

Abstract Submitted  
for the MAR06 Meeting of  
The American Physical Society

**Nonequilibrium Dynamics of Ultracold Neutral Plasmas** THOMAS

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Dresden, Germany, JAN-MICHAEL ROST, Max-Planck-Institute for the Physics  
of Complex Systems, Dresden, Germany — In a number of recent experiments ul-  
tracold plasmas (UNPs) have been produced by photoionizing laser-cooled atomic  
ensembles [1]. Their very low initial kinetic energies suggest that they are cre-  
ated deeply in the strongly correlated regime. Moreover, UNPs are produced far  
from equilibrium, leading to a complex relaxation dynamics. We present a hybrid-  
molecular dynamics approach [2], to describe the long-time plasma evolution while  
fully taking into account the strongly correlated character of the ionic motion. We  
demonstrate that the method yields an accurate description of recent measurements  
[2,3] and allows to address problems beyond present experimental capabilities [3].  
It turns out that under the conditions in UNPs the commonly applied Bogoliubov  
assumption about a hierarchy of relaxation timescale becomes invalid, resulting in  
an unusual relaxation dynamics connected with a wave-like temperature evolution  
and an ultimate relaxation to a non-equilibrium undercorrelated state.

(1) Y.C. Chen et al., Phys. Rev. Lett. 93, 265003 (2004).

(2) T. Pohl, T. Pattard and J.M. Rost, Phys. Rev. A 70, 033416 (2004).

(3) T. Pohl, T. Pattard and J.M. Rost, Phys. Rev. Lett. 94, 205003 (2005); Phys.  
Rev. Lett. 92, 205003 (2004).

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Date submitted: 30 Nov 2005

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