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A photonic platform hosting telecom photon emitters in silicon

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Silicon, a ubiquitous material in modern computing, is an emerging platform for realizing a source of indistinguishable single-photons on demand. The integration of recently discovered single-photon emitters in silicon into photonic structures is advantageous to exploit their full potential for integrated photonic quantum technologies [1] [2]. Here, we show the integration of telecom photon emitters in a photonic platform consisting of silicon nanopillars. We developed a CMOS-compatible nanofabrication method, enabling the production of thousands of individual nanopillars per square millimetre with state-of-the-art photonic-circuit pitch, all the while being free of fabrication-related radiation damage defects. We found a waveguiding effect of the 1278 nm G-center emission along individual pillars accompanied by improved brightness, photoluminescence signal-to-noise ratio and photon extraction efficiency compared to that of bulk silicon. These results unlock clear pathways to monolithically integrating single-photon emitters into a photonic platform at a scale that matches the required pitch of quantum photonic circuits.
[1] Hollenbach M., Berencén Y. et al. "Engineering telecom single-photon emitters in silicon for scalable quantum photonics", Opt. Express 28, 26111-26121 (2020)
[2] Redjem W., Durand, A., Herzig, T. et al. "Single artificial atoms in silicon emitting at telecom wavelengths", Nat. Electronics 3, 738–743 (2020)

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