

The optical instabilities and blinking phenomena in the emission of InGaN quantum wells

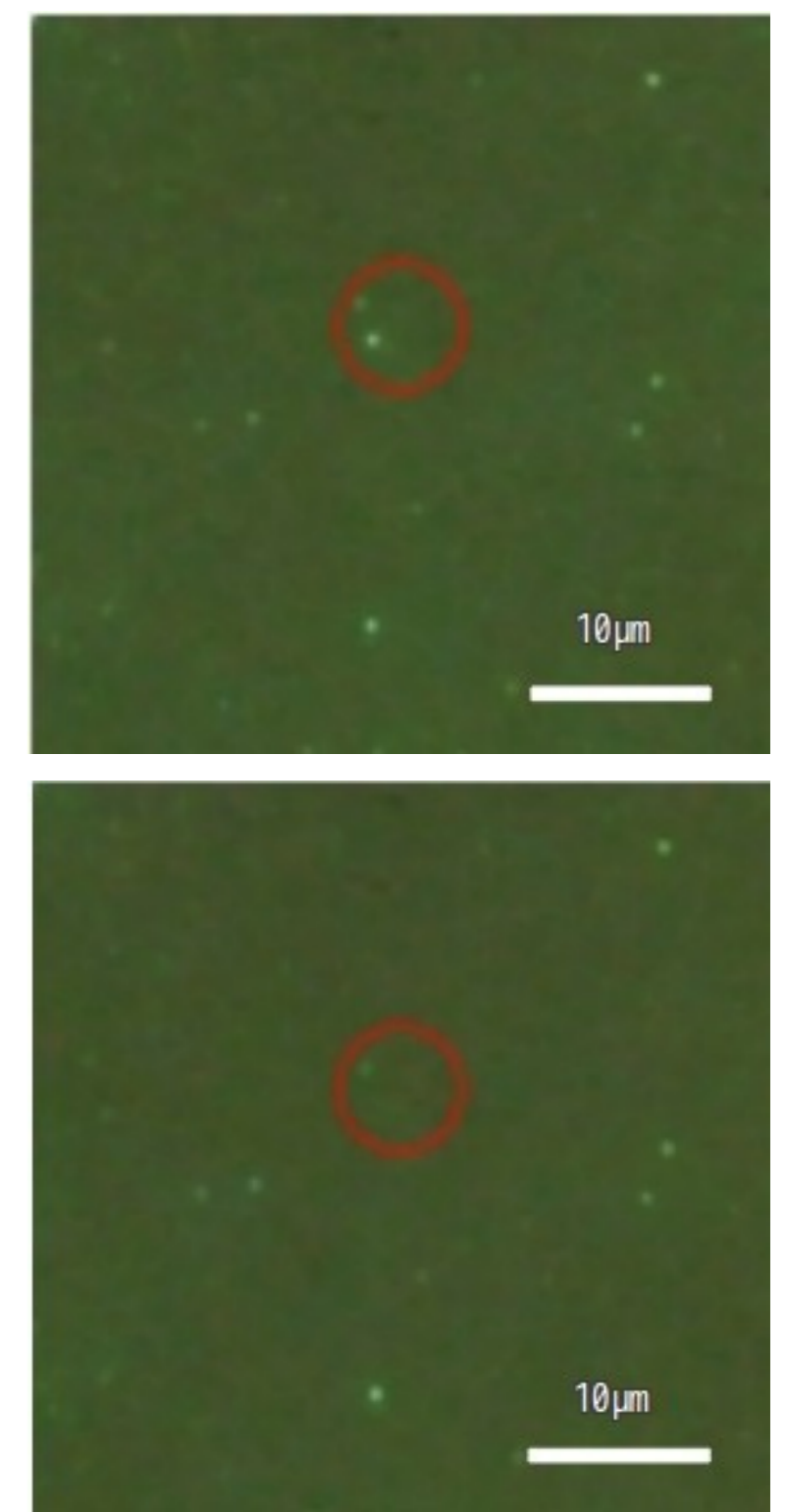
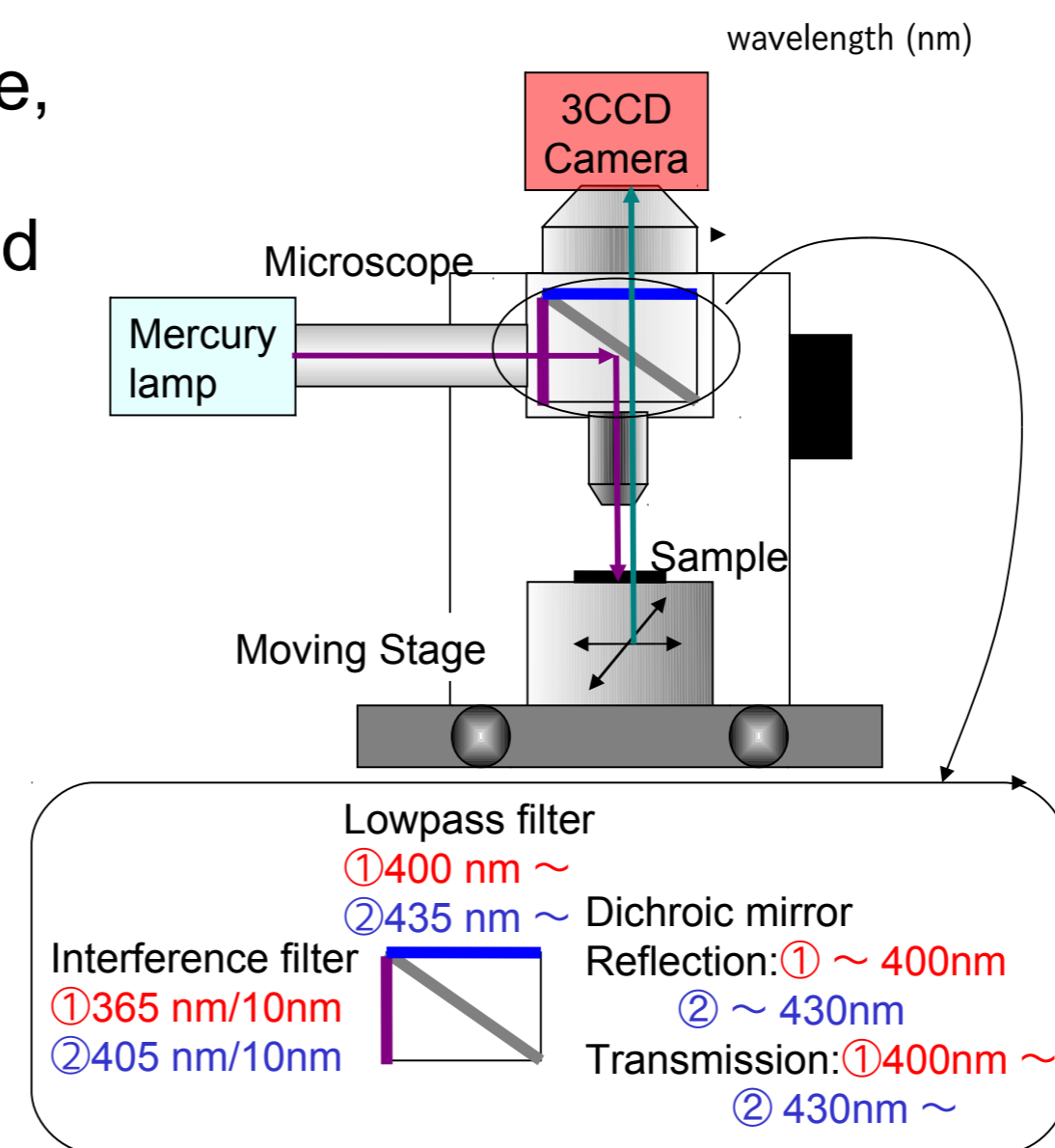
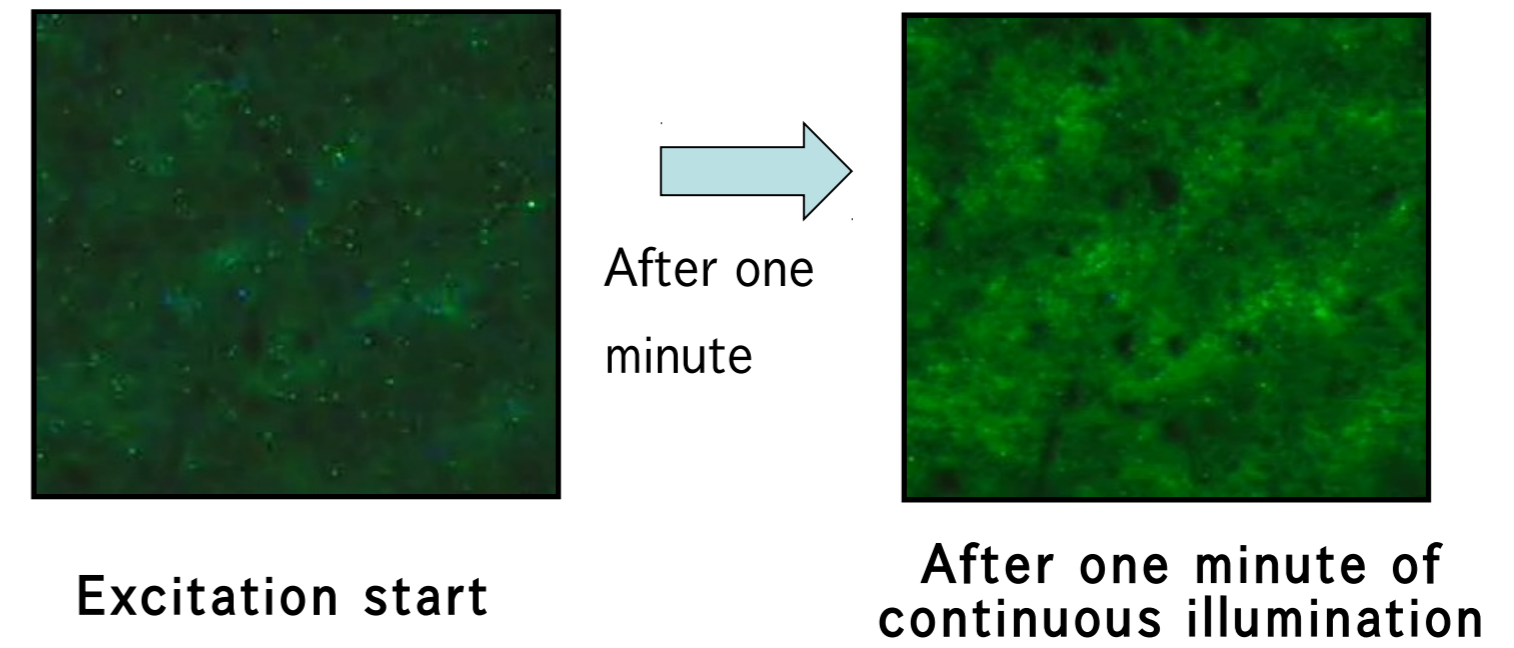


