Ninnat Dangniam

PHYS 353

Final Project

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4 June 2008

Abstract

Investigating critical phenomena, we introduce the renormalization group (RG) method, a powerful mathematical method not being limited only within the field of statistical physics. We begin with the observed natures of critical phenomena, namely classification of phase transitions, order parameters, critical exponents, scaling laws, and universality classes. We introduce the concept of self-similarity by the calculation of block-spin RG method applied to Ising model. By contrast to mean field theory, this theory can explain universality classes and give us the correct critical exponents. Finally, we present some historical aspect of RG theory.

References

Baierlein, Ralph. *Thermal Physics*. New York: Cambridge University Press, 1999.

Binney, J. J., Dowrick, N. J., Fisher, A. J., and Newman, M. E. J. *The Theory of Critical Phenomena, An Introduction to the Renormalization Group*. Clarendon Press, 1992.

Chandler, David. *Introduction to Modern Statistical Mechanics*. New York: Oxford University Press, 1987.

Huang, Kerson. *Statistical Mechanics*. New York: Wiley, 1987.

Maris, Humphrey J. and Kadanoff, Leo P. "Teaching the Renormalization Group." *American Journal of Physics*. **46**, 652-657 (1978).

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PHYS 353 Winter 2008

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9 May 2008

<div align="center">References</div>

Baierlein, Ralph. *Thermal Physics*. New York: Cambridge University Press, 1999.

Chandler, David. *Introduction to Modern Statistical Mechanics*. New York: Oxford
University Press, 1987.

Fisher, M. E**. "**Renormalization Group Theory: Its Basis and Formulation in Statistical
Physics." *Reviews of Modern Physics*. 70 (1998): 653-81.

Ma, Shang-Keng. *Modern Theory of Critical Phenomena*. Westview Press, 2000.

Maris, Humphrey J. and Kadanoff, Leo P. "Teaching the Renormalization Group."
American Journal of Physics. 46 (1978): 652-57.

Tobochnik, Jan. "Resource Letter CPPPT-1: Critical Point Phenomena and Phase
Transitions." *American Journal of Physics.* 69 (2001): 255-63.