Frequency-encoded linear cluster states with coherent Raman photons.

Dale Scerri
School of Engineering and physical Sciences, Heriot-Watt University, Edinburgh, EH14 4AS, United Kingdom

Short abstract:
Solid-state emitters can mediate interactions between subsequently emitted photons via their spin, thus offering a route towards generating entangled multi photon states. We here propose a novel approach of employing spin-flip Raman scattering events of self-assembled quantum dots to generate highly entangled photonic linear cluster states.

Detailed abstract:
Entangled multi-qubit states are an essential resource for quantum information and computation. Solid-state emitters can mediate interactions between subsequently emitted photons via their spin, thus offering a route towards generating entangled multi-photon states. However, existing schemes typically rely on the excitation-relaxation of the emitter, resulting in incoherently emitted single photons and suffer from severe practical limitations, for self-assembled quantum dots most notably the limited spin coherence time due to Overhauser magnetic field fluctuations. We here propose an alternative approach based on a spin-Λ system that overcomes the limitations of previous proposals. Studying the example of spin-flip Raman scattering of self-assembled quantum dots in Voigt geometry, we argue that weakly driven hole spins constitute a promising platform for the practical generation of frequency-entangled photonic cluster states.