Mini-conference "Dense quantum plasma simulation" at the APS-DPP meeting Salt Lake City, November 14-18, 2011

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A. Topic Definition

Dense two-component and multi-component non-relativistic plasma with quantum electrons and classical ions, possibly also neutrals

B. Motivation

1. Experimental progress in dense quantum plasmas
    a.) Laser compression of Coulomb matter at NIF and other facilities. New powerful facilities will appear within the next 5 years (such as ELI in Europe)
    b.) Ion beam compression experiments: new facilities in the U.S., new facility FAIR (GSI Darmstadt) under construction
    c.) New x-ray free electron laser facilities (LCLS at SLAC, FLASH at DESY and the future facility XFEL)
2. Continuing interest in dense astrophysical plasmas with similar parameters (e.g. white dwarfs, neutron star crust)
3. Expanding interest and results for high energy density and warm dense matter state conditions.

C. Theoretical challenge

There is a current need for ab initio based treatment of strongly mass-asymmetric plasmas, including strong ionic correlations and quantum degeneracy of electrons and formation of bound states. There exist solutions to some aspects of the problem including quantum electrons and strongly correlated classical ions, but no working computer codes treating the entire plasma with strong electron-ion correlations. There exist activities in various groups, and the symposium aims at bringing these together to foster exchange and new developments.

D. Goal

There exists partial experience in diverse fields of physics including condensed matter physics (treating the initial target material), quantum chemistry (treating the atoms) and nonideal plasmas. Our goal is to bring together experts from those fields to come closer to an integrated simulation of dense quantum plasmas which will have to be multi-disciplinary and multi-scale. The DPP meeting will have substantial value added due to this.

It is expected that the mini-conference will encourage participation from scientists who do not usually attend DPP Meetings, in particular condensed matter scientists, quantum chemists and others. This directly meets the requirements of DPP.

E. Format

2 sessions, total of 13 talks (25 min plus 5 min discussion)
1 poster session as part of a regular poster session

Topics for talks and solicited speakers

I. First principle equilibrium properties of partially ionized plasma from Path integral Monte Carlo simulations (Burkhard Militzer, Berkeley)
II. Effective quantum potentials for dynamic simulations of degenerate electrons in plasmas (C. Dharma-Wardana, NRC-CNRC)
III. Strongly coupled ion dynamics with dynamically screened interaction (Patrick Ludwig, Christian-Albrechts)
IV. Kinetic theory molecular dynamics for inertial confinement plasmas (Michael Murillo, LANL)
V. Quantum Molecular dynamics, i.e. Molecular dynamics combined with density functional theory for electrons (Joel Kress, LANL)
VI. QMD calculation of electrical and thermal transport properties (Michael Desjarlais, Sandia)
VII. Quantum-classical transport concepts in quantum chemistry (Haobin Wang, New Mexico State)
VIII.Quantum kinetic theory for nonequilibrium electrons: from TDHF to Keldysh Green functions (Michael Bonitz, Christian-Albrechts)
IX. Orbital-free DFT (Jean Clerouin, CEA France)

X.-XIII.: four additional speakers to be decided by program committee