



Iranian Journal of Physics Research, Vol. 25, No. 2, 2025
DOI: 10.47176/ijpr.25.2.01979

Radiative transfer in accretion discs with variable Eddington factor

F Habibi

University of Birjand-, Birjand-, Iran

E-mail: f_habibi@birjand.ac.ir

(Received 1 October 2024; in final form 6 March 2025)

Abstract

In this research, radiative transfer in the atmosphere of a geometrically thin disc with finite optical depth is investigated. Using the parallel plane approximation and neglecting the radial gradients, we consider the flow to be one-dimensional and along the z-axis. We also assume that in the presence of an internal heating source, the flow is in radiative equilibrium. Then, with the help of the Eddington approximation and using the variable Eddington factor that depends on the optical depth, we solve the radiative transfer equations analytically. The results show that the optical depth, mass heating and the total optical depth of the disc significantly affect the radiation quantities. In addition, we show that the emergent intensity for a disc with a total optical depth less than one decreases towards the pole and shows the effect of edge illumination. On the other hand, the emergent intensity of a disc with a total optical depth greater than one increases towards the pole and the effect of edge darkness is observed for them.

Keywords: Accretion disc, Radiative transfer, Optical depth, Methods: analytical

For full article, refer to the Persian section