

# Charged exciton confined in an InGaAs/GaAs quantum rod as a single photon emitter at liquid nitrogen temperature

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The rapidly evolving field of optical quantum communication requires utilization of efficient sources of single photons (SPS). A possible realization of such emitter in a solid-state-system, integrable with today's complex electronic and photonic schemes, is based on a single semiconductor quantum dot (QD). Most of the implemented SPSs are based on the QD ground state neutral exciton, whose maximum achievable emission rate is limited by dark states existing along with bright states. Therefore, the charged exciton is potentially more interesting as an emitting complex, since it enables to achieve higher generation rates in respect to neutral exciton [1]. Nevertheless, deterioration of the emission efficiency due to enhanced non-radiative processes with increasing emitter temperature still prevents practical implementation of the SPS at ambient temperatures when based on some of the easily integrable III-V material systems, in spite of their very mature fabrication technology.

Epitaxially-grown single (In,Ga)As/GaAs quantum rods have been investigated in the respect. Identification of the charged exciton complex has been performed by  $\mu$ PL studies in magnetic field. The registered set of optical transitions (cross-linearly polarized pairs of doublets) corresponds perfectly to the spin-dependent optical selection rules for the trion state under the magnetic field in the Voigt geometry.

In order to evaluate the non-classicality of the emitter auto-correlation statistics of the emission process has been registered. In the entire temperature range clear antibunching dip of the auto-correlation function at zero delay times has been recorded with the as-measured  $g^{(2)}(0)$  values equal to 0.32 and 0.46 at temperatures of 10 and 80 K, respectively. After including the PL background counts correction, these values could be further reduced down to 0.26 and 0.29, respectively.

Our experimental findings allow for predictions that such GaAs-based quantum rod structures are prospective for efficient single photon sources operating above the cryogenic temperatures.

[1] S. Strauf, N.G. Stoltz, M.T. Rakher, L.A. Coldren, P.M. Petroff, and D. Bouwmeester, Nat. Photonics **1**, 704 (2007).