Resonant Cavity Emitter That Reliably Emits at Telecommunications Wavelengths

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Improvements in emitter wavelengths range in long-distance optical fiber transmission: The ability to control photons is central to further developments in quantum computing, lasers, and telecommunications. Sources that emit a single photon per pulse would be useful for experiments and could be used to distribute quantum keys. Currently, the ability to produce single photons at room temperature with wavelengths within a predefined range is severely limited.

Emitters to generate photons with telecommunications wavelengths: This technology describes a number of ways to couple resonant cavities with emitters to controllably produce photons with telecommunications wavelengths. The resonant cavities are constructed out of photonic crystals, which can produce photons with very specific wavelengths. The photonic crystals are periodic arrays of materials with different dielectric constants and can for example consist of air cylinder-shaped holes in a thin layer of silicon. By varying the dimensions and geometries of the air cylinders, one gains fine control over the crystals’ photonic band structures within photonic crystals. The emitters consist of quantum dots that can be tuned to emit at the same frequencies at which light is produced by the carefully-constructed cavities. Resonant cavity emitters are produced by growing or situating the emitters within cavities matching their emission wavelength.

Applications:
• Can produce wavelengths within the predefined telecommunications range for long-distance optical fiber transmission of single photons
• May be used as a single-photon source
• May provide a means of quantum key distribution
• May be used as a quantum repeater
• May be used in bosonic exciton lasers

Advantages:
• Works at room temperature
• Operates in the near-infrared
• Details a number of possible cavity-emitter combinations, allowing great flexibility in device design


Licensing Status: Available for Licensing and Sponsored Research Support

Publications: R. Bose, X. Yang, R. Chatterjee, J. Gao, and C. W. Wong, Weak coupling interactions of colloidal lead sulphide nanocrystals with silicon photonic crystal nanocavities near 1.55 um at room temperature, Appl.
Inventors

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