# Measurement of the Quantum Geometric Tensor in a Plasmonic Lattice

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Topologically protected modes in the field of Photonics enable fundamentally new types of optical applications which circumvent fabrication defects and may feature unidirectional propagation, in diverse platforms such as arrays of helical waveguides [1] and photonic crystals [2]. An important tool in the description of these topological systems is the quantum geometric tensor (QGT) which contains the quantum metric as the real part and the Berry curvature as the imaginary part. The QGT characterizes the Hamiltonian eigenstate structure, and it is crucially connected to an increasing number of topology-related phenomena, including superfluidity in flat bands [3].

Measurements of the QGT have been performed in several systems such as microcavities [4] or nitrogen-vacancy centers in diamond [5]. Plasmonic lattices also represent an attractive platform for topological studies as they support protected bound states in continuum [6] and polarization textures [7]. They sustain electromagnetic modes called surface lattice resonances (SLRs) that emerge from the long-range radiative interactions provided by the diffraction orders of the lattice, which mediate between the localized resonances of individual nanoparticles. The description of SLRs goes well beyond tight binding approximations, opening an intriguing new regime for studies on topological photonics.

Here we present measurements of the QGT in a plasmonic lattice, showing novel non-trivial topological features that result from time-reversal symmetry breaking. We confirm these results with extensive numerical simulations and a simplified lattice model, concluding that the observed effects emerge from the interplay of polarization-dependent properties of SLR bands and the unique mode structure ruled by long-range radiative interactions [8]. Owing to the ease of nanofabrication and flexible design of plasmonic lattices, we expect these phenomena to extend to multiple lattice geometries, exotic particle shapes and arrangements, and magnetic materials.

## References

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