A coordinated X-ray and Optical Campaign of the Nearest Massive Eclipsing Binary, delta Orionis Aa: IV. A multiwavelength, non-LTE spectroscopic analysis

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Eclipsing systems of massive stars allow one to explore the properties of their components in great detail. We perform a multi-wavelength, non-LTE analysis of the three components of the massive multiple system delta Ori A, focusing on the fundamental stellar properties, stellar winds, and X-ray characteristics of the system.

The primaryâ€™s distance-independent parameters turn out to be characteristic for its spectral type (O9.5 II), but usage of the Hipparcos parallax yields surprisingly low values for the mass, radius, and luminosity. Consistent values follow only if delta Ori lies at about twice the Hipparcos distance, in the vicinity of the sigma-Orionis cluster. The primary and tertiary dominate the spectrum and leave the secondary only marginally detectable. We estimate the V-band magnitude difference between primary and secondary to be 2.8 mag. The inferred parameters suggest the secondary is an early B-type dwarf (~B1 V), while the tertiary is an early B-type subgiant (~B0 IV). We find evidence for rapid turbulent velocities (âˆ¼200 km/s) and wind inhomogeneities, partially optically thick, in the primaryâ€™s wind. The bulk of the X-ray emission likely emerges from the primaryâ€™s stellar wind (log LX/LBol~ âˆ'6.85), initiating close to the stellar su R0âˆ¼1.1RâˆŒ. Accounting for clumping, the mass-loss rate of the primary is found to be log Mdot ~ 6.4 [Msun/yr], which agrees with hydrodynamic predictions, and provides a consistent picture along the X-ray, UV, optical and radio spectral domains.

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