Odd viscosity in chiral active liquids

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Abstract

Chiral active liquids, composed of self-rotating interacting units, are fluids that break both time reversal symmetry and parity. As a con- sequence, their viscous stress acquires an additional contribution called odd-viscosity (originally discovered in quantum Hall fluids) that is pro- portional to the angular momentum density. We construct a non-linear hydrodynamic theory of chiral active fluids, which captures previously neglected odd viscosity contributions. In the incompressible limit, the effect of odd viscosity is to modify the boundary pressure by an ad- ditional term proportional to the local vorticity. In the bulk, the odd viscosity affects the response of compressible chiral active fluids by gen- erating transverse currents (with respects to applied pressure) in Burgers shocks.

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