

CENIDE & WIN Seminar Series on 2D-MATURE

DFG IRTG 2803 & NSERC CREATE



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TU Dresden

“Optically detected transport in low-dimensional semiconductors”

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Alexey Chernikov obtained his doctoral degree at the University of Marburg for the work on the optical properties of semiconducting materials and external cavity semiconducting lasers in 2012. In 2013, he was granted a Feodor-Lynen Fellowship from the Alexander von Humboldt Foundation to conduct his postdoctoral research on Coulomb phenomena in atomically-thin 2D systems in the group of Tony F. Heinz at Columbia University. Alexey joined TU Dresden in 2021 as a professor leading the group “Ultrafast Microscopy and Photonics”. His research is focused on studying and understanding electronic and optical many-particle phenomena in low-dimensional systems.

Transport of optical excitations in semiconducting solids plays a central role from both fundamental and technological perspectives. In systems with strong Coulomb interaction the propagation of optically injected carriers is dominated by excitons instead of free electrons or holes. These correlations can affect both the overall energy landscape and the interactions with vibrational modes, with a strong impact on the mobility of the excitations. In two-dimensional semiconductors, the electron-hole correlations present a particularly interesting case combining the properties of Wannier-Mott excitations in inorganic quantum well systems with high exciton binding energies, strong-light matter interaction, and spin-valley degrees of freedom. In addition, the possibility to artificially create heterostructures featuring a manifold of excitonic states as well as the recent demonstration of excitons in two-dimensional magnets offer a rich playground for research and, possibly, technological applications. In this talk, I will discuss optical access to exciton transport via transient microscopy, linear and non-linear diffusion, and present indications of quantum transport phenomena. An additional focus will be placed on the coupling of exciton propagation to magnetic order and spin fluctuations in two-dimensional semiconducting magnets.