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Chiral Edge Modes in Helmholtz-Onsager Vortex Systems
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Vortices play a fundamental role in the physics of 2 dimensional (2d) fluids across a range of length scales, from quantum superfluids to geophysical flows. Despite a history dating back to Helmholtz, the study of point vortices in a classical 2d fluid continues to present challenges, owing to its unusual statistical mechanics. Here we show that these Helmholtz-Onsager systems contain edge modes at subcritical temperatures, extending a previously identified analogy between vortex matter and quantum hall systems. Through numerical simulations and mean field models, we demonstrate that angular momentum conservation in a disk leads to a symmetry protected edge mode. These edge modes are robust, persisting in nonconvex domains. Furthermore, using analytics and numerical simulations, we exhibit a subcritical phase separation associated with edge modes in neutral Helmholtz-Onsager systems.

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