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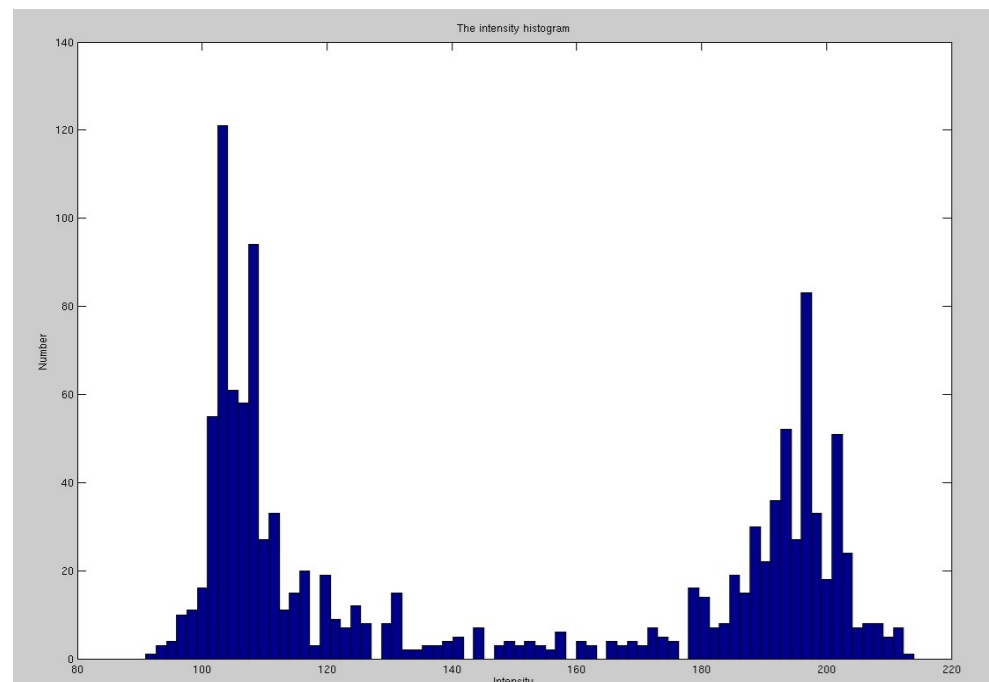
Recent advances in studies for InGaN/GaN have led to high-brightness green and blue light emitting diodes (LED). These wide band gap materials are currently used for many applications, for example full color displays, white (RGB) light sources or for the creation of shorter wavelength devices for optical data storage.

