A 3: Correlation dynamics in plasmas and clusters I

Time: Monday 10:30–12:00 Location: V47.03

Invited Talk A 3.1 Mon 10:30 V47.03

Many-electron dynamics triggered by strong FEL pulse — •Ulf Saalmann — Max-Planck-Institut für Physik komplexer Systeme · Dresden

Intense pulses at extreme-ultraviolet or Xray wavelengths — as available from short-wavelength free-electron laser sources like FLASH in Hamburg/Germany, SACLA at Spring8/Japan or LCLS in Stanford/California — couple a large numbers of photons into clusters or bio-molecules, or more generally, extended systems. Within femtoseconds many electrons are released through single-photon absorption. The induced many-electron dynamics depends critically on the photon frequency and the pulse duration. We discuss the various regimes, ranging from nano-plasma termalization [1] to massively parallel ionization [2]. The dynamics can be studied experimentally by measuring electron spectra. We present spectra as obtained by means of a generic model, called Coulomb complexes [3], and from simple analytical considerations.

[1] U Saalmann, I Georgescu, J-M Rost, New J. Phys. 10, 025014 (2008).
[2] Ch Gnodtke, U Saalmann, J-M Rost, arxiv.org/abs/1111.6888
[3] Ch Gnodtke, U Saalmann, J-M Rost, New J. Phys. 13 013028 (2011).

Invited Talk A 3.2 Mon 11:00 V47.03

Ignition and dynamics of doped He nanodroplets in intense few-cycle IR pulses — Siva Krishnan[1], Lutz Fechner[1], Robert Moshammer[1], Joachim Ullrich[1], Frank Stienkemeier[2], •Marcel Mudrich[2], Alexey Mikaberidze[3], Ulf Saalmann[3], Jan-Michael Rost[3], Christian Peltz[4], and Thomas Fennel[4] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Physikalisches Institut, Uni Freiburg, Germany — [3]Max-Planck-Institut für Physik komplexer Systeme, Dresden, Germany — [4]Physics Institute, University of Rostock, Germany

Doped He nanodroplets are widely used as inert, transparent, and cold matrix for spectroscopy of embedded molecules and clusters [1]. When exposed to strong laser fields, however, a few dopant atoms are sufficient to "ignite" avalanche-like ionization that turns the whole droplet into a strongly absorbing nanoplasma [2,3]. We present experiments and model calculations on the ignition and dynamics of rare gas-doped He nanodroplets illuminated by few-cycle laser pulses.

[1] J. P. Toennies and A. Vilesov, Angew. Chem. Int. Ed. 43, 2622 (2004)
[2] A. Mikaberidze, U. Saalmann, and J. M. Rost, Phys. Rev. Lett. 102, 128102 (2009)
[3] S. R. Krishnan et al., Phys. Rev. Lett. 107, 173402 (2011)

Invited Talk A 3.3 Mon 11:30 V47.03

Quantum and classical measures of molecular ultracold plasma dynamics — Jonathan Morrison, Hossein Sadeghi, Markus Schulz-Weiling, Donald Kelloway, Nicolas Saquet, and •Edward Grant — University of British Columbia, Vancouver, Canada

Ultracold plasmas offer laboratory access to an important regime of ionized gases in which moderate densities combine with very low ion and electron temperatures to approach conditions of strong Coulomb coupling. Many examples have been studied in atomic systems under conditions of laser cooling in magneto-optical traps. Work in our laboratory has developed an alternative approach using samples cooled in a seeded supersonic molecular beam. This method yields much higher charged particle densities, and appears to attain comparable or even lower electron and ion temperatures, elevating the prospect of strong coupling. Using a beam, we can readily form plasmas composed of molecular ions. Experiments together with model calculations show that molecular effects play a significant role in plasma evolution. For example, ultracold plasmas show promise as bright sources of electrons. Such utility depends on their properties of expansion and decay. This talk presents new results on the ultracold plasma formed by exciting NO in a molecular beam. Aided by model calculations, we show how molecular processes, including dissociative recombination and collision-induced internal conversion, act to effect the spatial and energetic relaxation of the plasma.