OPTICAL VORTEX CORE SWITCHING IN POLARITON CONDENSATES

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Vortices are topological objects carrying quantized orbital angular momentum, also known as topological charge, and have been widely studied in many physical systems. In those with spin degree of freedom the elementary excitations are so called half-vortices (HVs), referring to a vortex state carrying a topological charge in only one circular polarization component of a spinor system. We demonstrate the spontaneous formation of localized half-vortices in spinor polariton condensates, non-resonantly excited by a linearly polarized ring-shaped pump [1,2]. In the core region of the half-vortex the condensate is circularly polarized, while it is linearly polarized elsewhere. With TE-TM splitting, the pseudospin structure of the condensate gives rise to solutions with broken cylindrical symmetry. The attractive cross-interaction between different spin components can be used to realize optical vortex core switching between left- and right-circularly polarized HV states [1]. This switching process (Fig. 1) results in the reversal of the circular polarization state in the HV core. It can be easily detected by measuring the polarization resolved intensity in the vortex core region, and the same method can also be applied to higher order states.

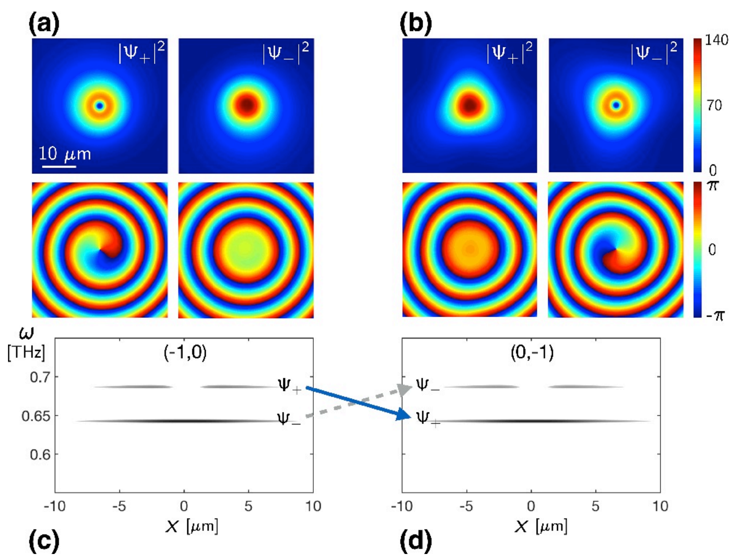

Fig. 1 (a,b) Densities and phase profiles of the initial and final states in the two circular polarization components Ψ+ and Ψ−. (c,d) Corresponding condensate spectra in real space. The grey dashed arrow represents imprinting of a vortex state in the Ψ− component due to the resonant control beam, while the blue arrow shows the simultaneous transition into the ground state (non-vortex) of the Ψ+ component, induced by the attractive cross-interaction leading to a redshift.

References

[1] M. Pukrop, S. Schumacher, and X. Ma, arXiv:1907.10974, 2019.

[2] X. Ma and S. Schumacher, *Physical Review Letters*, 2018, **121**, 227404.