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Nuemrical simulation of accretion onto black holes using relativistic equation of state

Accretion flows onto a black hole (BH) has to be transonic and transrelativistic. In such wide range in space and temperature, the flow far away from the BH is subsonic and non relativistic and close to the BH it is hot and relativistic. Such a range cannot be described a fixed adiabatic index, equation of state (EoS). An approximate but an accurate EoS was proposed few years ago by Chattopadhyay and Ryu (CR). Steady state semi analytical solutions using CR EoS has been implemented by many authors to study BH accretion, jets etc. We study all possible accretion solutions in the advective regime using CR EoS. We have developed a numerical simulation code based on the TVD routine of Harten (1983). We regenerate the full range of accretion solutions, monotonic Bondi type, monotonic ADAF type, and non monotonic solutions including shocks. We show that these shocks can oscillate depending on viscosity parameter and cooling processes. In such cases various types of QPOs are easily explained. We also discuss the formation of jets and outflows from such accretion discs.

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