ments, and allow an easy excitation of the long-range surface plasmons in the grating.

We show how plasmonic systems built of gratings and nanoparticles can be of interest for SERS, and how strong near-fields may be achieved. SERS measurements done with a confocal Raman microscope permit to study the dependence of near-field intensity on the shape of the particle and on the excitation conditions.

HL 31: Poster I: Devices, Quantum Dots and Quantum Wires

Time: Tuesday 18:30–20:30 Location: Poster D1

HL 31.1 Tue 18:30 Poster D1

Quantum Electrodynamics on a Chip — •Peiqing Jin[1], Alessandro Romito[1], Jared Cole[1], Alexander Shnirman[2], and Gerd Schön[1] — [1]Institut für Theoretische Festkörperphysik, Karlsruhe Institute of Technology, 76131 Karlsruhe — [2]Institut für Theorie der Kondensierten Materie, Karlsruhe Institute of Technology, 76131 Karlsruhe

Circuit QED [1], where a superconducting qubit, playing the role of an artificial atom, is coupled to an on-chip superconducting resonator, provides novel methods for studying quantum optics in electrical circuits and for realizing elements for quantum computing. Recently, single qubit lasing and cooling were demonstrated in such a system [2].

We investigate extensions of the circuit QED concepts to situations where the electron spin of an ensemble of quantum dots is coupled to a microwave resonator. The total spin of the electrons in the ensemble can be controlled via a train of laser pulses, as shown in recent experiments [3]. We explore the possibilities offered by such a spin manipulation to achieve Sisyphus amplification and damping of the resonator.

Reference: [1] A. Wallraff, et al., Nature 431, 162 (2004) [2] M. Grajcar, et al., Nature Physics 4, 612 (2008) [3] A. Greilich, et al, Science 317, 1896 (2007)

HL 31.2 Tue 18:30 Poster D1

Small and large signal analysis of quantum dot lasers — •Roland Aust[1], Christian Otto[1], Joshua Horowitz[2], Kathy Lüdge[1], and Eckehard Schöll[1] — [1]Institut f. Theoretische Physik, Sekr. EW 7-1, Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin — [2]Massachusetts Institute of Technology, Cambridge

In this work a quantum dot laser with an external cavity is modeled using a rate equation system treating electron and hole dynamics separately and including microscopically calculated carrier-carrier scattering rates. We show under which conditions the model reproduces the dynamics of an experimental setup perfectly, and, which additional effects are observed by introducing the external cavity. The laser's small signal response is discussed in detail as well as a large signal analysis in terms of eye diagrams.

HL 31.3 Tue 18:30 Poster D1

Cavity design and heat management in Vertical-External-Cavity Surface-Emitting Lasers (VECSELs) — •Jens Herrmann[1], Alexej Chernikov[1], Martin Koch[1], Tsuei-Lian Wang[2], Yushi Kaneda[2], Mike Yarborough[2], Jörg Hader[2], Jerome V. Moloney[2], Bernardette Kunert[1], Wolfgang Stolz[1], Sangam Chatterjee[1], and Stephan W. Koch[1] — [1]Faculty of Physics and Material Sciences Center, Philipps-Universität Marburg — [2]College of Optical Sciences, University of Arizona, Tucson, USA

Vertical-External-Cavity Surface-Emitting Lasers (VECSELs) represent a combination of high output power, high efficiency and good beam quality with compact design in the infrared spectral range. Furthermore large areas of the visible spectrum are accessible due to high-speed frequency-doubled SDLs. In high-power applications cavity design combined with heat management is very important.

We experimentally investigate a model high-power device at 1040nm. The linear cavity consists of the semiconductor chip and a spherical external output coupler. The performance dependence on the reflectance of the output coupler is discussed before we vary the pump spot with the help of the pump optics.

Following we compared the impact of different materials (copper and diamond) for the heat spreader and different heat management concepts. The performance of the device, spectrally resolved emission and the characteristic, curve is investigated under comparable high-power pump conditions and cavity design. In the end the impact of different cavity designs on the performance of the device is compared.