In this presentation, we will report our observations of intriguing optical instability (blinking phenomenon) in the photoluminescence of InGaN single quantum well devices. Similar fluorescence blinking has been observed in three dimensional confined systems (quantum dots) as CdSe, ZnCdSe, InP and GaAs, however the phenomenon is difficult to be explained in our case where the photoluminescence is generated in a system that is quantum confined only in a single direction (quantum well).

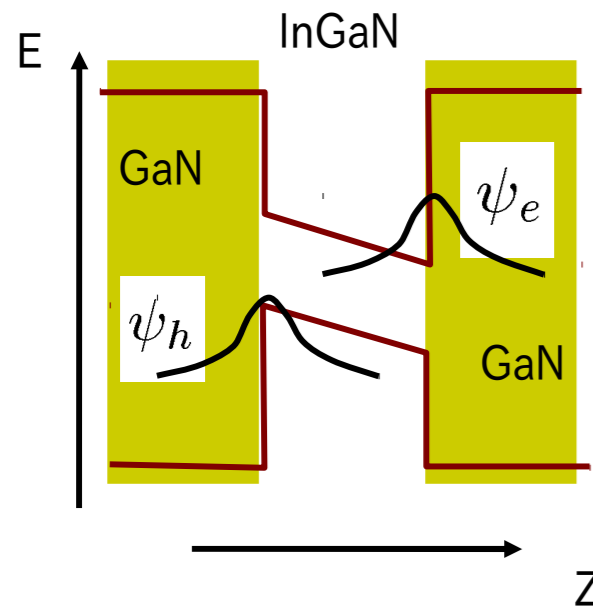
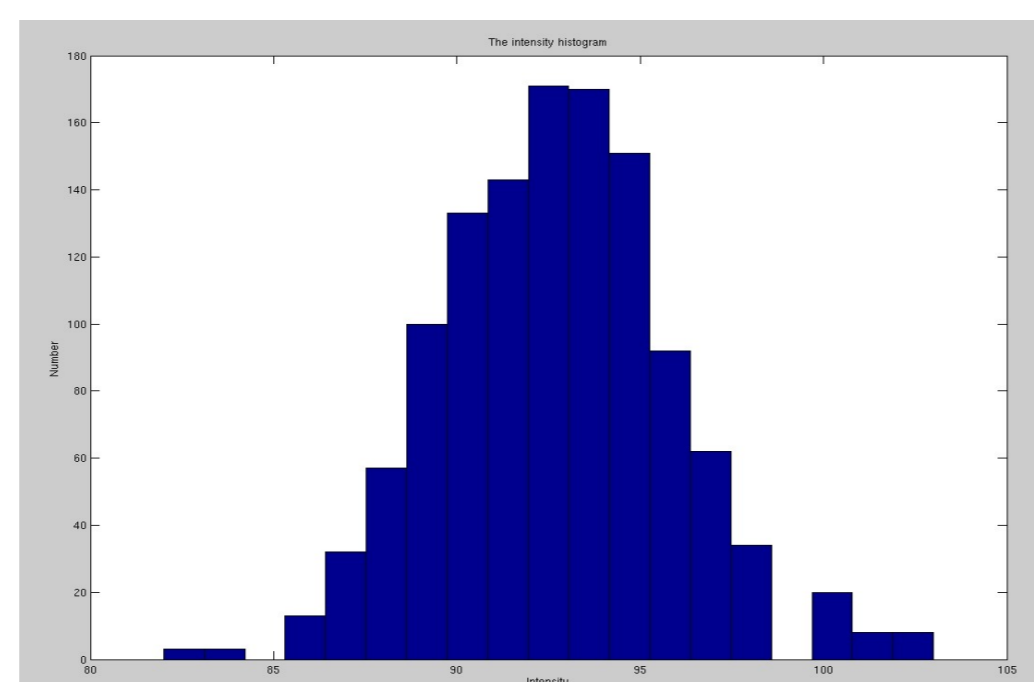


