



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

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**SHORT ABSTRACT**

One of the most efficient energy sources in the universe is matter accretion onto compact objects, such as black holes (BHs) and neutron stars (NSs). With the presence of an ample amount of angular momentum, this convergent matter cannot fall radially onto the central object. Instead, it forms a swirling disk-like structure widely known as the accretion disk. One of the major questions in accretion theory is to explain the angular momentum and energy transport within the disk.

Towards this, in the first part of the thesis, we investigate the structure of low angular momentum magnetohydrodynamic (MHD) accretion flows around Schwarzschild as well as Kerr BHs following a general relativistic (GR) treatment. To begin with, we adopt a steady, axisymmetric, advective accretion disk, which is threaded by the radial and toroidal components of magnetic fields. Considering ideal MHD approximation and a relativistic equation of state (REoS), we solve the governing flow equations and obtain the family of trans-magnetosonic accretion solutions around BHs. We notice that the toroidal magnetic field plays a pivotal role in determining the mid-plane disk dynamics. Further, the interplay between radial and toroidal magnetic fields develops Maxwell's stress within the disk, which successfully transports the flow angular momentum outwards. Next, we discuss the thermodynamically favourable shock-induced GRMHD accretion solutions around BHs.

In the second part of the thesis, we focus on the hydrodynamics part, where we study the effects of thermal conduction on hot accretion flows. We notice that thermal conduction dominates in the outer part of the accretion disk. Finally, we study the post-Newtonian hydrodynamics in the context of accretion flows around a rotating compact body. We observe that the post-Newtonian theory could become a potential alternative to GR formalism of accretion flows. Lastly, we provide the overall conclusion of the thesis with a summary of possible future studies.

