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Vortex Stability in Ultralight Scalar Solitons

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Galaxies and their dark-matter haloes are commonly presupposed to spin. But it is an open question how this spin manifests in haloes and soliton cores made of scalar dark matter (SDM, including fuzzy/wave/ultralight-axion dark matter). One way spin could manifest in a necessarily irrotational SDM velocity field is with a vortex. But recent results have cast doubt on this scenario, finding that vortices are generally unstable except with substantial repulsive self-interaction. We introduce an alternative route to stability: in both (non-relativistic) analytic calculations and simulations, a black hole or other central mass at least as massive as a soliton can stabilize a vortex within it. This conclusion may also apply to stellar-scale Bose stars.

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