DESCRIPTION OF THE PROPOSED PROJECT WORK AND THE AIM OF THE VISIT

Exact results in the equilibrium statistical mechanics of classical two-dimensional Coulomb fluids, obtained through their equivalence with (1+1)-dimensional field theories like the sine-Gordon model, are of my primary interest. According to the correspondence principle, the quantum description of a particle system reduces to the classical one in the high-temperature limit. To describe correctly a quantum Coulomb system at a finite temperature, the long-wavelength plasma oscillations are quantized in terms of collective modes, namely nondispersive bulk and surface plasmons. These plasmons do not account for retardation (relativistic) effects due to the coupling of charged particles to the electromagnetic field radiated just by these particles. During my last visit of B. Jancovici in Orsay within a MISGAM short-visit grant, we succeeded in taking into account retardation effects in equilibrium long-ranged charge correlations at the rectilinear surface of a conductor [arXiv:0811.0295, to appear in Physical Review E]. This was done by applying a fluctuational theory of the electromagnetic field. The result is surprising: the inclusion of retardation causes the quantum formula to take its classical form, for any temperature.

The aim of my next planned collaboration with B. Jancovici in Orsay is the generalization of the above results to Coulomb fluids constrained to an arbitrarily shaped domain, with plain hard walls impenetrable for charges. This problem is related to the calculation of the dielectric susceptibility tensor which describes the linear response of the Coulomb system to a constant external electric field. The tensor, although being defined per unit volume, depends on the shape of the domain. This shape dependence is directly related to the long-range nature of the charge correlations along the domain surface. Our experience with integrable models allowed us to evaluate the dielectric susceptibility tensor for classical Coulomb fluids and specially shaped constraining domains, like a disk or a sphere, by considering the balance of all forces acting on a body in thermal equilibrium [J. Stat. Phys. 114 (2004) 1211-1234]. Now, we would like to generalize the exact classical result to the quantum one, first without retardation effects and afterwards with retardation effects. This will be done by applying the fluctuational theory of the electromagnetic field, both in the bulk and on the surface of the constraining domain.

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CURRICULUM VITAE

Name and First name	: Š A M A J Ladislav
Date and place of birth	: June 21, 1959 in Čadca, Slovak Republic
Nationality	: Slovak
Private Address	: Kuklovská 48, 841 05 Bratislava, Slovak Republic

Education

1974 - 1978: Grammar School in Bratislava
specialization: Natural Sciences and Modern Languages

1978 - 1983: Comenius University in Bratislava, Faculty of Mathematics and Physics
specialization: Theoretical Solid-State Physics
- the subject of my RNDr. Thesis (supervisor Prof. V. Bezák) was the theoretical treatment of recombination processes at grain boundaries in polycrystalline semiconductors
- I graduated in 1983 with honour and I was awarded by the prize of Chancellor of the University

1984 - 1988: Postgraduate studies at Slovak Academy of Sciences, Institute of Physics (supervisor Prof. E. Majerníková)
orientation: Statistical mechanics of homogeneous, inhomogeneous and random Ising models

Degrees

1983: Doctor of Natural Sciences (RNDr.)
1988: Diploma of Ph.D.
2001: The leading scientist at the Slovak Academy of Sciences
2007: DrSc. (the highest scientific title in Slovakia, superior to Ph.D.)

Short-term study stays

1987, 1989: International Centre for Theoretical Physics, Trieste, Italy (1 month)

1988: Joint Institute for Nuclear Research, Institute of Theoretical Physics, Dubna, USSR (3 months)

2000-2001: Laboratoire de Physique Théorique, Université de Paris-Sud, Orsay, France (9 months); collaboration with Prof. B. Jancovici within the framework of a NATO grant

2008: Laboratoire de Physique Théorique, Université de Paris-Sud, Orsay, France (3 months); Visiting Professor

Work

1988-1992, 1996-1997, since 1999: Institute of Physics, Slovak Academy of Sciences, Bratislava, Slovak Republic

1993-1996, 1998: Courant Institute of Mathematical Sciences, New York University, New York, USA; collaboration with Profs. J. K. Percus and J. L. Lebowitz within the framework of NASA and NSF grants

Since 1986: The author or coauthor of 76 SCI publications

Since 1990: lecturer at Comenius University (Bratislava) in the field of exactly solvable models in statistical and quantum mechanics

Since 1997: Principal investigator of grants VEGA (Slovak grant agency) in the field of statistical and quantum mechanics, with 8 co-workers

2001-2008: The member of the editorial board of the *Journal of Statistical Physics* (Springer)

Since 2004: The member of the editorial board of the *Journal of Statistical Mechanics: Theory and Experiment* resp. JSTAT (IOP + SISSA Trieste)

Since 2005: The member of the Steering Committee of the ESF program MISGAM

2007: Prize of the Slovak Academy of Sciences for basic research

Since 2007: Scientific Secretary of the Institute of Physics, SAS

Language knowledge

English, French, Russian: spoken - understood - written

Bratislava, February 3, 2009

L. Šamaj