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BISTABILITY ROTATING RADIATION DRIVEN WIND FOR B[E] SUPERGIANTS: THE OBLATE FINITE CONE ANGLE CORRECTION FACTOR

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Curé et al. (2005) revisited radiative driven wind models for rapidly rotating B[e] supergiants, assuming a change in the line-force parameters due to the bi-stability jump. From their model calculations, they made predictions on the density contrast close and far from the star and also the disk half-opening angle. In that work they neglected the effect of rotation in the shape of the star and also in the finite- disk correction factor. In the present work, we present our first steps in the study of the influence of the oblate finite disk correction factor due to rotation (Pelupessy et al. 2000) in the wind solutions.

The effects of rapid rotation and bi-stability upon the density contrast between the equatorial and polar directions in B[e] supergiants have been analysed (e.g. Pelupessy et al. 2000; Curé et al. 2005). Curé (2004) demonstrated that the m-CAK solution (Pauldrach et al. 1986; Friend & Abbott 1986) vanishes for rotational speeds of 70–80% of the break-up velocity and that there exists a new much denser and slower solution than the classical m-CAK solution: the slow solution. Under this consideration, they found density contrasts of the order of $10^2 - 10^4$ close to the stellar surface and about $10^1 - 10^2$ at 100 stelar radii. Since Curé et al. (2005) did not take into account the modification of the finite-disk correction factor due to the rotation (Cranmer & Owocki 1995; Pelupessy et al. 2000), we present our first results considering this effect in the polar and equatorial solutions.

The standard model for radiation-driven stellar winds or CAK model (Castor et al. 1975), considers a stationary, isothermic and spherically symmetric regime, neglecting the effect of viscosity, heat conduction and magnetic field. In our case, the correction factor CF from the velocity law, is computed numerically as described in Pelupessy et al. (2000) in order to account for the rotational oblateness of the star. The procedure of solving a nonlinear differential equation and its eigenvalue, imposing conditions of regularity and singularity, is clearly explained in Curé et al. (2004). At the stellar surface the density is set according to the corresponding Kurucz model.

When taking into account the effect of the oblate finite disk correction factor in the equator, we find that when Ω (rotational speed/break-up speed) grows from zero to 0.2, the terminal velocity decreases, leading to higher densities close and far from the central star. The effect close to the central star is somewhat higher than far form the central star, even when this low rotation is considered.

Considering a B[e] supergiant star, with the wind parameters as described in Curé et al. (2005), we obtained the velocity-density distribution in the polar and equatorial direction. In this opportunity we have only considered a low value of Ω, and found differences between the cases in which the finite disk and the oblate finite disk are considered. We have found larger densities and a slightly larger equator-pole density contrast when we include the oblate finite disk correction factor due to rotation, even when low rotational velocities are considered.

We plan to extend soon our results to larger rotational velocities, considering the slow solution found by Curé, and to all angles from the pole to the equator of the star in order to compare our results with those of Pelupessy et al. (2000) and Curé et al. (2005).

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REFERENCES

Castor, J. I., et al. 1975, ApJ, 195, 157
Curé, M. 2004, ApJ, 614, 929
Curé, M., & Rial, D. F. 2004, A&A, 428, 545
Curé, M., et al. 2005, A&A, 437, 929
Cranmer, S. R., & Owocki, S. P. 1995, ApJ, 440, 308
Friend, D. B., & Abbott, D. C. 1986, ApJ, 311, 701
Pauldrach, A., et al. 1986, A&A, 164, 86
Pelupessy, I., et al. 2000, A&A, 359, 695