176	**Rf modulation of surface-emitting mid-IR ring DFB Quantum Cascade Lasers** *Borislav Hinkov [1], Jakob Hayden [1], Rolf Szedlak [1], Pedro Martin-Mateos [2], Borja Jerez [2], Pablo Acedo [2], Gottfried Strasser [1,3], Bernhard Lendl [4]* *[1] Institute of Solid State Electronics, TU Wien, [2] Universidad Carlos III de Madrid,* *[3] Center for Micro- and Nanostructures, TU Wien, [4] Inst. of Chemical Technologies and Analytics, TU Wien* The fast modulation characteristics of quantum cascade lasers (QCLs) up to the MHz-/GHz-range give insight into their dynamical properties and act as a prerequisite for QCL-based experiments like e.g. the injection locking of mid-infrared frequency combs, spectroscopic measurements or high data transmission optical free-space telecommunication applications. In this paper we present the first analysis of the optical high-frequency modulation characteristics of surface-emitting mid-IR DFB-ring QCLs up to 160 MHz. We compare them to DFB-ridge QCLs from the same gain material and show the existence of the (quasi) single-sideband ((q)SSB) regime, a special FM-state in QCLs, not present in regular diode lasers. Surface-emitting ring-QCLs are particularly relevant, since they show significant potential in array integration and monolithic (ring-in-ring) laser-detector schemes.
177	**Homogeneous, bound-to-continuum THz Quantum Cascade Laser: 1.65 THz spectral bandwidth and RF injection locking** *Andres Forrer, David Stark, Martin Franckié, Tudor Olariu, Mattias Beck, Jérôme Faist, Giacomo Scalari, ETH Zürich* We present a homogeneous, bound-to-continuum Quantum Cascade Laser (QCL) featuring a spectral bandwidth up to 1.65 THz centered at 3.45 THz in a bi-stable CW lasing point above the typically not accessible NDR regime due to voltage driven operation. Below the NDR a spectral coverage of ~1 THz is observed with an electrically detected single and narrow beatnote indicating frequency comb emission. Further, injection locking to an external RF synthesizer with powers down to roughly -55 dBm at the QCL was realized. For increasing injection power the locking range follows the prediction of the Adler's Equation. Therefore, the device features the advantages of low injection powers and low threshold current density, 115 A/cm^2, but bandwidths still comparable to heterogeneous devices.
178	**A polarization-rotating Vivaldi antenna for improved far-field patterns of broadband terahertz quantum cascade lasers** *Urban Senica, Elena Mavrona, Tudor Olariu, Andres Forrer, Mattias Beck. Jérôme Faist, Giacomo Scalari, ETH Zürich* Terahertz quantum cascade lasers based on double metal waveguides are compact sources of terahertz radiation with excellent properties in terms of covering a large bandwidth and exhibiting low waveguide dispersion. However, as the optical mode is confined to subwavelength dimensions, the emitted radiation produces a highly divergent far-field pattern. We designed and fabricated an antipodal Vivaldi antenna which adiabatically expands the optical mode while rotating its polarization from vertical towards horizontal polarization. Numerical simulations predict a single-lobed far-field pattern with a beam width of less than 20°, spanning over two octaves in frequency (1.5-4.5 THz). Far-field measurements agree well with simulations.
179	**Microfabrication of devices for the measurement of non-local charge transport** *Jacopo Oswald [1], Steffen Riedt [1], Nitesh Kumar [2], Johannes Gooth [2], Kirsten Moselund [1], Claudia Felser [2], Philip Moll [3], Bernd Gotsmann [1], Heinz Schmid [1]* *[1] IBM Research – Zurich, [2] Max Planck Institute for the for Chemical Physics of Solids, [3] EPFL* Hydrodynamic electron transport has recently been observed in the Weyl semi-metal tungsten diphosphide (WP_2). However, manufacturing microdevices from single crystals is very challenging. Here, focused ion beam (FIB) milling is used to pattern and contact microstructures of WP_2 aiming to achieve precise device geometries and lowest contact resistances, which is important for accurate measurements. The (magneto-) transport of the samples is characterized at variable temperature (3 - 300 K) and variable magnetic field (9 T). Novel devices are realized for the investigation of hydrodynamic whirlpool formation and to investigate geometry-dependent resistivity.