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Compact objects in and beyond the Standard Model.

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Compact objects are unique probes of the strong gravity regime and may be the key to understanding long-standing puzzles in fundamental physics. These include the nature of dark matter, the possible extension of Einstein's gravity, and the fate of spacetime singularities. The advent of gravitational-wave astronomy provides new observations with present and future interferometers and is a great opportunity to address such foundational issues. We consider a theory in which a real scalar field is Yukawa-coupled to a fermion and has a potential with two non-degenerate vacua. If the coupling is sufficiently strong, a collection of N fermions deforms the true vacuum state, creating energetically-favored false-vacuum pockets in which fermions are trapped. We embed this model within General Relativity and prove that it admits self-gravitating compact objects where the scalar field acquires a non-trivial profile due to non-perturbative effects. We discuss some applications of this general mechanism in and beyond the Standard Model.

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