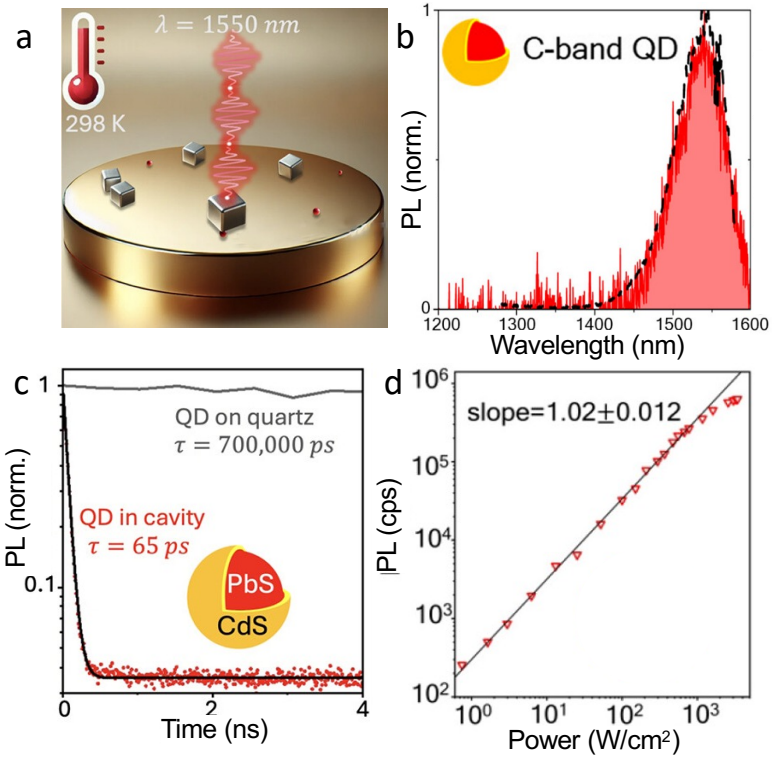
Solution-Processed Ultrafast, Room-Temperature Single-Photon Source at 1550 nm



(a) Solution-processed room-T C-band SPS. (b) PL spectrum of a single cavity-coupled QD. (c) Fast PL decay only in cavity. (d) 1550 nm SPS power-dependent counts-per-second (cps) (uncorrected)

Scientific Achievement

Created fastest (12.6 MHz) C-band room-temperature deterministic single-photon source (SPS) by integrating PbS/CdS quantum dot (QD) and plasmonic nanogap antenna

Significance and Impact

Addressed key limitations of telecom SPSs toward new quantum technologies: instability, need for cryogenic operation, or long radiative lifetimes that limit brightness and speed.

Research Details

- Fabricated ensemble and single cavity-coupled QDs.
- Studied effects of excitation and emission enhancement on photoluminescence (PL) revealing extreme Purcell enhancement factors to 10,700 and ultrafast PL lifetimes (to 65 ps).

Zhang, S.; Traverso, A. J.; Dolgopolova, E. A.; Singh, A.; Kishida, H.; Livshits, M. Y.; Sheehan, C. J.; Bowes, E. G.; Li, C.; Hollingsworth, J. A.; Mikkelsen, M. H. Solution-Processed Ultrafast, Room-Temperature Single-Photon Source at 1550 Nm. ACS Nano 2025.

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