Halbleiter-Nanophotonik

SFB 787

Einladung

Es spricht: **Gwénolé Jean Jacopin**

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Zeit: **Freitag, 22. Mai 2015, 11:15Uhr**

Ort: **Technische Universität Berlin**
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Thema: **"Ultrafast dynamics of III-Nitride quantum wells under high injection"**

Abstract:
Group III-nitride has been considered a promising avenue for the realization of optoelectronic devices since 1970. This is particularly relevant for the development of blue and UV light emitting diodes (LEDs). In addition, III-nitride semiconductors feature some advantageous optical properties such as large exciton binding energy and large oscillator strength of excitons. When associated with sufficiently high optical quality, these properties allow the observation of polariton condensation at room temperature [1].
However, as the carrier density increases, we expect the so-called Mott transition to occur: The transition from an insulating state consisting of a gas of excitons to a conductive electron-hole plasma. This crossover can drastically affect the optical characteristics of semiconductors and may, for instance, drive the transition from a polariton laser to a vertical cavity surface-emitting laser. High density effects are also of primary importance for the physics at play in III-nitride LEDs. Indeed, under high injection, these devices suffer from a strong decrease of efficacy/efficiency called the efficiency droop.
In this seminar, I will provide an overview of the optical characteristics of III-nitride quantum wells (QWs) under high injection. In the first part, I will present the investigation of the Mott transition occurring in single high-quality GaN/AlGaN QWs. I will explain how we determine the carrier density at which the Mott transition occurs in these III-nitride heterostructures [2]. I will also provide clear experimental evidence on the peculiar stability of biexcitons at those carrier densities [3]. This is of crucial importance to establish a comprehensive theory to better understand the physics of III-nitride lasers. In the second part, I will present similar studies on InGaN/GaN QWs. I will show that these experiments are perfectly suited to investigate the non-radiative recombination under high injection. Such studies can provide a deeper insight on the physical phenomena responsible for droop efficiency in III-nitride LEDs. We expect to stimulate several theoretical and experimental investigations on this subject.

[1] S. Christopoulos et al., Phys. Rev. Lett. 98, 126405 (2007).
[2] G. Rossbach et al., Phys. Rev. B 90, 201308 (2014).
[3] M. Shahmohammadi et al., Nat. Commun, 5, 5251(2014).

Gäste sind herzlich willkommen!

Prof. Dr. M. Kneissl