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Membership of academic societies:
Physical Society of Japan

Research Interest:

- Statistical Mechanics
- Mathematical Physics

Research Summary:

Statistical mechanics concerns basic raws which become valid in the limit of infinite degrees of freedom. It has been investigated in connection with many-body systems and condensed matter problems. Statistical mechanics is the theoretical bases to investigate various physical phenomena with large degrees of freedom, i.e. the bases of statistical physics. Statistical mechanics for non-equilibrium systems does not yet fully formulated except for the cases which lie in the neighborhood of equilibrium. It becomes difficult to investigate but becomes much more rich when interactions in the systems are assumed to be quantum mechanical.

Statistical mechanics is basically an area in traditional physics, but can also be viewed as a representation of some mathematical structure. Statistical mechanics is a subject for mathematical physics, when one concentrate especially on its mathematical structures.

Statistical mechanics relate pure mathematics through integrable systems especially solvable lattice models, e.g. Onsager's exact solution for the two-dimensional Ising model, some of the quantum spin models and vertex models. Quantum group was introduced in connection with the Yang-Baxter equation which is a key concept in this area.

Statistical mechanics has not yet been fully applied for systems with quite large but finite degrees of freedom, and still cannot explain non-equilibrium phenomena. However, in these areas, one can find interesting examples such as social and ecological phenomena, pattern formulations in network systems etc. In addition to it, quantum mechanics itself are now again investigated from the viewpoint of the new information theory that is based on purely quantum mechanical effects.

I will concern these new aspects of the statistical and quantum mechanics, in addition to the problems which I have been investigated, i.e. the problems of phase transitions in two-dimensional lattice models, exact solutions for classical and quantum lattice models.

Major Publications:

[1] K. Minami and M. Suzuki, Non-universal critical behaviour of two-dimensional Ising systems, J. Phys. **A27** (1994) 7301-7311.

[2] K. Minami, The zero-field susceptibility of the transverse Ising chain with arbitrary spin , J. Phys. **A29** (1996) 6395-6405.

[3] K. Minami, The susceptibility in arbitrary directions and the specific heat of general Ising-type chains with uniform, periodic and random structures, J.Phys.Soc.Jpn. **67** (1998) 2255-2269.

[4] K. Minami, An equivalence relation of boundary/initial conditions and the infinite limit properties, J.Phys.Soc.Jpn. **74** (2005) 1640.
[5] K. Minami, The free energies of six-vertex models and the n-equivalence relation, J. Math. Phys. **49** (2008) 033514.

Education and Appointments:

1993 Ph D, School of Science, the University of Tokyo
1995 Assistant Professor, Graduate School of Mathematics, Nagoya University
1998 Associate Professor, Graduate School of Mathematics, Nagoya University

Message to Prospective Students:

Let me list the textbooks which I have used in my seminar. It is recommended to move to original topics after finishing reading your textbooks of the statistical mechanics and the quantum mechanics.

D. N. Zubarev, " Non-equilibrium Statistical Thermodynamics"
L. D. Landau and E. F. Lifshitz, "Quantum Mechanics", "Statistical Physics"
J. von Neumann, "Mathematical Foundations of Quantum Mechanics"
A. Einstein, "Selected Papers of Professor A. Einstein"
A. S. Kompaneyets ,"Quantum Mechanics"
A. Arai and H. Ezawa, "Mathematical Structures of Quantum Mechanics"
M. A. Nielsen and I. L. Chuang, "Quantum computation and quantum information"
N. Masuda and N. Konno, "Complex Networks"
R. Kubo, "Statistical Mechanics"
Y. Higuchi, "Percolation"