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Relativistic radiation transfer for plane–parallel flows with the radiative equilibrium

F Habibi

Department of Physics, University of Birjand, Birjand, Iran

E-mail: f_habibi@birjand.ac.ir

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Abstract
In this research, we investigate the relativistic radiative transfer in the atmosphere of a geometrically thin disc with finite optical depth. Using the plane-parallel approximation, we consider the flow one-dimensional and along the z-axis. Under the assumption of a constant flow speed and using a variable Eddington factor, we analytically solved the relativistic transfer equations in a moving frame for the case of radiative equilibrium and in the presence of an internal heating source. Then, the analytical solutions were obtained for the emergent intensity as well as other radiative quantities. Our results show that the flow speed and the total optical depth of this disc significantly affect the radiation quantities. We also demonstrate that different quantities of radiation are a function of optical depth. However, the combined effects of speed, internal heating and total optical depth of the disc may changed the type of this dependence.

Keywords: accretion, accretion disc, radiative transfer, special relativity, optical depth

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