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Spin textures and gates in quasi-one-dimensional polariton condensates

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We report on the realization of a novel spin-selective spatial filter mediated by propagating Bose-Einstein exciton-polariton condensates in a quasi-1D semiconductor microcavity [1]. The switch is achieved using a controllable spin-dependent gating barrier: a non-resonant laser beam provides the source of propagating polaritons, while a second circularly polarized weak beam imprints a spin dependent potential barrier, which gates the polariton flow and generates polariton spin currents. A complete spin-based control over the blocked and transmitted polaritons is obtained by varying the gate polarization.

Furthermore, the discretization in energy of the lower polariton branch in our structure has notable consequences in the coherent transport of the spin vector. The confinement renders a TE-TM mode splitting, which remains for zero in-plane wave vector, and it acquires larger values than the TE-TM splitting in two-dimensional (2D) microcavities. A spectral analysis of the spin transport reveals different polariton spin textures from those observed in 2D systems [2]. The richness of these textures is related to the energy-dependent speed of propagation of polaritons in our system with lowered dimensionality. The ballistic propagation of spin-polarized polaritons along the ridge is observed over distances of ~100 μm [3].

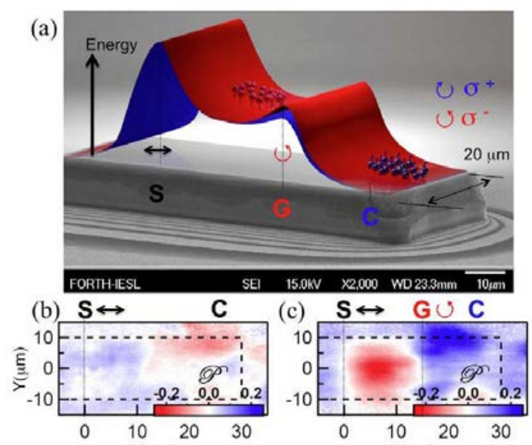

Fig. 1. (a) A schematic of the spin filter with the red and blue slopes depicting the energy landscape for σ^+ and σ^- polaritons for a σ^- (↺) gate (G). The source beam (S) has linear polarization. The degree of circular polarization, $\wp$, in real space (b) without and (c) with G present where the black dashed line shows the region of interest of the ridge.

References:

[1] T. Gao, *et al.*, Appl. Phys. Lett. **107**, 011106 (2015).
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