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From black-bounce to traversable wormhole, and beyond

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A recently proposed interesting class of black hole mimickers are the so-called "black-bounce" spacetimes. In static spherical symmetry, a candidate spacetime was explored which neatly interpolates between a classical Schwarzschild black hole, a regular black hole, and a traversable wormhole depending on the value of an additional scalar metric parameter. Since this analysis, the discourse surrounding "black-bounce" spacetimes has been exported into many varied contexts, exploring qualitatively different physical and geometrical frameworks. These include spherical symmetry with dynamics, axisymmetry, models inspired by the Fan–Wang mass function, and finally the full family of charged rotating black-bounce spacetimes, analogous to the classical Kerr–Newman black holes. Beyond analysing the qualitative features of each of these candidate spacetimes and extracting astrophysical observables for observational astronomers, a new look at developing a minimally modified alternative theory of gravity where the black-bounce spacetimes are vacuum solutions is discussed.

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