Light Matter Interaction at TeraHertz frequencies: Nonlinear optics and functional control

Colloquium given by
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Date: 17 April 2019 (Wednesday)
Time: 11.00 am - 12.00 pm
Venue: SPMS-LT5 (SPMS-03-08)
Host: PAP Seminar committee

Abstract

I will discuss how coherent electromagnetic radiation at infrared and TeraHertz frequencies can be used to drive collective excitations in solids non-linearly. The driven cooperative response can yield new types functional control. I will for example discuss experiments in which superconducting fluctuations can be amplified by light at temperatures higher than the thermodynamic transition temperature. I will also discuss the physics of superconducting plasmons in layered superconductors and how these reveal new nonlinear THz phenomena.

Short Biography

Andrea Cavalleri is the founding director of the Max Planck Institute for the Structure and Dynamics of Matter in Hamburg (Germany) and a professor of Physics at the University of Oxford (UK). After receiving a laurea degree from the University of Pavia (Italy), he held graduate, postgraduate, and research staff positions at the University of Essen (Germany), at the University of California, San Diego (US), and at the Lawrence Berkeley National Laboratory (US). He joined the Oxford faculty in 2005.

He is best known for his experiments in which intense TeraHertz pulses are used to drive large amplitude and coherent lattice distortions in solids, manipulating their electronic properties, and for demonstrating that one can induce non-equilibrium superconductivity far above the thermodynamic transition temperature. Motivated by the need to probe driven lattices, he has also been majorly involved in the development of ultrafast X-ray techniques, since their inception in the late 1990s through their modern incarnation at X-ray Free Electron Lasers.

Cavalleri is a recipient of the 2004 European Science Foundation Young Investigator Award, of the 2015 Max Born Medal from the IoP and the DFG, of the 2015 Dannie Heineman Prize from the Academy of Sciences in Goettingen and of the 2018 Isakson Prize from the American Physical Society. He is a fellow of the APS, of the AAAS, and of the IoP. In 2017, he was elected Member of the Academia Europaea.