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Spectra disentangling applied to the Hyades binary Theta^2 Tau AB: new orbit, orbital parallax and component properties

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Theta^2 Tauri is a detached and single-lined interferometric-spectroscopic binary as well as the most massive binary system of the Hyades cluster. The system revolves in an eccentric orbit with a periodicity of 140.7 days. The secondary has a similar temperature but is less evolved and fainter than the primary. It is also rotating more rapidly. Since the composite spectra are heavily blended, the direct extraction of radial velocities over the orbit of component B was hitherto unsuccessful. Using high-resolution spectroscopic data recently obtained with the Elodie (OHP, France) and Hermes (ORM, La Palma, Spain) spectrographs, and applying a spectra disentangling algorithm to three independent data sets including spectra from the Oak Ridge Observatory (USA), we derived an improved spectroscopic orbit and refined the solution by performing a combined astrometric-spectroscopic analysis based on the new spectroscopy and the long-baseline data from the Mark III optical interferometer. As a result, the velocity amplitude of the fainter component is obtained in a direct and objective way. Major progress based on this new determination includes an improved computation of the orbital parallax. Our mass ratio is in good agreement with the older estimates of Peterson et al. (1991, 1993), but the mass of the primary is 15-25% higher than the more recent estimates by Torres et al. (1997) and Armstrong et al. (2006). Due to the strategic position of the components in the turnoff region of the cluster, these new determinations imply stricter constraints for the age and the metallicity of the Hyades cluster. The location of component B can be explained by current evolutionary models, but the location of the more evolved component A is not trivially explained and requires a detailed abundance analysis of its disentangled spectrum.

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