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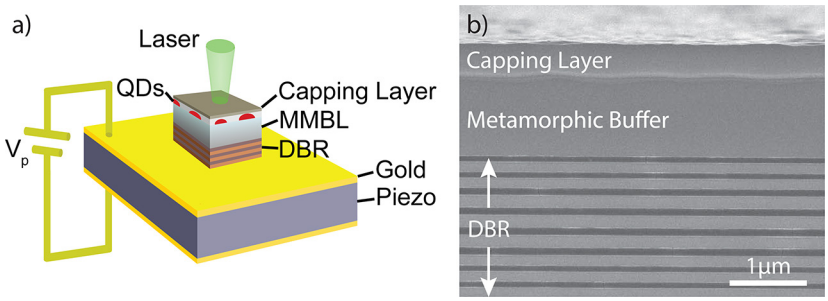
A stable, wavelength-tunable source of single photons brings researchers closer to realizing a quantum network.



In future quantum networks, single photons will transmit quantum information in the form of qubits between physically separate quantum computers. This means that fiber-based, long-range quantum communication requires an on-demand source of single photons at telecom wavelengths. These photons need to be tunable so they can spectrally overlap with remote sources of quantum network providers, and operate a quantum repeater — a device that store qubits and can be entangled through photon emission — to overcome transmission losses. But devising a source of single photons with the desired wavelength tunability has proven difficult, especially in telecom's so-called C-Band of emission wavelengths.

Currently, the most promising source of single photons are quantum dots, which reliably emit single photons and pairs of entangled photons. In *Applied Physics Letters*, researchers present the first wavelength-tunable source of single photons compatible with the global network of optical fibers. They reversibly tuned the wavelength over a range of 0.25 nanometers using piezoelectric strain tuning, which corresponded to 0.28 picometers per 1 volt of the piezoelectric driver, making it possible to tune photon emission with very high precision. The device also demonstrates unprecedented wavelength stability over several hours.

The researchers grew their quantum dots on GaAs wafers using a metamorphic buffer, creating samples with the desired nanostructures (InAs/GaAs quantum dots) to then integrate onto a piezoelectric substrate. They mechanically thinned samples with a diamond-based abrasive to increase the tuning range. The voltage-dependent strain provided by the piezo actuator altered the quantum dots' electronic structure, enabling the wavelength tunability of the single photon emitters.

This new tuning technique is easy to implement according to co-authors Katharina Zeuner and Klaus Jöns. They envision it helping to build a quantum network consisting of remote single photon sources that are tuned into resonance, and so able to perform entanglement swapping. This device brings the researchers closer to their larger goal of making a quantum repeater and realizing a quantum network.

Source: "A stable wavelength-tunable triggered source of single photons and cascaded photon pairs at the telecom C-band," by Katharina D. Zeuner, Matthias Paul, Thomas Lettner, Carl Reuterskiöld Hedlund, Lucas Schweickert, Stephan Steinhauer, Lily Yang, Julien Zichi, Mattias Hammar, Klaus D. Jöns, and Val Zwiller, *Applied Physics Letters* (2018). The article can be accessed at https://doi.org/10.1063/1.5021483.