Two images taken from the CCD camera few seconds apart

Bistable signal

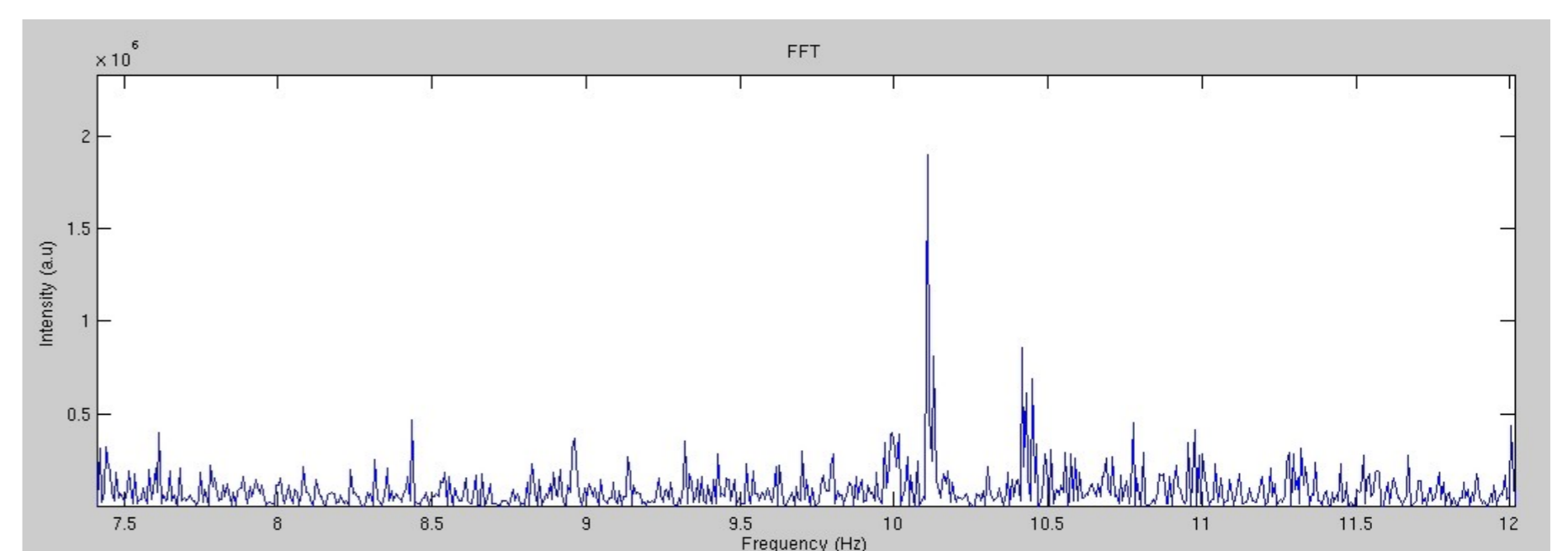
