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TWO-TEMPERATURE ACCRETION FLOWS AROUND COMPACT OBJECTS

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Accretion mechanism is one of the most efficient processes by which gravitational potential energy of matter can be converted into energy. This phenomenon provides us with an explanation regarding the huge amount of energy liberated and high luminosities observed in AGN's, X-ray binaries, etc. Therefore, modelling these accretion flows are necessary to obtain a proper picture of the system and to understand the underlying physical processes. Since electrons are the ones that radiate via processes like synchrotron, bremsstrahlung and inverse-Compton scattering, therefore the electron gas and proton gas, present in the ionised plasma of the accretion disc, are supposed to settle down into two different temperature distributions; thus the name two-temperature modelling. We investigated these flows in greater details in the pure general-relativistic regime. The problem with two-temperature flow is that, there is one more unknown than the number of equations. Solving the equations of motion for a given set of constants of motion, we find that no unique solution exists, unlike in the case of one-temperature flows. In other words, the solutions are degenerate. So, we get different kinds of transonic solutions with drastically different topologies but for the same constants of motion. In addition, there is no known principle dictated by plasma physics that may constrain the relation between these two-temperatures in any of the boundaries. We removed the degeneracy with the help of second law of thermodynamics. We show that only one of the solutions among all has the maximum entropy and therefore is the correct solution, thus eliminating degeneracy. As far as we know, no methodology of obtaining unique transonic two-temperature solutions has been reported so far in the literature. This is the first time we have attempted towards getting the general picture of the physical solutions.

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