ULTRAFAST AND ULTRACOLD: FINITE PLASMAS UNDER EXTREME CONDITIONS

JAN M. ROST
Institut Max Planck Institute for the Physics of Complex Systems,
Nothnitzer Str. 38, 01187 Dresden
E-mail: rost@pks.mpg.de

Abstract. Over the last decade a new way to generate plasmas of fnite systems has been established using a cloud of ultracold trapped atoms, Killian et al. (2007), and recently even molecules, Morrison et al. (2008). Unusual resonance phenomena result from the soft boundary and finite temperature of those plasmas Fletcher et al. (2006). In general, they provide a unique and very attractive realization to understand plasma dynamics. Firstly, plasma properties in space and time can be mapped out to experimentally easily accessible scales (nano to microseconds and micrometers). Secondly, the strongly coupled regime can be reached where potential energy dominates the kinetic one which implies ordering phenomena culminating in crystallization of quasi neutral plasma without external confinement, Pohl et al. (2004). In parallel, finite plasmas in rare gas clusters have been generated with short and very intense laser pulses Wabnitz et al. (2002). The volume these clusters occupy is about 12 orders of magnitude smaller than in the ultracold case. Correspondingly, the intrinsic time scale of these clusters is about 6 orders of magnitudes faster. Nevertheless, attosecond laser pulses, now available experimentally, will be able to trace the dynamics of these ultrafast plasmas Georgescu et al. (2007).

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