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Nonlinear, driven-dissipative hydrodynamics and effective chiral description of an exciton-polariton superfluid MANAS KULKARNI, GERMAN KOLMAKOV, New York City College of Technology, City University of New York — Given recent remarkable experimental success on capturing hydrodynamic features of exciton-polariton condensates in optical microcavities and their potential implications for quantum and optical computing and information technologies, we present an effective chiral description for such systems. This description captures the fingerprints of hydrodynamics, namely, nonlinearity, dispersion and dissipation in the exciton-polariton system. The resulting chiral equation for the condensate perturbation wave dynamics is found to be of Burgers-type thereby providing a more transparent understanding of the complicated underlying coupled exciton-photon dynamics. By using analytical calculations and numerical simulations, we describe the phenomenon of polariton shock waves, solitons and defects in such systems. Our mapping is expected to have broad implications for other polariton and photon systems including dipolar exciton and magnon condensates. This mapping can further help one in engineering a delicate balance between the pump and damping to produce stable optical signals propagating in polariton circuits.

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