INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Accretion-ejection mechanism from advective accretion disc around rotating black holes

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In the first work, we investigate the effect of spin on the mass outflow rates from a steady, advective, inviscid, geometrically thin accretion flow around a rotating black hole. For this purpose, we adopt pseudo-Kerr potentials to mimic the space-time geometry around rotating black holes. We calculate maximum outflow rates in terms of spin of the black holes. Interestingly, we observe a weak correlation between the spin and the maximum outflow rates from our model. Finally, we apply our accretion-ejection model to estimate the kinetic jet power for various black hole sources. In the second work, we consider a steady, dissipative, geometrically thin accretion flow around a rotating black hole. We find that the shock waves exist for a wide range of dissipative parameters. We also calculate critical limit of viscosity parameters in terms of spin of the black holes that permits shock solutions. We also calculate the maximum QPO frequency in terms of the black hole spin using our accretion-ejection model. Finally, we apply our formalism to constrain the spin parameter of the black hole source GRO J1655-40. In the third work, we perform a comparative study of a steady, dissipative, geometrically thin accretion flow around a rotating black hole using three pseudo-Kerr potentials. We observe that in case of weakly rotating black holes, the critical viscosity parameters for all the pseudo-potentials agrees quite well, but differs considerably from each other for rapidly rotating black holes. We also indicate that BH-XRBs along the 'outliers' track seems to be rapidly rotating based on our model. In the fourth work, we study the dynamics of advective inviscid accretion flow using time-dependent hydrodynamical simulation around rotating black holes. Due to the shock compression, the post-shock corona (hereafter PSC) usually becomes very hot and dense and therefore, acts as a source of high energy radiations. When PSC modulates, the high energy photon flux coming out from PSC is also oscillates that eventually exhibits Quasi-periodic Oscillations (QPOs). When PSC executes very fast oscillation, it demonstrates high frequency QPOs (HFQPOs). We carry out the numerical investigation of HFQPOs for various sets of input parameters and compare our results with the observation of LAXPC/AstroSat and RXTE for galactic black hole source GRS 1915+105. Based on this comparative study, we indicate the possible range of mass and spin values of this source.