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Faraday rotation of plasmas in the vicinity of a Schwarzschild black hole[1] FELIPE ASENJO, Universidad Adolfo Ibanez, CHINMOY BHATTACHARJEE, SWADESH MAHAJAN, University of Texas at Austin — The propagation of an electromagnetic wave in a multi-specie plasmas (ion-electron and ion-electron-positron), embedded in the gravitational field of a Schwarzschild black hole, is investigated with particular emphasis on studying the Faraday rotation (rotation of the phase angle of the right and left-handed components of wave). In order to appropriately deal with the strong gravitational field (affecting the plasma in the proximity of the black hole horizon), we employ Rindler coordinates in the 3+1 decomposition of general relativity. The rather complex dispersion relation for high-frequency electromagnetic waves reveals the dependence of Faraday rotation on the number density of different constituents of the multi-specie plasma, the background magnetic field, and the mass of the black hole. Amongst other things, the expression for the Faraday rotation allows us to determine the black hole mass if the number density and magnetic field strength are estimated, and the rotation of the phase angle is measured. It is also shown how Faraday rotation could be harnessed to infer black hole features in a more complete theory that pertains, for example, to Kerr black holes. Different astrophysical implications are pointed out.

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