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# The mathematical description of the influence of the expansion of the Universe on the metric of a black hole

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The existence of black holes has its analytical argumentation in Einstein's field equations. The first solution of general relativity that would characterize a black hole was found by Schwarzschild in 1916. Since then, these cosmic objects are being studied and investigated in their various variants: Scwartzshild, Kerr, Reissner-Nordström, Kerr-Newman, and others. The no-hair theorem states that a black hole has only three independent properties: mass, charge and angular momentum and is characterized by producing intense gravitational fields. On the other hand, the existence in the Universe of a dark material component of the repulsive type against the attractive action of gravitation can be represented by the quintessence. The effect of the quintessence surrounding the black hole is then introduced. Ordinarily, an additional element within the stress-energy-moment tensor of the Einstein field equations is introduced. The mathematical description of this problem is complicated, in general. In this investigation, we have chosen to use a variant in which the effect of the quintessence is introduced as a perturbative action in the metric of the ordinary black hole introducing the time-dependent scale factor. The Einstein field equations are obtained using the perturbed metric and the results obtained correspond to those obtained by the ordinary way.

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