Quantum Dot Single-Photon Generation

Picosecond Laser for Ultimate Control of the Emission Process of Quantum Dots

picoEmerald & pulseSlicer: Ultimate control of the emission process of quantum dots with a pulsed picosecond laser

Two key elements are required to realize a quantum dot single-photon source: a quantum dot emitter and appropriate control of the emission process.

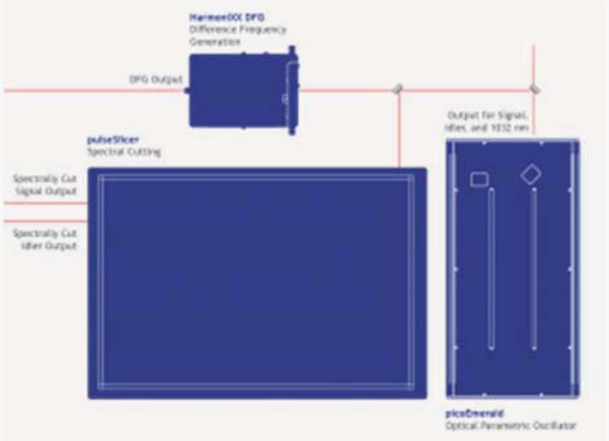
Controlled single-photon generation “on demand”, i.e. by means of a trigger event, can be achieved by pulsed excitation of the single photon emitter. Picosecond (ps) lasers are particularly suitable for the pulsed excitation of quantum dots. Compared to femtosecond sourches, picosecond lasers are particularly narrow-band. They therefore enable resonant excitation of the QD emitter with very high efficiency and without disturbing background emissions.

The optimum degree of narrowness to achieve resonant excitation conditions depends on the properties of the individual quantum dot emitter system. And obviously, the resonant excitation of the QD system also depends on the center wavelength of the pulsed light source. Therefore, it can be seen as an advantage to use a pulsed and wavelength-tunable ps-source whose degree of narrowness is adjustable.

The combination of the tunable ps laser picoEmerald and the spectrum slicer (laser monochomator) pulseSlicer from APE offers this possibility and supports its customers in the field of quantum research.

Key Features

- Small bandwidths because resonances in the sample are close to each other (selectivity)
- Wavelength tunability of the picosecond laser to respond to different resonances
- Wavelength tunability for spectroscopy (different resonances are addressed)
- Two colors simultaniously available, overlapping in space and time
- Variable bandwidths to optimally address resonances of different widths (realization with pulseSlicer)
- High repetition rate for small time constants, since the relatively weak single-photon signals have to be accumulated over a large number of measurements
- High spectral power density (= small bandwidth) given by picosecond laser excitation
- picoEmerald offers larger tuning range compared to Ti:Sa (1500 nm is not available with TiSa); a Ti:Sa in combination with an OPO would be possible, but the power density would be very low
- Further wavelength tunability into the mid-infrared with the DFG from APE
- Additional automation of the bandwidth (via the pulseSlicer) in combination with the picoEmerald



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