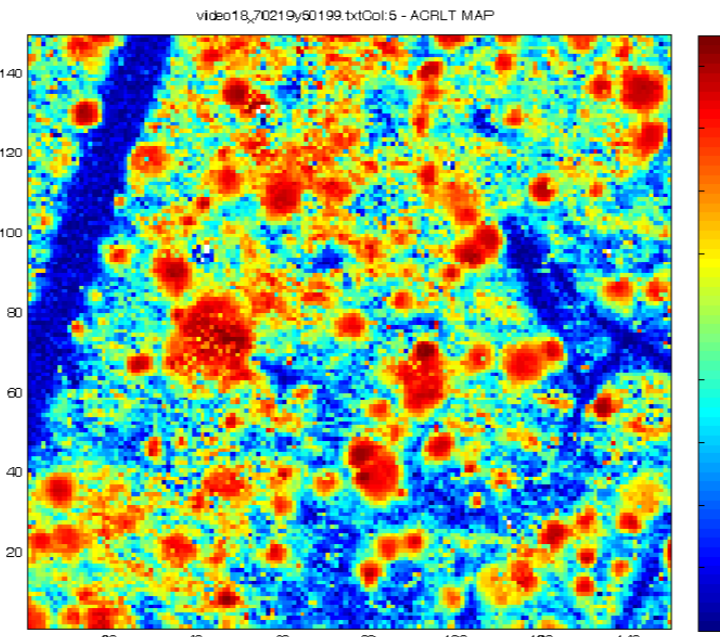
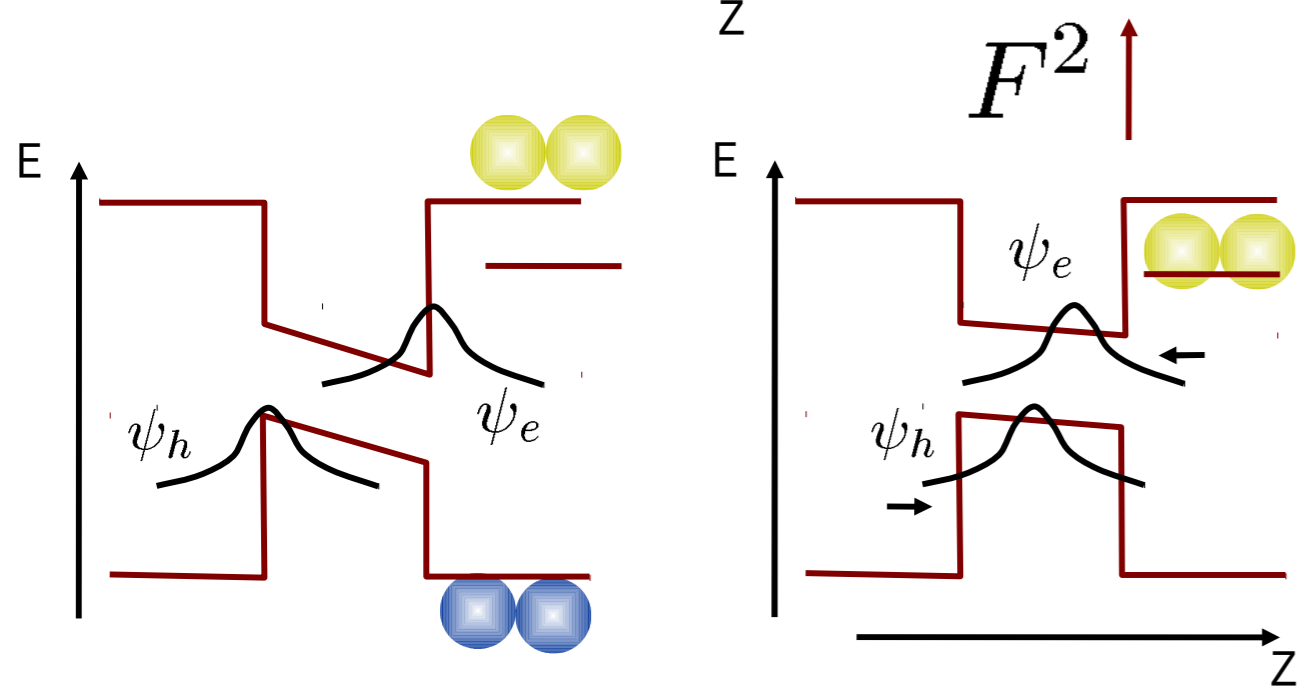


