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U(1) gauged boson stars and hairy Reissner-Nordström black holes

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We construct black holes in U(1) gauged scalar theories, minimally coupled to Einstein gravity in asymptotically flat space. Particular examples include non-linear O(3) sigma model, Einstein-Maxwell-Friedberg-Lee-Sirlin type model and in the Einstein-Maxwell-Skyrme theory. We analyze the properties of the hairy black holes and determine their domain of existence. Our discussion focuses mostly on the case of a long-ranged massless real scalar field. Our results indicate that, depending on the coupling constants, the resonant hairy dyonic black holes may bifurcate from Reissner-Nordström black holes at maximal chemical potential, while the limiting solutions at minimal chemical potential may be related to the Penney solution.

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