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Advective accretion onto a non-spherical accretor in white dwarf and neutron star binaries: a new scenario of shock formation

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Numerous studies on hydrodynamics of the Keplerian as well as the sub-Keplerian accretion disc around a compact object (e.g., white dwarf (WD), neutron star (NS), or a black hole (BH)) attempted to explain the observed UV, soft and hard X-ray spectra. Although, when the compact object (e.g., a WD or an NS) has a finite surface, its rapid rotation, the stellar magnetic field could cause deformation of the spherical symmetry. Earlier studies for Keplerian disc showed that a deviation from the spherical symmetry of the compact object could affect the observed light curve and spectra at high frequencies. Here, we have explored the effect of the non-spherical nature of a compact object on the hydrodynamics of an optically thin, geometrically thick sub-Keplerian advective flow. We find that due to non-spherical shape of the central accretor, there is a possibility to trigger Rankine-Hugoniot shock in the sub-Keplerian advective flow close to the accretor without considering any general relativistic effect or presence of the hard surface of the star. Our results are more relevant for accretion onto WD as hardly any general relativistic effect will come in the picture. We propose that some observational features e.g., high significance of fitting the spectra with multi-temperature plasma models rather than single temperature models, and variable efficiency of X-ray emission (X-ray luminosity in comparison with optical and UV luminosity of the disk) in nonmagnetic cataclysmic variables can be explained by the presence of shock in the sub-Keplerian advective flow.

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