SOLITON PATTERNS AND STATIONARY ARRAYS OF VORTEX STREETS IN A 2D POLARITON SUPERFLUID

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The quantum fluids of light [1] are a wide family of systems where an effective photon-photon interaction can be engineered, resulting in collective hydrodynamic effects. Exciton-PoIaritons in semiconductor microcavities are a paradigmatic example of this behaviour.
In this work, we show how, in a resonantly driven 2D polariton superfluid, the combination of the bistability behaviour of the system with flexible all-optical methods allows to shape the potential polariton landscape and to control the formation and the propagation of a new class of dark solitons. Due to the onset of the snake instabilities these topological defects evolve in stationary symmetric or anti-symmetric arrays of vortex streets, straightforwardly observable in CW experiments [2]. The flexibility of this photonic platform allows implementing more complicated potentials such as maze-like channels, with the vortex streets connecting the entrances and thus solving the maze. These results open the way to the study of quantum turbulence.

References

[1] I. Carusotto and C. Ciuti, Quantum Fluids of Light, Rev. Mod. Phys. 85, 299 (2013)
[2] S. V. Koniakhin et al., arXiv: 1905.04063v1