PHYS-7654 Basic Training in CMP, Spring 2009 Prof. Eun-Ah Kim

Schedule

Lect. 1 I. Introduction
II. Quantum Statistical Mechanics & Quantum Field Theory
A. Classical vs quantum partition functions
(probability density vs density matrix)
B. Density matrix and path integral

Lect. 2 C. Quantum -> Classical mapping
- When it works: 1D Josephson junction array
- When it does not work.
D. Dynamics & Thermodynamics

Lect. 3 III. Quantum Phase Transitions
A. Scaling at T=0
B. Finite temperature
C. Quantum to classical crossover

Lect. 4 IV. How to identify QPT
A. Tuning parameter
B. Universality class <- Scaling exponent
C. Modeling
D. Triplon condensation in spin-dimer compound

Lect. 5 V. Field driven QPT in spin-dimer Hamiltonian part I (Theory)

Lect. 6 part II. Comparison with Experiment

References

• “RMP Colloquia: Continuous quantum phase transitions”, Sondhi, Girvin, Carini, Shahar, RMP **69**, 315 (1997)
•“Quantum phase transitions”, S. Sachdev, Cambridge press (1999).
• “Quantum phases and phase transitions of Mott insulators”, Sachdev, arXiv: cond-mat/0401041,
• “Dimensional reduction at a quantum critical point”, S. E. Sebastian et al, Nature **441**, 617 (2006).