Stellar Wind X-Ray Absorption in OB Stars

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A key factor in the analysis of X-ray data from OB stars is determining the true nature of the X-ray absorption, i.e., the relative strengths of the "local" and ISM absorption components. The local component is in addition to the fixed ISM absorption and refers to the X-ray attenuation caused by the massive, highly ionized stellar wind. Determining the strength of this local component is crucial to understanding the X-ray production mechanism in these stars. Although observational evidence supporting the existence of wind absorption has increased somewhat over the past few years, a clear physical picture of the significance of this component has not emerged. In this study, we discuss the characteristics of X-ray signatures of wind absorption. We demonstrate how PSFC and IPC hardness ratio data can be used as an effective diagnostic tool for establishing the presence of stellar wind absorption. To show the importance of this local component, we present detailed spectral analyses of PSFC data for several OB stars. Used in conjunction with IPC data, we find that stringent constraints can be placed on the strength of the local absorption component. From the strength of this component, the X-ray source location, relative to the stellar reference frame, can be ascertained. The implications of our results, with respect to the various proposed X-ray production models, are discussed.

This work was supported in part by NASA contract NAS5-31220.

Spectroscopic and Orbital Properties of the Binary Feige 24 and Discovery of External Plasma at Inferior Conjunction

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We have obtained new high-dispersion optical (KPNO) and ultraviolet spectroscopy (IUE) of the close white dwarf + red dwarf binary system Feige 24 (P = 4.2316 d). The optical range shows a composite DA+dM spectrum, together with H I Balmer and He I emission. The orbital phase dependence of the emission shows that it results from extreme ultraviolet (UV) light reprocessing in the red dwarf photosphere. The systems close enough and hot enough to show this reprocessing signature must arise from common-envelope evolution. The ultraviolet spectrum is dominated by the white dwarf. It shows numerous Fe V absorption lines together with C IV, N V, and Si IV resonance doublets and few excited lines from the most abundant elements (N IV, O IV, Si IV). We measured accurate (1 km s\(^{-1}\)) radial velocities of the red dwarf component motion, traced by both optical absorption and emission lines, and new radial velocities of the white dwarf, traced by UV Fe V lines. Combining these measurements, we refine the orbital parameters presented by Vennes et al. (1991, ApJ, 372, L37), and we confirm that the white dwarf gravitational redshift is exceptionally small (8 ± 2 km s\(^{-1}\)). Using theoretical radii for thin hydrogen layers we can uniquely constrain its mass and radius to \(M_{\text{WD}} = 0.40 ± 0.04\ M_{\odot}\) and \(R_{\text{WD}} = 0.24 ± 0.02\ R_{\odot}\). The mass of the red dwarf and the inclination of the system naturally follow: \(M_{\text{RM}} = 0.27 ± 0.03\ M_{\odot}\), \(i = 65°\). The IUE spectra taken when the system is near inferior conjunction show strong He II 1640 absorption. The profile is highly variable in width and intensity and appears correlated with the passage of the white dwarf in the background of plasma associated with the red dwarf, almost 4\(R_{\odot}\) above the orbital plane. At maximum, the line absorption is broad (130 km s\(^{-1}\)) and blueshifted (−20 km s\(^{-1}\)) relative to the systemic velocity. The plasma probably consists of coronal material and/or wind material. Additional UV spectroscopy will help determine the nature, dynamics, and temperature of this external plasma. This work is supported by NASA contract NAS5-30180 and grant NAGS-1805.

Discovery of Strong EUV-induced Balmer Emission in the New WD+dM Binary EUVE J2013+40.0 (RE 2013+400)

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The binary system EUVE J2013+40.0 (= RE 2013+400) was discovered in the EUV-selected sample of white dwarfs identified in the course of the ROSAT Wide Field Camera (WFC) all-sky survey (Pounds et al. 1993, MNras, 260, 777). The intense extreme ultraviolet (EUV) emission from the hot white dwarf (DAO type) was also detected in the course of the Extreme Ultraviolet Explorer (EUVE) all-sky survey (Borwier et al. 1993, ApJ, submitted), and the subsequent optical identification campaign suggested the association of EUVE J2013+40.0 with the Feige 24 class of binary systems (see Vennes & Thorstensen, these proceedings). Such systems consist of a hot H rich white dwarf (DA/DAO) and a red dwarf companion (dM) and are characterized by strong, narrow, variable Balmer emission. We obtained spectroscopy with 4 Å resolution at the Michigan-Dartmouth-MIT Hiltn er 2.4 m, covering the

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