Researchers change the color and shape of a single photon

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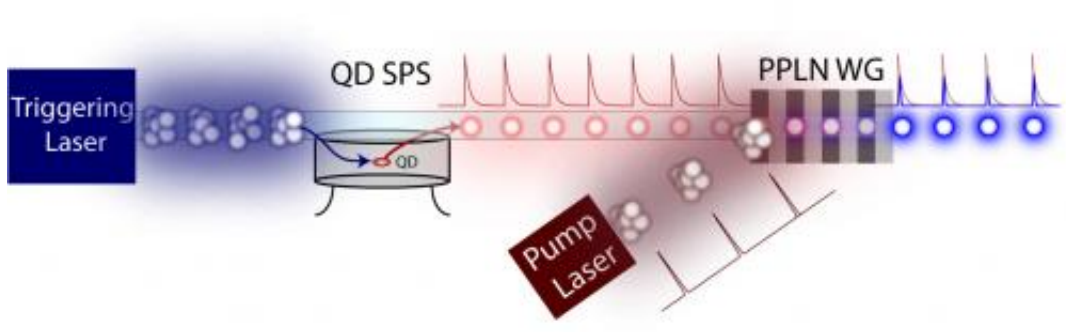

The color and shape of single photons produced by a quantum dot single photon source (QD SPS) are changed by combining them with a strong, pulsed pump laser in a nonlinear crystal (PPLN WG).

(PhysOrg.com) -- A team of researchers from the CNST and ITL has simultaneously changed the color and shape of a single photon, the smallest unit of light.

The work, reported in the August 19 issue of *Physical Review Letters*, represents an important step towards implementing communication over long distances with privacy secured by the laws of quantum physics.

Using a specially designed optical fiber probe, a single photon at a telecommunications wavelength was extracted from a quantum dot, a semiconductor analog of an atom, that was engineered to emit photons

one at a time.

Each photon was then combined with a much stronger pulsed laser beam inside a nonlinear optical crystal that enables the two light beams to interact efficiently.

After exiting the crystal, the wavelength, or color, of the photon is shifted by almost 600 nm, an amount greater than the size of the entire visible spectrum.

Because the researchers use a pulsed laser, its temporal shape becomes imprinted on the single photon during the color-conversion process.

Researchers utilizing different quantum technologies, which often require single photons of a specific wavelength and shape, may be able to use this approach to link their previously incompatible systems together in a large-scale network for quantum information processing applications.

More information: Simultaneous wavelength translation and amplitude modulation of single photons from a quantum dot, M. T. Rakher, L. Ma, M. Davanço, O. Slattery, X. Tang, and K. Srinivasan, *Physical Review Letters* 107, 083602 (2011).

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