

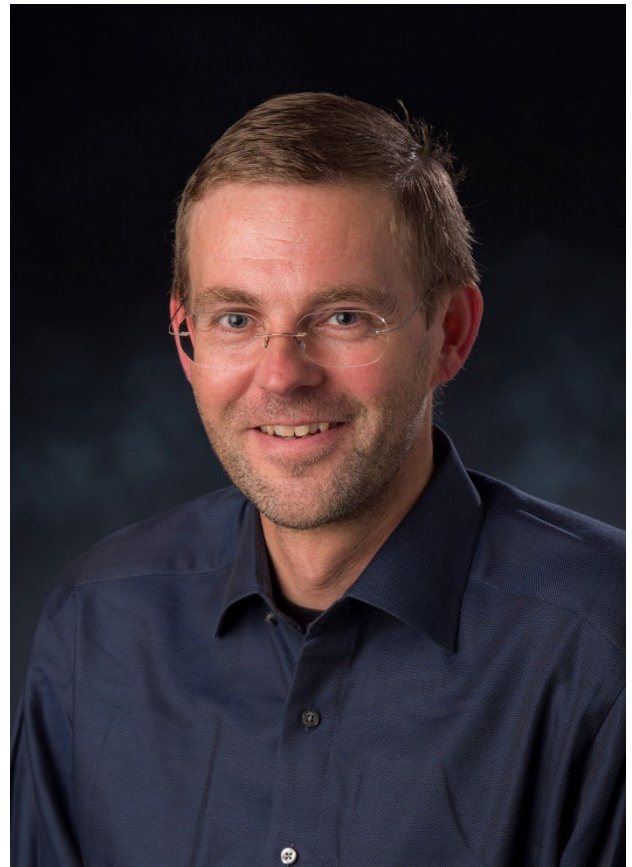
Thursday, February 9th, 2023

Refreshments at 3:15pm in PSF 186
Colloquium from 3:30 PM – 4:30 PM in PSF 101

Ultrafast nano-imaging: Resolving structure, Coupling, and Dynamics of Matter on its Natural Time and Length Scales

Professor Markus Raschke

University of Colorado Boulder



Abstract:

Understanding and ultimately controlling the properties of matter, from molecular to quantum systems, requires imaging the elementary excitations on their natural time and length scales. To achieve this goal, we developed scanning probe microscopy with ultrafast and shaped laser pulse excitation for multiscale spatio-temporal optical nano-imaging. In corresponding ultrafast movies we resolve the fundamental quantum dynamics from the few-femtosecond coherent to the nanosecond thermal transport regime. I will discuss specific examples visualizing in space and time the nanoscale heterogeneity in competing structural and electronic dynamic processes that define the performance in perovskite photovoltaics or energy dissipation in 2D heterostructures. I will then extend the discussion to new forms of photon-matter hybrid states that emerge from confining light on the nano- to atomic scale, with imaging in tip-enhanced strong coupling of single emitters, to new regimes of nonlocal and quantum nonlinear nano-optics. As a perspective I will show how we are approaching the ultimate goal of functional imaging and control, to link macroscopic properties to microscopic interactions in materials at their fundamental spatio-temporal levels.

Biography:

Markus Raschke is professor at the Department of Physics and JILA at the University of Colorado at Boulder. His research is on the development and application of nano-scale nonlinear and ultrafast spectroscopy to control the light-matter interaction on the nanoscale. These techniques allow for imaging structure and dynamics of molecular and quantum matter with nanometer spatial resolution. He received his PhD in 2000 from the Max-Planck Institute of Quantum Optics and the Technical University in Munich, Germany. Following research appointments at the University of California at Berkeley, and the Max-Born-Institute in Berlin, he became faculty member at the University of Washington in 2006, before moving to Boulder in 2010. He is fellow of the Optical Society of America, the American Physical Society, the American Association for the Advancement of Science, and the Explorers Club.

Host: Prof. Robert Kaindl

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