XI SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
August 21-25, 2017, Šabac, Serbia
Book of Abstracts, Eds. L. Č. Popović, A. Kovačević and S. Simić
Astronomical Observatory Belgrade, 2017

Invited Lecture

IRRADIATION EFFECTS IN SPECTRA OF CLOSE BINARY SYSTEMS

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Irradiation effects in secondary stars of close binary systems are crucial for a reliable determination of system parameters and understanding the close binary evolution. They affect the stellar structure of the irradiated star and are reflected in the appearance of characteristic features in the spectroscopic and photometric data of these systems. I will present the research we have done studying the light originating from the irradiated side of the low mass component of close binary eclipsing systems comprising a hot subdwarf primary and a low mass companion, in order to precisely interpret their high precision photometric and spectroscopic data, and accurately determine their system and surface parameters. The talk will focus on the spectra of AA Dor system where irradiation features have already been detected. After removing the predominant contribution of the hot subdwarf primary, the residual spectra reveal more than 100 emission lines from the heated side of the secondary that show maximum intensity close to the phases around secondary eclipse. We analyse the residual spectrum in order to model the irradiation of the low mass secondary. We performed a detailed analysis of 22 narrow emission lines of the irradiated secondary, mainly of O II, with a few significant C II lines. Their phase profiles constrain the emission region of the heated side to a ≥ 95 % of the radius of the secondary, while the shape of their velocity profiles reveals two distinct asymmetry features one at the quadrature and the other at the secondary eclipse. In addition, we identify weaker emission signatures originating from more than 70 lines including lines from He I, N II, Si III, Ca II and Mg II. From the emission lines of the heated side of the secondary star we determine the radial velocity semi-amplitude of the center-of-light and correct it to the centre-of-mass of the secondary which in turn gives accurate masses of both components of the AA Dor system. The resulting masses $M_1 = 0.46 \pm 0.01 M_\odot$ and $M_2 = 0.079 \pm 0.002 M_\odot$ are in perfect accordance with those of a canonical hot subdwarf primary and a low mass just at the substellar limit for the companion. We also compute a first generation atmosphere model of the low mass secondary, which includes irradiation effects and matches the observed spectrum well. We find an indication of an extended atmosphere of the irradiated secondary star.