



Prof. Filip Ligmajer

Brno University of Technology, Central European Institute of Technology, Brno, Czech Republic

Tunable nanophotonics based on phase-change materials VO₂ and Sb₂S₃

Phase-change materials (PCMs) have emerged as a promising platform for active nanophotonics, enabling dynamic control over the amplitude, phase, and polarization of light through high-contrast refractive index modulation. However, as photonic resonators are scaled down to the sub-wavelength regime, nanoscale confinement effects fundamentally reshape the phase transition dynamics. In my talk, I will provide a general introduction to the material physics and optical properties of two contrasting PCM platforms: vanadium dioxide (VO₂) providing a volatile metal-insulator transition, and antimony trisulfide (Sb₂S₃) providing a non-volatile amorphous-crystalline transition. I will discuss how the unique properties of these materials can be utilized in tunable nanophotonics and how physical confinement at the nanoscale reshapes the thermodynamics, phase nucleation kinetics, and domain distribution in these materials. Finally, I want to propose that by leveraging these confinement effects, we can move beyond uniform film properties to engineer spatially variant, multi-level, and ultra-compact active photonic components for applications in optical signal processing, neuromorphic photonics, and dynamic holography.

Date: Tuesday, 20 October 16:15

Location: Lecture Hall 05.01, Institute of Physics, University of Graz, Universitätsplatz 5

Host: Joachim Krenn

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