NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2018-2019

BOOSTING BLUE NANOLED SPEED THANKS TO PURCELL EFFECT

General Scope:

More than three billion people are now connected to the internet. Every minute, 200 million e-mails are sent and 5 million searches are performed with Google. In 2016, total internet traffic was estimated at 1.2 zettabytes (10^{21} bytes) and it is expected to triple within 5 years. There is therefore an increase in the number of data centers. In the United States, the equivalent of 8 nuclear reactors is required to power data centers each year. Most of data center energy consumption is the result of moving data from one point to another one through electrical interconnects. To mitigate this energy inefficiency, we intend to replace on-chip electrical interconnects (for 100 µm - 1 cm distances) by optical interconnects using fast LEDs.

Research topic and facilities available:

In this context, we develop fast nano-LEDs emitting in the visible range based on InGaN/GaN core-shell nanowires. With these nanoobjects, modulation speed up to 1 GHz has been already demonstrated. However, to replace electrical interconnects, the nano-LEDs must commute even faster (above 10 GHz). To reach such a speed, the aim of the internship is to explore innovative solutions to boost the speed of our LEDs thanks to the Purcell effect by using plasmonic coupling.

In this project, the student will fabricate the samples using the clean room facilities of the Néel Institute. He/She will also carry the measurements of the device thanks to ultra-fast spectroscopy techniques at the nanoscale (time-resolved cathodoluminescence).

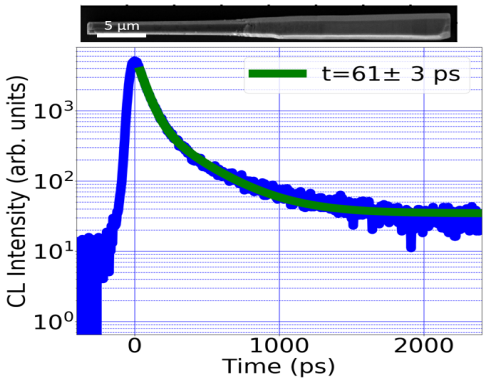

Figure 2 – Preliminary TR-CL measurements on a single nanowire showing a fast recombination at room temperature on InGaN/GaN core-shell nanowire LEDs grown at CEA-INAC.

Possible collaboration and networking: CEA-INAC Grenoble, EPFL.

Possible extension as a PhD: Yes

Required skills: We look for highly motivated student with knowledge of semiconductor physics as well as good skills for experimental work.

Starting date: Flexible

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