Switching the topological charge of exciton polariton vortices

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Vortices are elementary excitations arising in exciton polariton condensates [1] and consist of a 2π·m radial phase shift of the polariton wavefunction, where m is the topological charge of the vortex. This topological charge translates into the orbital angular momentum (OAM) state of the emitted light field and can be detected by application of a dedicated OAM spectroscopy technique [2]. This technique gives us the opportunity to study the temporal dynamics of vortices in exciton polariton condensates without using complex interferometric techniques that also always require a phase reference. Here, we experimentally demonstrate the switching of the topological charge of a vortex due to a pulsed perturbation [3].
First, we create a stable localized m=+1 vortex inside an annular trap created all-optically by a CW laser. Then an additional non-resonant pulsed laser is switched on in addition to create a potential barrier, which interacts with the polariton vortex and may reverse its direction of rotation. Depending on the pumping power of the pulsed laser a switching to the m=-1 state is observed. This effect is shown in Fig. 1.

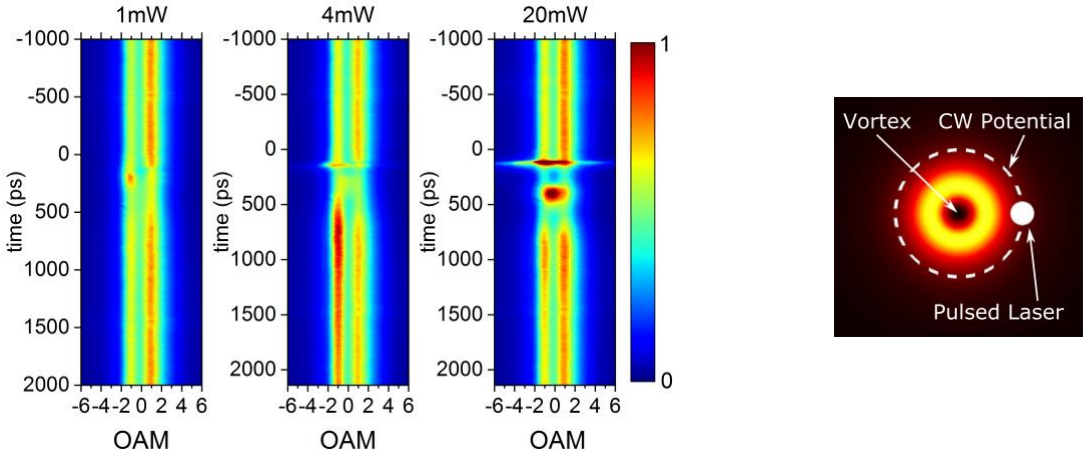

Fig. 1. Left: Vortex switching in dependence of the excitation power of the pulsed perturbation. Right: Experimental geometry.

References

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