The detection of variable radio emission from the fast rotating magnetic hot B-star HR7355 and evidence for its X-ray aurorae

P. Leto, C. Trigilio, L. Oskinova, R. Ignace, C.S. Buemi, G. Umana, A. Ingallinera, H. Todt, F. Leone

INAF - Osservatorio Astrofisico di Catania, Via S. Sofia 78, 95123 Catania, Italy

In this paper we investigate the multiwavelengths properties of the magnetic early B-type star HR7355. We present its radio light curves at several frequencies, taken with the Jansky Very Large Array, and X-ray spectra, taken with the XMM X-ray telescope. Modeling of the radio light curves for the Stokes I and V provides a quantitative analysis of the HR7355 magnetosphere. A comparison between HR7355 and a similar analysis for the Ap star CUVir, allows us to study how the different physical parameters of the two stars affect the structure of the respective magnetospheres where the non-thermal electrons originate. Our model includes a cold thermal plasma component that accumulates at high magnetic latitudes that influences the radio regime, but does not give rise to X-ray emission. Instead, the thermal X-ray emission arises from shocks generated by wind stream collisions close to the magnetic equatorial plane. The analysis of the X-ray spectrum of HR7355 also suggests the presence of a non-thermal radiation. Comparison between the spectral index of the power-law X-ray energy distribution with the non-thermal electron energy distribution indicates that the non-thermal X-ray component could be the auroral signature of the non-thermal electrons that impact the stellar surface, the same non-thermal electrons that are responsible for the observed radio emission. On the basis of our analysis, we suggest a novel model that simultaneously explains the X-ray and the radio features of HR7355 and is likely relevant for magnetospheres of other magnetic early type stars.

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Email: paolo.leto@oact.inaf.it