Cyclic Variability of the Circumstellar Disc of the Be Star ζ Tau. II. Testing the 2D Global Disc Oscillation Model

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About 2/3 of the Be stars present the so called V/R variations, a phenomenon characterized by the quasi-cyclic variation of the ratio between the violet and red emission peaks of the H I emission lines. These variations are generally explained by global oscillations in the circumstellar disc forming a one-armed spiral density pattern that precesses around the star with a period of a few years.
In this paper we model, in a self-consistent way, polarimetric, photometric, spectrophotometric and interferometric observations of the classical Be star ζ Tauri. Our primary goal is to conduct a critical quantitative test of the global oscillation scenario.
We have carried out detailed three-dimensional, NLTE radiative transfer calculations using the radiative transfer code HDUST. For the input for the code we have used the most up-to-date research on Be stars to include a physically realistic description for the central star and the circumstellar disc.
We adopt a rotationally deformed, gravity darkened central star, surrounded by a disc whose unperturbed state is given by a steady-state viscous decretion disc model. We further assume that disc is in vertical hydrostatic equilibrium.
By adopting a viscous decretion disc model for ζ Tauri and a rigorous solution of the radiative transfer, we have obtained a very good fit of the time-average properties of the disc. This provides strong theoretical evidence that the viscous decretion disc model is the mechanism responsible for disc formation.
With the global oscillation model we have successfully fitted spatially resolved VLTI/AMBER observations and the temporal V/R variations of the Hα and Brγ lines. This result convincingly demonstrates that the oscillation pattern in the disc is a one-armed spiral.
Possible model shortcomings, as well as suggestions for future improvements, are also discussed

Reference: A&A, in press
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/0901.1098

Comments:

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