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Influence of the velocity gradient on the line formation in discs of cataclysmic variables

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Abstract

Context. The velocity field gradient in the radiative transfer in disc models of cataclysmic variables (CVs) is usually neglected; however, the geometry of the system and the value of Keplerian velocity suggest that it can be important for high inclination angles. Aims. We investigate the influence of the Keplerian velocity gradient on the line formation in CV discs. Methods. The vertical structure of the disc was determined using the NLTE accretion disc code AcDc, where the hydrostatic equation, the energy balance equation, the radiative transfer equation, the rate equations, and the equations of charge and particle conservation are consistently solved using the accelerated lambda iteration. NLTE opacities and emissivities are interpolated onto a 2D grid, where the radiative transfer equation was then solved with the velocity field taken into account. Results. We show line-profile changes and limb-darkening dependences for the Hα and Hγ lines in a model of SS Cyg, along with the HeI 4923 A° line of a model representing a typical AM CVn system. Both systems are considered in the quiescent phase. Conclusions. The line-profile changes due to the velocity gradient in the disc are small enough for most CV discs to allow the classical approach, where the radiative transfer is solved through the static disc and the velocity field is only taken into account in the final flux integration. However, the exact solution must be performed for CVs, where the disc rim plays an important role (inclination angles almost 90°). Extremely cool and relatively transparent discs under high inclinations should also be investigated with detailed radiative transfer models. © 2011 ESO.

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Keywords

Methods: numerical, Novae, cataclysmic variables, Radiative transfer, Stars: individual: AM CVn, Stars: individual: SS Cyg