yield log n_e (where n_e is the electron density in cm^{-3}) of $9.7^{+0.2}_{-0.2}$ in the plume and $9.4^{+0.2}_{-0.3}$ in the quiet sun. [From J. W. Brosius & E. Landi, *The Astrophysical Journal*, vol. 632, in press (2005 Oct. 20).]