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Edge states in confined active fluids ANTON SOUSLOV, VINCENZO VITELLI, Leiden University — Recently, topologically protected edge modes have been proposed and realized in both mechanical and acoustic metamaterials. In one class of such metamaterials, Time-Reversal Symmetry is broken, and, to achieve this TRS breaking in mechanical and acoustic systems, an external energy input must be used. For example, motors provide a driving force that uses energy and, thus, explicitly break TRS. As a result, motors have been used as an essential component in the design of topological metamaterials. By contrast, we explore the design of topological metamaterials that use a class of far-from-equilibrium liquids, called polar active liquids, that spontaneously break TRS. We thus envision the confinement of a polar active liquid to a prescribed geometry in order to realize topological order with broken time-reversal symmetry. We address the design of the requisite geometries, for example a regular honeycomb lattice composed of annular channels, in which the active liquid may be confined. We also consider the physical character of the active liquid that, when introduced into the prescribed geometry, will spontaneously form the flow pattern of a metamaterial with topologically protected edge states. Finally, we comment on potential experimental realizations of such metamaterials.

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