TRR 142
Tailored Nonlinear Photonics

TRR Guest Scientist Lecture / Seminar

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Overcoming inhomogeneous broadening of III-Nitrides non-classical light sources in nano-pyramid apex quantum-dots

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Abstract:

The feasibility of generating non-classical lights with unity degree of linear polarization operating at high temperature makes III-nitrides material attractive candidate for semiconductor quantum emitters [1-2]. However, the presence of strong built-in electric field in this material could cause considerable inhomogeneous broadening of the photon emissions via spectral diffusion, which could randomize the coherence property for achieving indistinguishability, i.e. a prerequisite for many suggested quantum information applications.
Here, we present an unconventional InGaN/GaN QD potential in a nano-pyramid structure where a decoupling of single exciton emission from the influence of built-in electric field was manifested. Through morphological as well as detailed optical characterizations, we report a sharp emission linewidth with negligible quantum-confined Stark effect, thereby estimated a homogeneous linewidth beyond the spectral resolution limit via Fourier-transform spectroscopy. We report that these emitted photons exhibited sub-Poissonian statistics which retained its antibunching characteristics at an elevated temperature. Furthermore, we investigated the acoustic-phonon coupling with excitons in our system discussing their significance and implication. The results presented in this talk are relevant towards developing coherent non-classical light sources based on large bandgap semiconductors with inherent piezoelectric fields.

Reference
1. J. H. Kim *et al*., Scientific Reports 3, 2150 (2013)
2. S. H. Gong *et al*., Proceeding of the National Academy of Sciences 112, 5280 (2015)

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