InGaN 量子ドットにおけるスペクトル拡散評価時間の測定
Measurement of the Temporal Scale of the Spectral Diffusion from an InGaN Quantum Dot

◦高亢 [1], H. Springbett[3], T. Zhu[3], R. Oliver[3], M. Holmes[1, 2], 荒川泰彦 [1, 2]
1. 東大生研，2. 東大ナノ量子機構，3. ケンブリッジ大
◦K. Gao[1], H. Springbett[3], T. Zhu[3], R. Oliver[3], M. Holmes[1,2], and Y. Arakawa[1,2],
1. IIS, 2. NanoQuine, Univ. of Tokyo, 3. Univ. of Cambridge, UK
E-mail: pandagk@iis.u-tokyo.ac.jp

Spectral diffusion is a random spectral jump phenomenon which leads to the emission linewidth broadening from an emitter due to the interaction with its environment. This effect becomes a topic of interest in III-Nitride quantum dots (QDs) as it will have detrimental effects on the use of III-nitride semiconductors nanostructures as single photon emitters. Recently, nanosecond time-scale spectral diffusion in the single photon emission from a GaN QD has been reported via spectrally selective autocorrelation measurement.[1] However, further investigation and comparison of these fast spectral diffusion phenomena in III-Nitride materials is still needed. In this work, we present the study of spectral diffusion time-scale via autocorrelation measurement from a single self-assembled InGaN QD embedded in a micropillar with meso-porous distributed Bragg Reflectors.

The sample was cooled down to 5K and was excited by a 375nm wavelength CW laser with an excitation power of 3μW. A standard HBT setup with two PMT detectors was used to perform the autocorrelation measurement after spectral filtering by the exit slit selection of the spectrometer. Figure 1 shows the emission spectrum from an isolated single InGaN QD. Autocorrelation measurements of both one-eighth and the whole profile (according to the dash boxes shown in figure 1) of the emission peak from this QD are shown in figure 2. The anti-bunching effect around time delay zero shows the single photon emission. Meanwhile, the observed additional long scale bunching effect in figure 2 (a) reveals a spectral diffusion characteristic time of ~260ns.

This measurement provides us with further information on the temporal scale of the spectral diffusion process in III-Nitride nanostructure systems, which will have important implications for their future quantum applications such as the generation of indistinguishable photons.

Acknowledgements: This work was supported by JSPS KAKENHI Grant-in-Aid for Specially Promoted Research (15H05700), KAKENHI project (17K14655), the JSPS Summer Program, the Takuetsu program of the Ministry of Education, culture, sports, Science and Technology, Japan, and the UK Engineering and Physical Sciences Research Council Grant (EP/M011682/1) **References:** [1] K. Gao *et al.*, *AIP Advances*, 7 125216 (2017).

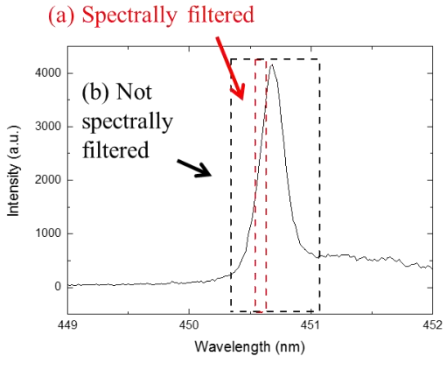

Figure 1: Spectrum of a single self-assembled InGaN QD under 375nm CW laser an excitation power of 3μW at 5K.

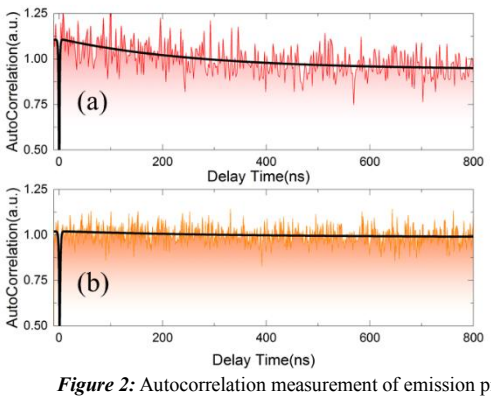

Figure 2: Autocorrelation measurement of emission profile selected as shown in the dash box in Figure 1.