



Tuesday, October 1st, 2019 – 11:00 pm
CFEL Seminar room IV (Bldg. 99)

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Relativistic ultra-intense laser-plasma physics: from classical to QED regimes

Ultra-intense lasers deliver unprecedented energy densities within microscopic volumes and shortest time spans, as exemplified by last year's Physics Nobel Prize. Today, these lasers facilitate many compact technical applications such as particle accelerators and sources of intense electromagnetic radiation. And the next development stages promise significant technical advancements as well as deep insights into fundamental science ranging from nonlinear quantum field theory to studying the complex quantum vacuum itself. As atomic systems exposed to ultra-intense laser pulses are instantaneously ionized, the laser interacts with a plasma of relativistic electrons and highly charged ions, driving rich quantum electrodynamics (QED) dynamics. Furthermore, ultra-intense laser fields feature such tremendous photon densities that conventional perturbative QED becomes inapplicable and non-perturbative QED methods are needed. While certain aspects of the ensuing dynamics can be described by classical plasma physics, a proper nonperturbative multi-particle QED theory, however, does not yet exist. This talk focuses on how ultra-intense laser-plasma interactions at this border between classical and nonlinear QED physics can be theoretically analyzed to optimize existing applications, disclose new perspectives and to address basic science issues. We will also discuss in what aspects the two theory approaches need to be unified and explore tentative routes to provide such hitherto unachievable unifications.

Host: Michael Ruggenthaler