HL 31.4 Tue 18:30 Poster D1

Design and Characterisation of InGaN-based vertical external cavity surface emitting lasers — •Ralph Debusmann[1], Nacef Dhidah[2], Veit Hoffmann[3], Leonhard Weixelbaum[3], Uwe Brauch[2], Markus Weyers[3], Michael Kneissl[1], and Patrick Vogt[1] — [1]Institut für Festkörperphysik, TU-Berlin, EW 6-1, Hardenbergstr. 36, 10623 Berlin — [2]Institut für Strahlwerkzeuge, Universität Stuttgart, 70569 Stuttgart — [3]Ferdinand-Braun-Institut für Höchstfrequenztechnik, Gustav-Kirchhoff-Str. 4; 12489 Berlin

Optically pumped semiconductor disk lasers (SCDL) with external resonator allow the scaling of laser sources to higher output power levels with diffraction limited beam quality. This idea has already been successfully demonstrated in the infrared spectral region with SCDL based on the material system InGaAs. Here we present a SCDL emitting in the blue-violet wavelength region that is based on the material system InGaN. We have investigated different designs of the InGaN quantum well active region, in particular the application of a resonant periodic gain (RPG) structure and the influence of the cavity length onto the device parameters.

We will discuss implications for the design of the active region besides the presentation of basic device parameters i.e. output-power vs. pump-power, slope efficiency and the far- and near-field pattern.

Pumped by a pulsed nitrogen laser at 337 nm emission wavelength and pulse width of 3 ns the SCDL emits at a wavelength of 394 nm with a threshold power density of 700 kW/cm^2 and a peak output power of 300 W. The conversion efficiency is 3.5

HL 31.5 Tue 18:30 Poster D1

Micro-Printing Setup for Selective Biofunctionalization of Micro-Resonators — •Julian Fischer[1], Torsten Beck[1], Simone Schleede[1], Mario Hauser[1], Tobias Grossmann[1,2], Christoph Vannahme[2], Timo Mappes[2], and Heinz Kalt[1] — [1]Institut für Angewandte Physik, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]Institut für Mikrostrukturtechnik, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Optical resonators with rotational symmetry like micro-spheres and micro-toroids have been introduced for label-free biomolecule detection. Semiconductor fabrication methods in combination with reflow processes are used to build high-Q optical cavities made of silica or PMMA. Whispering gallery-modes that are excited in the resonators polarize molecules attached to the resonator. This leads to a shift of the mode frequencies. For the parallel detection of different types of bio-molecules, each resonator on a chip has to be functionalized for a specific type of molecules. Therefore a high-voltage micro-printer was set up. A pipette (tip diameter 10-50 μm) is fabricated by thermally extending a glass capillary tube using a standard glass tube puller. A shaped electric pulse is amplified to high voltage ($\sim$ 1kV). The amplifier is connected to the capillary as anode and the substrate holder as cathode. The high electric field due to the voltage pulse generates a droplet impinging on the substrate. The scope of this economic and robust technique, that allows the precise depletion of femto- to nanoliters droplets, is presented.

HL 31.6 Tue 18:30 Poster D1

Oxygen vacancies in ultrathin gate dielectric of MOSFETs and their influence on the leakage current: an ab initio investigation — •Ebrahim Nadimi[1,2], Philipp Plänitz[1,2], Christian Radehaus[2], and Michael Schreiber[1] — [1]Institut für Physik, Technische Universität Chemnitz, D-09107 Chemnitz, Germany — [2]GWT-TUD GmbH - Geschäftsstelle Chemnitz, Annaberger Str. 240, D-09125 Chemnitz, Germany

Oxygen vacancies are known to be the dominant defect in dielectric layer of the MOSFET transistors and are responsible for stress induced leakage current (SILC) as well as degradation of the the gate oxide.