Analogue physics with exciton-polaritons

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Exciton-polaritons are a versatile solid-state platform providing large opportunities for simulating various physical phenomena. These quasiparticles appear from the strong coupling of excitons and photons in microcavities [1]. The excitonic part provides strong non-linear interaction and thermalization, whereas the photonic part brings a small effective mass and a possibility to create complicated potentials. Quantum fluids of exciton-polaritons [2] are routinely created either by condensation with a reservoir or by direct optical injection by a coherent laser. Such fluids extend the possibilities of studying analogue effects.

The analogue physics in polariton condensates has been developing in several directions. Effective magnetic monopoles have been predicted and observed experimentally [3,4]. Analogue black holes and wormholes were predicted [5], and crucial steps towards their observation have been taken [6]. Topological insulators for polaritons can be seen as analogs of solid-state systems [7] or as a base for optical devices [8]. An array of polariton condensates allows to simulate the XY model [9]. Finally, the analog of the formation of topological defects in the primordial Universe via the Kibble-Zurek mechanism can be studied in a zigzag chain of pillar microcavities [10].

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