Noise-like signal



$\lambda = 365 \text{ nm}$

GaN (undoped) 5nm
In _x Ga _{1-x} N 3nm
GaN (undoped) 4µm
Sapphire



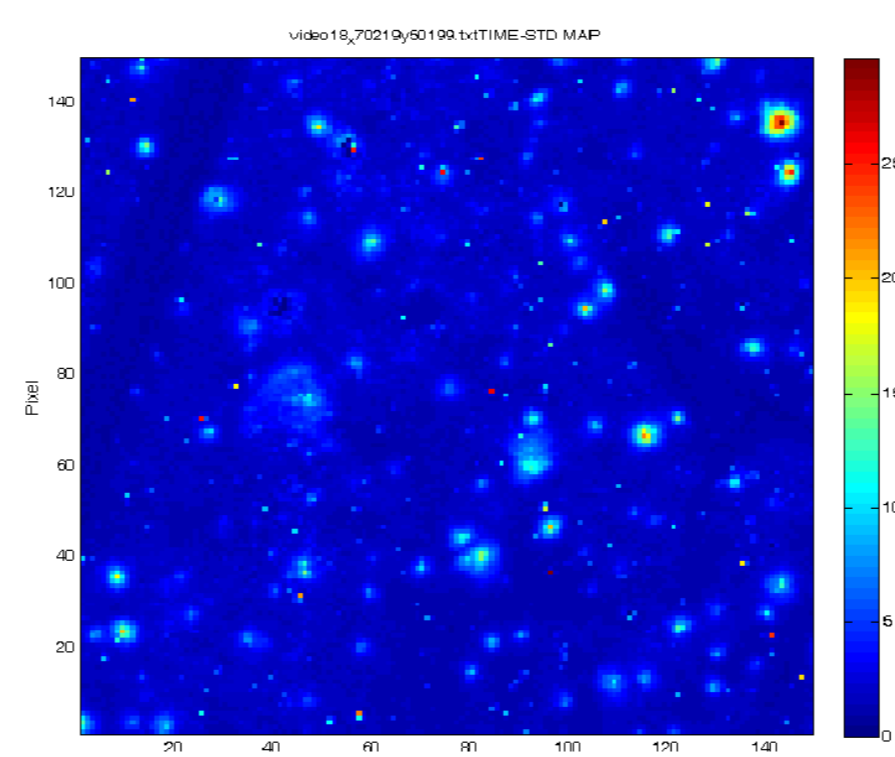
Peak in the range of 5~10Hz

Sample 510nm, room temperature and low temperature

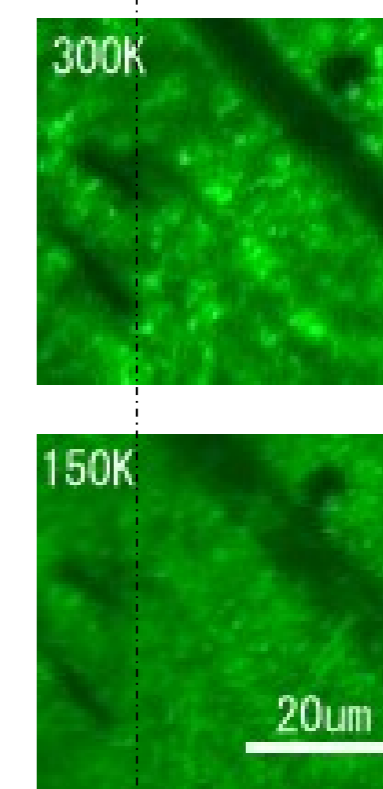
Conclusions

- We detected **intermittency** in PL fluorescence in GaN/InGaN sample
- We found dependence with **Indium** concentration, Excitation **wavelength**, excitation **power**, **temperature**
- Blinking is **not a random** process, it is not pure chaos.
- We found several domains that show **autocorrelation**.
- There is **correlation** between distant blinking domain.
- Correlation depends on **time lag**, suggesting space drift

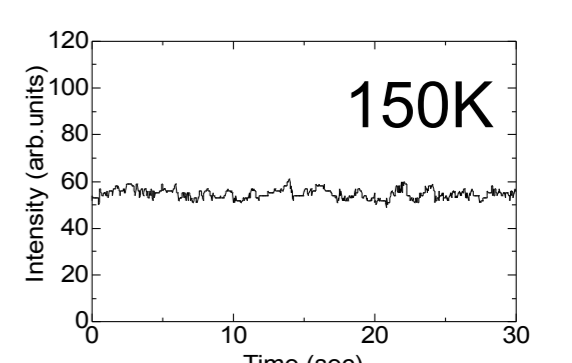
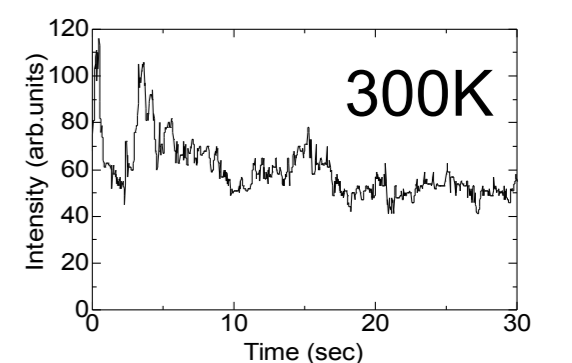
- We found new spatial structures in the crystal that manifest themselves only in the blinking phenomenon.



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Difference of behavior at lower temperature



Trap seems to loose effect a lower temperature