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ORIGINAL ARTICLE

Radiation spectrum of a magnetized supercritical accretion disc with thermal conduction

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Abstract we examine the effect of thermal conduction on the observational properties of a super critical hot magnetized flow. We obtained self-similar solution of a magnetized disc when the thermal conduction plays an important role. Follow of our first paper (Ghasemnezhad et al. in Astrophys. J. 750, 2012 (hereafter GKA12)) we have extended our solution on the observational appearance of the disc to show how physical condition such as thermal conduction, viscosity, and advection will change the observed luminosity of the disc, Continuous spectra and surface temperature of such discs was plotted. We apply the present model to black-hole X-ray binary LMC X-3 and narrow-line seyfert 1 galaxies, which are supposed to be under critical accretion rate. Our results show clearly that the surface temperature is strongly depends on the thermal conduction, the magnetic field and advection parameter. However we see that thermal conduction acts to oppose the temperature gradient as we expect and observed luminosity of the disc will reduce when thermal conduction is high. We have shown that in this model the spectra of critical accretion flows strongly depends on the inclination angle.

Keywords Accretion · Accretion flow · Thermal conduction

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1 Introduction

Accretion discs are found around several kind of astrophysical objects: from young stars (protoplanetary discs) to supermassive black holes in AGNs. The dynamics of these discs is however poorly understood. Accretion process is penetrated itself in various ways depending on that how angular momentum of the discs it carries away and how the its energy is dissipated. Such systems typically under the effect of several physical process. It is known that, on average, matter moves inward resulting in the accretion of material onto the central object and powers the most luminous objects in the universe by converting gravitational potential energy into highly energetic radiation. Accretion disc forms when gaseous matter, usually an assembly of free electrons and various types of ions, spirals onto a central gravitating body by gradually losing its initial angular momentum effectively in a timescales compatible with observations, as a result of viscous and magnetic stresses. The energy released by accretion discs depends on the mass accretion rate as well as spin and mass of central black hole. There is a maximum value for luminosity (Eddington luminosity) of accretion disc which gravity is able to exceed the outward pressure of radiation.

The theory of black hole accretion disc has been developed rapidly since 1970s and brings a lot of successes in describing high-energy astronomical phenomena (See for a review Kato et al. 2008). As for thermally stable black hole accretion disc models, there are only three classes have been developed. The fist one is the standard Shakura and Sunyaev disc, which is optically thick and geometrically thin, Keplerian rotation with very small infall velocity, and truncated at the marginally stable orbit. The standard disc was studied for the Newtonian case (e.g., Shakura and Sunyaev 1973) and for the relativistic case (e.g., Novikov and Thorne 1973).