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Towards exotic gravitational analogue in quantum fluids of light

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Exciton-polaritons in semiconductor microcavities can be understood essentially as interacting photons that are confined into a bidimensional degree of freedom. Collectively, polaritons behave as a quantum fluid, with its typical features such as a superfluid state with sonic excitations. As such, and considering their photonic character, polaritons offer an exciting platform to simulate the physics of gravitational structures, such as black holes.

In this context, the main peculiarity of polariton fluids, i.e. their its driven-dissipative character, offers original physical situations and resources that are not readily available in equilibrium system. I will illustrate this idea with a few recent experimental investigations. I will show for instance that a polaritonic black hole, featuring a maximal surface gravity, can be engineered by exploiting their hysteretic dynamics. I will also present preliminary results towards the realization of a quantum fluid of polaritons in the analogue of the relativistic regime, i.e. in which the free particle effective mass $m_{\text{eff}}c^2$ in the condensate is comparable or smaller than the interaction energy gn.

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