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Spontaneous scalarisation of charged black holes

**Abstract**

Extended scalar-tensor-Gauss-Bonnet (eSTGB) gravity has been recently argued to exhibit spontaneous scalarisation of vacuum black holes (BHs). A similar phenomenon can be expected in a larger class of models, which includes Einstein-Maxwell-scalar (EMS) models, where spontaneous scalarisation of electrovacuum BHs should occur. EMS models have no higher curvature corrections, a technical simplification over eSTGB models that allows us to investigate BH scalarisation in a more systematic way. The corresponding BHs bifurcate from the RN BH trunk, forming an infinite (countable) number of branches, and possess a large freedom in their multipole structure. Unlike the case of electrovacuum, the EMS model admits static, asymptotically flat, regular on and outside the horizon BHs without spherical symmetry and even without any spatial isometries, which are thermodynamically preferred over the electrovacuum state.