Investigation of magnetized accretion flow properties around a black hole and prospects with Astrosat

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Abstract

In recent years, magnetically supported, optically thin, advection dominated accretion disc around black holes (BHs) have been extensively investigated to explain many interesting features of BH sources. We investigate a single-temperature, magneto-fluid model for accretion disc around a BH in presence of dissipation. The steady, transonic solutions of BH accretion flows are obtained taking into account azimuthal magnetic fields and optically thin radiative cooling. The global transonic accretion solutions may contain shock, whenever possible. The accretion rate ($\dot{m}$) and magnetic parameter $\beta$ are found to significantly affect the shock properties and dynamics of the post shock corona (PSC). Interestingly, the shocked accretion solutions are found to be more luminous than shock free solutions and may explain the energetics of BH candidates. The maximum dissipated energy released from the PSC is further computed and its variation studied with $\dot{m}$, $\beta$ and spin of the BH. This dissipated energy can possibly explain the kinetic luminosity of jets. In view of the significant developments in the theoretical modelling of accretion discs, at the end, we discuss the role of the recent AstroSat mission to explore the observational aspects. The unprecedented multi-waveband coverage of AstroSat allows us to examine the detailed spectro-timing characteristics of the astrophysical sources. We discuss the identification of the various spectral components in the wide band X-ray spectra of the BH binaries using broad energy coverage in X-rays using joint spectrum from SXT and LAXPC. Also, we consider about the detailed study of timing behaviour of the sources using advanced timing techniques e.g. power spectral density with the softwares LAXPCSoft and GHATS. Finally, we highlight the importance of Astrosat data in validating the theoretical models available in literature.