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On the structure of magnetized accretion flows in the system of Beta Lyrae

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Abstract. In this paper we show the structure of gas flows between the components of the massive interacting system Beta Lyrae.
Key words: stars: individual: Beta Lyrae – magnetic fields – stars: magnetic field – binaries: general

1. Introduction

We show that the structure of gas flows between the components of the well-known massive interacting system Beta Lyrae is due, above all, to the presence of the magnetic field of the donor with an axis directed along the phases 0.35–0.85 P and deflected relative to the gravitational axis of this binary system (Skul'Kij, 1985; Skul'Skij & Plachinda, 1993).

In the phase range around 0.8–0.9 P this field is maximal and the axis of its dipole on the donor surface is closest to the accretion disk. This presumes the presence of more effective shock collisions of the magnetized plasma in the phases of the second quadrature 0.6–0.9 P. This leads to the observation of the hot arc on the accretion disk rim facing the donor (Skulsky, 2015).

The configuration of the donor magnetic field and the gravitation of the massive accretor explain also the hotter region on the accretion disk, which dominates in accordance with Mennickent & Djurašević (2013) in the phases near 0.80 P. This region on the disk can be formed by collision with this disk of magnetized gas which is channeled by the magnetic field of the donor in the direction of the massive accretor. The energy effect from the collision on the disk is significantly strengthened here by the opposite rotation of the disk rim at velocities up to 250 $\mathrm{km\,s^{-1}}$ towards the falling gas flows. The specific configuration of the magnetic field of the donor is an influencing factor on the mass transfer, evidenced by analysis of the absolute spectrophotometry, curves of magnetic field changes, intensities and radial velocities of spectral lines with the phases of the orbital period, and also the study of circumstellar gas structures, their dynamics and energetics (Alekseev & Skulskii, 1989; Burnashev & Skul'Skii, 1991; Skul'Skii & Mal'Kov, 1992).

As a result of high-energy a collision of ionized plasma, which is canalized by the donor's magnetic field, with the accretion disk is generating a scattering gas

shell that partially masks the components of this binary system outside of the Lyman limit and completely in the soft X-ray region (Hack et al., 1977; Polidan, 1989; Kondo et al., 1994; Ignace et al., 2008). The problem of the real existence and physical nature of jet-like structures in the Beta Lyrae system can be solved in a similar way.

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