SCCS 2014

International Conference on
Strongly Coupled Coulomb Systems

July 27th-August 1st
Santa Fe, New Mexico, USA

15:15–15:30 Contributed **J. L. Belof & J. L. DuBois**, "Variational Path Integral Monte Carlo Approach for Warm Dense Matter"

15:30–15:45 Contributed **Charles Starrett, Jérôme Daligault & Didier Saumon**, "Pseudo-atom molecular dynamics"

15:45–16:00 Contributed **V. Filinov, Yu. Ivanov, M. Bonitz, V. Fortov & P. Levashov**, "Quantum simulation of thermodynamic and transport properties of quark - gluon plasma"

16:00–16:15 Contributed **A. D. Baczewski, L. Shulenburger, M. P. Desjarlais & R. J. Magyar**, "Dielectric Response in Extreme Conditions Using Time-Dependent Density Functional Theory"

16:15–16:30 **Coffee Break – Lumpkin Ballroom North**

16:30–18:30 **Poster Session 1 – Lumpkin Ballroom North**

Poster 1.01 **A. Calisti, S. Ferri & B. Talin**, "Ionization potential depression in hot dense plasmas through a pure classical model"

Poster 1.02 **D. Saumon, C. E. Starrett & J. O. Daligault**, "The calculation of diffusion coefficients in warm and hot dense matter"

Poster 1.03 **Dongdong Kang, Jiayu Dai, Huayang Sun & Jianmin Yuan**, "Nuclear quantum effects on the structure and dynamics of dense hydrogen"

Poster 1.04 **H. D. Whitley, W. E. Alley, J. I. Castor, A. Szoke, J. Nilsen & H. E. DeWitt**, "Solidification and Screening Enhancement in Asymmetric Binary Ionic Mixtures"

Poster 1.05 **Huayang Sun, Jiayu Dai, Dongdong Kang, Jiaolong Zeng & Jianmin Yuan**, "Temperature-dependent interatomic potential based on ab initio simulation"

Poster 1.06 **I. M. Saitov**, "DFT calculation of plasma frequency and free electron density in dense xenon plasma"

Poster 1.07 **In Gee Kim & Michael S. Murillo**, "Quantum Statistical Potentials for Electron-Ion Plasmas in the Random-Phase Approximation"

Poster 1.08 **Jérôme Daligault**, "A step towards a kinetic theory of strongly coupled Coulomb systems."

Poster 1.09 **K. N. Dzhumagulova, E. O. Shalenov & T. S. Ramazanov**, "Influence of dynamic screening on the scattering cross sections of the particles of the dense semiclassical plasma"

Poster 1.10 **L. G. Stanton & M. S. Murillo**, "Impact of Screening and Ionization on Coulomb Coupling in Strongly Coupled Plasmas"

Poster 1.11 **M. T. Gabdullin, T. S. Ramazanov, T. N. Ismagambetova & G. B. Ahtanova**, "Thermodynamic Properties of Semiclassical Partially Ionized Hydrogen and Helium Plasmas"

Influence of dynamic screening on the scattering cross sections of the particles of the dense semiclassical plasma

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In work[1] the effective potential for electron – charge interaction considering both effects of screening and diffraction in the dense semiclassical plasma was presented. The way taking into account of the dynamic screening was proposed in work [2], where the static Debye radius was replaced by the dynamic screening radius:

$$r_o = r_D(1+\frac{v^2}{v_{Th}^2})^{1/2}. \tag{1}$$

Here v is the relative velocity of the colliding particles, v_{Th} is the thermal velocity of the particles in the system. Then the potential from [1] with dynamic screening can be rewritten as [3]:

$$\Phi_{\alpha\beta}(r) = \frac{Z_\alpha Z_\beta e^2}{\sqrt{1-4\lambda_{\alpha\beta}^2/(r_D^2(1+\delta^2))}}\left(\frac{e^{-Br}}{r}-\frac{e^{-Ar}}{r}\right), \tag{2}$$

where $A^2 = \frac{1}{2D^2}\left(1+\sqrt{1-4D_{\alpha\beta}^2/(r_D^2(1+\delta^2))}\right)$; $B^2 = \frac{1}{2D^2}\left(1-\sqrt{1-4D_{\alpha\beta}^2/(r_D^2(1+\delta^2))}\right)$;

$\delta = v/v_{Th}$ is the parameter of the relative velocity of the colliding particles.

In the same way the potential for electron-atom [4] taking into account the effect diffraction and dynamic screening effects has the following form:

$$\Phi_{ea}^{dyn}(r) = -\frac{e^2\alpha}{2r^4(1-4D_{ea}^2/r_o^2)}\left(e^{-Br}(1+Br)-e^{-Ar}(1+Ar)\right)^2, \tag{3}$$

where, $A^2 = \frac{1}{2D_{ea}^2}\left(1+\sqrt{1-4D_{ea}^2/r_o^2}\right)$, $B^2 = \frac{1}{2D_{ea}^2}\left(1-\sqrt{1-4D_{ea}^2/r_o^2}\right)$, $r_o = r_D(1+\frac{v^2}{v_{Th}^2})^{1/2}$.

Based on the new dynamic interactions models the scattering cross-sections of the plasma particles were investigated. Quantum mechanical method of phase functions was used for their calculation.

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[1] Ramazanov T.S., Dzhumagulova K.N. Effective screened potentials of strongly coupled semiclassical plasma. *Physics of Plasmas*. 2002.-Vol. 9.- P.3758-3761

[2] Kremp D., Schalges M., Kraeft W.-D. *Quantum Statistics of Nonideal Plasmas*, Berlin, Springer, 2005. - 326 p.

[3] K.N. Dzhumagulova, G.L. Gabdullina, E.O. Shalenov. Dynamic interaction potential and the scattering cross sections of the semiclassical plasma particles. *Physics of Plasmas*. - 2013. –Vol. 20. – P. 042702.

[4] Ramazanov T.S., Dzhumagulova K.N. and Omarbakiyeva Y.A. Effective polarization interaction potential "charge-atom" for partially ionized dense plasma. *Physics of Plasmas*. 2005. – Vol.12.- P.092702.