Modified Fluid Closure of Collisionless Systems in Radiatively-Inefficient Accretion Flows

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May 1, 2017

Abstract

The diversity of plasmas in nature divides their study into many different regimes which are valid only within certain approximations. This paper attempts to extend the validity of one such regime (a fluids framework) to another (kinetic theory, for collisionless plasmas). The focus is more narrowly on astrophysical systems, where studies of collisionless plasmas very often use the fluid model which should theoretically not apply and yet are routinely employed. Recent kinetic simulations of black hole accretion flows make radiatively inefficient accretion flows an ideal starting point to investigate the possibility of using a modified fluids closure to model collisionless plasmas. If the fluid regime is found to be an appropriate model, then the door is opened for future work on global simulations and other weakly collisional plasmas. Study of these accretion flows is done through three-dimensional local shearing box magnetohydrodynamic simulations with anisotropic viscosity and a maximum pressure anisotropy, a choice motivated by the aforementioned kinetic simulations.