Metasurface-based hybrid optical cavities for chiral sensing

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Quantum metasurfaces, i.e., two-dimensional subwavelength arrays of quantum emitters, can be employed as mirrors towards the design of hybrid cavities, where the optical response is given by the interplay of a cavity-confined field and the surface modes supported by the arrays [1]. We show that, under external magnetic field control, stacked layers of quantum metasurfaces can serve as helicity-preserving cavities. These structures exhibit ultranarrow resonances and can enhance the intensity of the incoming field by orders of magnitude, while simultaneously preserving the handedness of the field circulating inside the resonator, as opposed to conventional cavities. The rapid phase shift in the cavity transmission around the resonance can be exploited for the sensitive detection of chiral scatterers passing through the cavity. We discuss possible applications of these resonators as sensors for the discrimination of chiral molecules. [2]

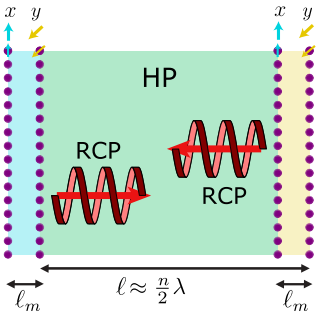

Fig. 1: Sketch of the cavity set-up for a helicity-preserving cavity which may be used to facilitate chiral sensing.

References

[1] N. S. Baßler, M. Reitz, K. P. Schmidt, and C. Genes, Linear optical elements based on cooperative subwavelength emitter arrays, Opt. Express 31, 6003 (2023).

[2] N. S. Bassler, A. Aiello, K. P. Schmidt, C. Genes, and M. Reitz, Metasurface-Based hybrid pptical cavities for chiral sensing [arxiv:2306.00568]

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