Electrically contacted bullseye resonators for efficient telecom-band quantum light generation

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InAs quantum dots (QDs) are a leading platform for quantum networks, offering on-demand photon emission, excellent quantum-optical properties, and a natural interface between stationary and flying qubits, including spin–photon entanglement at telecom wavelengths [1]. Embedding InAs QDs in bullseye resonators has enabled bright, fiber-compatible sources in the telecom bands, but further progress toward scalable multiphoton protocols [2] requires electrical control for Stark tuning, deterministic charging, and improved coherence [3].

We introduce a new device platform that integrates telecom-wavelength QDs with electrically contacted resonators incorporating hole-grating structures [4]. These gratings support efficient charge carrier transport while preserving the performance of bullseye cavities. We demonstrate bright, Purcell-enhanced single-photon emission in the telecom C-band under above-band and phonon-assisted excitation. We also present electrically contacted devices in the telecom O-band, showing controlled Stark tuning of individual QD transitions. Together, these results represent key steps toward scalable, tunable, and electrically controlled quantum light sources suitable for integrated quantum-photonic applications.

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