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Book Review: *Thermodynamics of One-Dimensional Solvable Models*

Thermodynamics of One-Dimensional Solvable Models. Minoru Takahashi, Cambridge University Press, Cambridge, 1999.

Exactly solvable models are very important in physics. The models of statistical mechanics and condensed matter can be unified in universality classes. Each universality class contain at least one solvable model. Many important physical values can be calculated explicitly in solvable models. They represent the whole universality class. In order to relate these models to experiment one should study thermodynamics. Takahashi's book explains in a clear and pedagogic manner the Bethe ansatz and thermodynamic properties for the most important models: the Bose gas with delta function interactions, quantum spin chains, the continuous nonrelativistic electron gas, and the Hubbard model. Temperature correlations are briefly mentioned in the book.

The book is written so that it can be used as a text, from which the reader will learn the most significant features of the physics of a set of solvable models. It would be a good idea to develop a course based on this book for use in graduate schools.

The author of this book, Minoru is a world-reknowned expert in the field of exactly solvable models in condensed matter physics and statistical mechanics. He has developed fundamental results in the thermodynamics of quantum spin chains and strongly correlated electrons.

On the other hand an essential development of the theory of correlation functions at finite temperature is not included in the book, important results in thermodynamics are also missing. Here is some references for the experts:

- Quantum transfer matrix approach to thermodynamics can be reformulated in terms of nonlinear integral equations. There are only two equations for quantum spin chains. This reformulation clarifies the physical meaning of quantum transfer matrix approach, it is a description of thermodynamics in the spinon basis. For the Hubbard model thermodynamics

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was reformulated in terms of four nonlinear integral equations. The following papers are important: A. Klümper, *Ann. Physik* **1**:540–553 (1992); A. Klümper, *Z. Phys. B* **91**:507–519 (1993); G. Jüttner, A. Klümper, and J. Suzuki, *J. Phys. A* **30**:1881 (1997); *Nucl. Phys. B* **522**:471 (1998); *Physica B* **259**: 1019–1020 (1999); A. Klümper and R. Z. Bariev, *Nucl. Phys. B* **458**[FS]: 623 (1996); C. Destri and H. J. de Vega, *Nucl. Phys. B* **438**:413 (1995) and **504**:621 (1997).

• Correlation length for Bose gas with repulsive delta interaction was calculated in the paper N. M. Bogoliubiv and V. E. Korepin, *Nucl. Phys. B* **257**[FS14]:766–778 (1985).

• Space, time and temperature dependent correlation function in isotropic XY model $\langle \sigma^+(x,t)\,\sigma^-(0,0)\rangle$ was calculated in the paper A. Izergin, V. Korepin, and N. Slavnov, *Phys. Rev. Lett.* **70**:1704–1708 (1993).

• At low temperatures space, time and temperature dependent correlation functions functions in Hubbard model were evaluated by means of conformal approach in the paper H. Frahm and V. Korepin, *Phys. Rev. B* **42**:10553 (1990).

• For electrons with delta interaction space, time and temperature dependent correlation functions were calculated in the paper F. Göhmann, A. R. Its, and V. E. Korepin, *Phys. Lett. A* **249**:117 (1998).

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