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VARIABILITY OF THE DECRETION DISC OF BE STARS IN BINARY SYSTEMS

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RESUMEN

Las estrellas Be son estrellas B altamente variables rodeadas por una estructura circunestelar saliente, llamada disco de decreción. Se ha sugerido en el pasado y se demuestra que la variabilidad a pequeña escala en los observables se puede atribuir al efecto de marea en el disco por un compañero binario. En particular, se presentan variaciones de V/R ancladas a la fase orbital para binarios circulares coplanares.

ABSTRACT

Be stars are highly variable B stars surrounded by an outflowing circumstellar structure, called the decretion disc. It has been suggested in the past and is hereby shown that small-scale variability in the observables can be attributed to the tidal effect on the disc from a binary companion. In particular, V/R variations locked to the orbital phase are presented for coplanar circular Be binaries.

Key Words: hydrodynamics — radiative transfer — stars: binaries — stars: circumstellar matter — stars: emission line, Be — stars: mass loss

Be stars are fast-rotating and highly variable B stars, which are surrounded by an outflowing circumstellar structure, called the decretion disc. It has been established that given appropriate angular momentum, matter can be drawn to higher orbits through viscous forces, allowing the Be disc to grow. However, the disc feeding mechanism is still under debate. In this work the disc formation and variability is attributed to the gravitational effect from a binary companion.

The binary system was modelled with a smoothed particle hydrodynamics code, exploring the parameter space for coplanar binaries (Panoglou et al. 2016). It was found that, after the steady state has been reached, two spiral arms are formed and the disc density varies both azimuthally and with the orbital phase. The degree of variability varies depending on the parameters of the system. Smaller orbital separations, low viscosities and high secondary-to-primary mass ratios result in more massive discs and more elongated structures. In circular orbits the spiral arms are symmetrical, and the disc does not exhibit any variability along the orbital cycle, other than that the structure rotates in phase with the secondary. In highly eccentric orbits, the disc extent maximises a little after the periastron and almost vanishes for the rest of the cycle.

In order to examine the variability of the violet-to-red (V/R) peaks ratio of the line profiles, it is necessary to calculate the radiation transfer at various epochs during the evolution of the disc. The process is largely simplified in coplanar circular orbits, in which the steady rotating structure allows for direct transformation of the azimuthal domain to orbital phase domain. Representative results are shown in Fig. 1 for binary systems of two different orbital periods. A shorter period causes a denser disc (Panoglou et al. 2016) and stronger V/R variations.

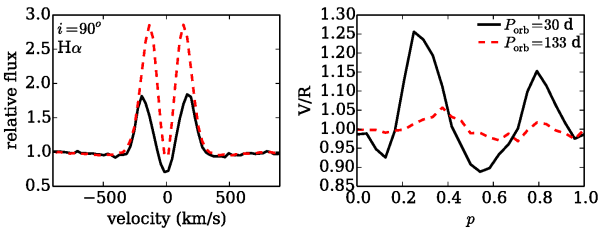

Fig. 1. The Hα line profile (left) and the orbital modulation of the V/R ratio (right), seen edge-on ($i = 90^o$) for two binary systems differing only by their orbital periods.

We conclude that our model is able not only to constrain the parameters involved in Be binaries, but also to trace binarity in systems with invisible companions through the orbital-phase dependence of their observables.

REFERENCES

Panoglou, D., Carciofi, A. C., Vieira, R. G., et al. 2016, MNRAS, 461, 2616

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