

PADERBORN PHOTONICS LECTURE

04.07.2018

LECTURE HALL A1

16:15

Optical non-linearities from longitudinal excitons and plasmon propagation in zero-index media

Dr. Munise Cobet

**Center for Surface- and Nanoanalytics - ZONA,
Johannes Kepler University Linz, Austria**



Abstract:

Remarkable nonlinear optical effects have been predicted in materials where the effective dielectric permittivity is near zero. Thin flat films or nanostructured confinement potentials induce different boundary conditions for incoming radiation with angles not normal to the surface. This allows to excite longitudinal waves like plasmons even with transverse electromagnetic waves (light). This condition is commonly achieved by complex structuring or multilayer designs containing metals providing free charge carriers. However, this inevitably comes along with high optical losses preventing successful integration in practical applications. Here, an alternative path is tested by using the intrinsic exciton-polariton coupling of hexagonal semiconductor crystals at the longitudinal wave solution frequency, also providing free carriers interfaced with the bulk. Polar semiconductors naturally form surfaces with opposite polarity along the c-axis, in order to match the chemical potentials and therefore form a quasi 2D-electron accumulation layer. Starting with ZnO single crystals, a low-cost and non-toxic medium, we study the Berreman-mode¹ in the violet region for the future development of devices supporting e.g. slow or stopped light, waveguiding, emission enhancement and SPASERS.



Center for Optoelectronics and Photonics Paderborn



Tailored Nonlinear Photonics