Quasi-resonant p-shell excitation of a telecom range InAs quantum dot

G. Peniakov [1], J. Michl [1], M. Helal [1], R. Joos [2], P. Michler [2], T. Huber-Loyola [1] and S. Höfling [1]

[1] *Julius-Maximilians-Universität Würzburg, Physikalisches Institut, Lehrstuhl für Technische Physik, Am Hubland, 97074 Würzburg, Deutschland*
[2] *Institut für Halbleiteroptik und Funktionelle Grenzflächen, Center for Integrated Quantum Science and Technology (IQST) and Research Center SCoPE, Universität Stuttgart, Allmandring 3, 70569 Stuttgart, Germany*

The study of various quantum dot excitation schemes is continuing to be a live and active research area: high fidelity and coherent excitation of quantum dots is key to using them as photon emitters capable of entangling pairs and strings of photons [1].
In this work, we present a spectroscopic study of an InAs quantum dot on a GaAs platform with a thin InGaAs metamorphic buffer layer emitting at the telecom wavelength range [2]. We use power series, polarization-resolved- and magneto-photoluminescence to identify the excitonic complexes responsible for the observed spectrum. We present polarization-sensitive photoluminescence-excitation (PLE) scans revealing an excited energy-level structure, yet to be fully interpreted (Fig. 1). We found that: (i) these scans are drastically sensitive to the application of additional above-bandgap laser at 1064 nm, and (ii) the quasi resonances show a diagonal-in-energy pattern, yet to be fully understood. Finally, we used the found quasi-resonances to excite the associated optical transitions and measure a lifetime of around 1 ns, and $g^{(2)}(\tau)$ correlations with <0.1 multi-photon probability.

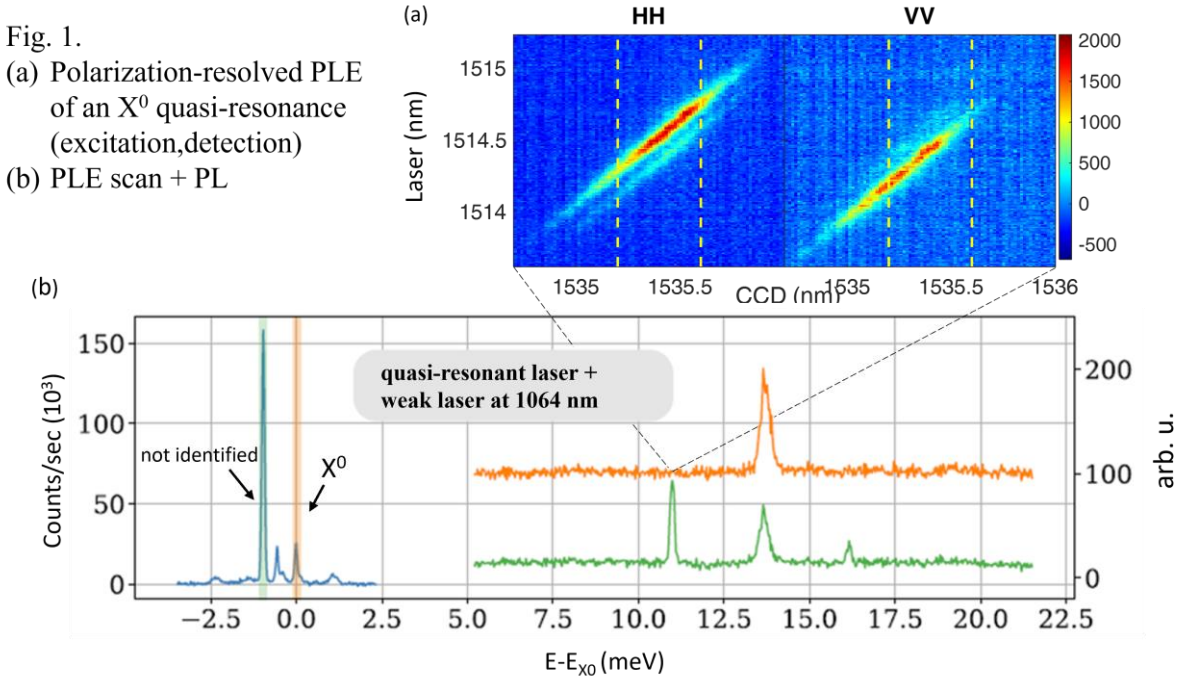

Fig. 1.
(a) Polarization-resolved PLE of an X^0 quasi-resonance (excitation,detection)
(b) PLE scan + PL

[1] I. Schwartz et. al., Science **354**, 434–437, (2016).
[2] R. Sitting et. al., Nanophotonics **11(6)**, 1109-1116 (2022).
[3] P. Podemski et. al., Journal of Luminescence **212**, 300-305 (2019).