Soliton patterns and stationary arrays of vortex streets in a 2D polariton superfluid

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Quantum fluids of light are systems in which the engineering of an effective photon-photon interactions gives rise to collective hydrodynamic effects. The excitons-polaritons in semiconductor microcavities exhibit such behaviors and their dissipative nature combined with their non-linear dynamics have allowed the observation of superfluidity [1] and the hydrodynamic generation of topological excitations like vortex-antivortex pairs and dark solitons [2, 3].

Thanks to the photonic component and the bistable dynamics of polaritons, the Quantum Fluids of Light Team has managed to develop purely optical methods making possible the on-demand generation and the controlled study of solitons over macroscopic distances through resonantly driven 2D polariton superfluid [4].

Inspired by a recent theoretical paper [5], the experimentally shaping with a Spatial Light Modulator of low-density corridors between high-density walls in the fluid has provided a means of observing the decay of soliton pairs into a stationary vortex street due to the snake-instabilities. This all-optical flexible approach can be used then to solve analog mazes with solitons in a given instability regime.

References

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