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Testing alternative spacetimes by fitting both the hot-spot data of Sgr A*, and high-frequency quasi-periodic oscillations observed in AGNs and microquasars

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We explore the class of stationary, axisymmetric, and asymptotically flat spacetimes describing charged black holes in general relativity combined with nonlinear electrodynamics, or reflecting the influence of dark matter, or in so-called parameterized dirty Kerr spacetimes, and test them using the observational data of both hot-spot and the high-frequency quasi-periodic oscillations detected in active galactic nuclei and microquasars. We show that the orbital frequencies as well as positions of the hot-spots orbiting the considered black holes fit the observed positions and periods of the flare orbits, and give relevant constraints on the parameters of the considered black hole spacetimes and the gravity or other theories behind such modified spacetimes. We demonstrate which spacetimes provide the best fit for high-frequency quasi-periodic oscillation data and could be fruitful for future exploration.

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