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Elucidating the impact of B incorporation in GaAs through nanowire growth

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Boron-containing III-V alloys have net yet been thoroughly characterized. Yet, the small lattice-constant of BAs enables applications in strain-engineering of nanowires. We report on the incorporation of B into self-catalyzed nanowires, grown by molecular beam epitaxy. Energy-dispersive X-ray spectroscopy scans in a scanning transmission electron microscope revealed a segregation of B atoms to the nanowire side-walls, causing inverse pyramidal voids. Electrical measurements on harvested nanowires revealed a p-type conductivity due to anti-site incorporation of B. A rate equation-based model allowed to extract a reduced surface diffusion length at the order of 1000 nm for Ga-adatoms on B:GaAs nanowire sidewalls.

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Dispersion measurements of Terahertz Quantum Cascade Fabry-Perot cavities and VECSELs

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A method for obtaining the dispersion of terahertz (THz) quantum cascade lasers (QCL) is presented. Previously shown in the mid-infrared (MIR) range, it involves measuring the relative phase of the center burst (0^{th} order harmonic peak) and first satellite (1^{st} order harmonic peak) from the interferogram of a THz QCL cavity, operated below threshold, emitting inside a Fourier Transform Infrared Spectrometer (FTIR). The electroluminescence spectrum is thus determined by performing Fourier Transform on the acquired signal and the group velocity dispersion can then be calculated. This method is applicable to any QCL – here shown for Fabry-Pérot (FP) ridge laser as well as vertical external-cavity surface-emitting laser (VECSEL) THz metasurface.

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Magnetic field-effect on the charge order in underdoped $YBa_2Cu_3O_y$.

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Underdoped cuprate high T_c superconductors have been intensively studied, especially since the discovery of the pseudogap phenomenon in the 1990's. An important step towards the identification of the HTSC pairing mechanism was the discovery of a charge density wave (CDW) existing in large parts of the underdoped phase diagram. In zero magnetic field (B = 0) the short-ranged, static CDW is induced by defects, while a long-range CDW can be induced for high B-fields along the c-axis (perpendicular to the CuO_2 layers). Here we aim to search for the origin of this CDW and its relationship with superconductivity (competing or interwined order). We performed reflection experiments from THz-NIR region (50 cm^{-1} - 6000 cm^{-1}) while applying high magnetic fields up to B = 30 Tesla.

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Stability of the Q-phase of $CeCoIn_5$ in the presents of localized magnetic impurities

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The well-known Q-phase in $CeCoIn_5$ is a rare example of cooperative coexistence of superconducting and magnetic order. For $Nd_{0.05}Ce_{0.95}CoIn_5$, a second magnetic phase is stabilized at zero magnetic field with identical symmetry of Q-phase separated by a quantum critical point [1]. We present studies on 2% and 3.5% Nd-doped $CeCoIn_5$ which interestingly shows that the SDW phase vanishes with increasing magnetic fields before the Q-phase is stabilized. This suggests that the two phases are separated by a disordered magnetic phase for low Nd-doped $CeCoIn_5$, representing for two magnetic instabilities and suggesting different origins of the two phases.

[1] S. Gerber et al, Nature Physics 10, 126 (2014).