WWU MÜNSTER

Aktuelle Fragen der Nanophysik

Mittwoch, 15.02.2023 um 10:15 Uhr
R718, Wilhelm-Klemm-Str. 10

Red-detuned Excitation of a Quantum Dot

© Florian Kappe

Florian Kappe

Institut für Experimentalphysik; AG Photonik
Universität Innsbruck, Austria

The future of photonic quantum technologies relies on bright, photostable, and on-demand sources of single and indistinguishable photons. In the search for such perfect quantum light sources, semiconductor quantum dots have emerged as a promising platform with excellent performance characteristics. Quantum dots benefit from their excellent photostability, near Fourierlimited emission linewidth, and growth technologies that allow easy integration into nanoscale devices. To operate as an on-demand single-photon source, the quantum dot has to be prepared in its exciton state, which recombines to emit a single photon. Several resonant or near resonant excitation schemes like Rabi rotations, ARP, dichromatic excitation, and phonon-assisted excitation have been developed to this end. In this work, we use two red-detuned pulses in the recently proposed swing-up of quantum emitter population (SUPER) scheme to excite a quantum dot. It is rather surprising that this is possible at all, because neither of the two pulses alone will yield a significant exciton occupation. The experiment relies on a beautifully simple pulse shaping technique utilizing a spatial light modulator (SLM), giving full control over the excitation spectrum. We demonstrate that, under optimized detuning and intensity, a red detuned pulse pair can populate the exciton state in a quantum dot via the coherent coupling of the said two laser fields relying on swing up mechanism.

Ref: Nano Letters 2022 22 (16), 6567-6572
https://pubs.acs.org/doi/full/10.1021/acs.nanolett.2c01783