

Redshift of a photon emitted along the black hole horizon

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Abstract

© 2017, The Author(s). In this work we derive some general features of the redshift measured by radially moving observers in the black hole background. Let observer 1 cross the black hole horizon emitting a photon, while observer 2 crossing the same horizon later receives it. We show that if (i) the horizon is the outer one (event horizon) and (ii) it is nonextremal, the received frequency is redshifted. This generalizes recent results in the literature. For the inner horizon (like in the Reissner–Nordström metric) the frequency is blueshifted. If the horizon is extremal, the frequency does not change. We derive explicit formulas describing the frequency shift in generalized Kruskal- and Lemaitre-like coordinates.

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