



Sonderforschungsbereich 1277

Emergent Relativistic Effects in Condensed Matter -
From Fundamental Aspects to Electronic Functionality



SFB – Colloquium

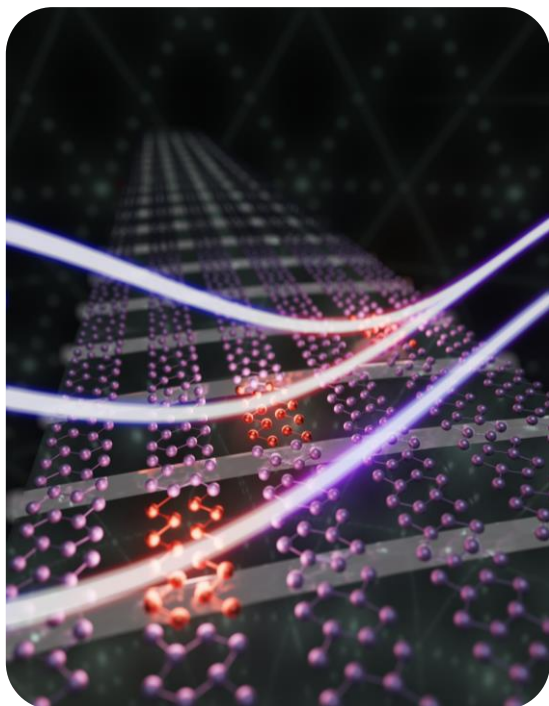
Speaker: **Dr. Jan Gerrit Horstmann**
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Date: Tuesday, 31 May 2022, 14:15, H34

Topic: Mode-selective optical control over a surface
structural phase transition

Abstract:



Artist's impression of the optically-induced structural phase transition in atomic indium wires on the (111) surface of silicon.

Exploiting vibrational excitation for the dynamic control of material properties is an attractive goal with wide-ranging technological potential. Most metal-to-insulator transitions are mediated by few structural modes and are thus ideal candidates for the selective driving towards a desired electronic phase. Such targeted navigation within a multi-dimensional potential energy landscape requires microscopic insight into the non-equilibrium pathway. However, the role of coherent inertial motion across the transition state has remained elusive. This talk presents the mode-selective control over the metal-to-insulator phase transition in indium nanowires on silicon, monitored by ultrafast low-energy electron diffraction. We use tailored pulse sequences to enhance or suppress key phonon modes and thereby steer the collective atomic motion within the potential energy surface underlying the structural transformation. Ab initio molecular dynamics simulations further demonstrate the ballistic character of the transition. Our work illustrates that coherent excitation of collective modes enables the dynamic control of materials functionality.

Hosts: Dr. Markus Huber and Prof. Dr. Rupert Huber