Harvard University       Physics 268r       Spring 2012
Special Topics in Condensed Matter Physics. Quantum Many-Body Systems

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Course Meetings           TTh, 11:30 - 1:00 in Lyman 250
Course Grade             Grading will be based on class participation (10%), homeworks (50%),
                        and final projects (40%).

Office hours             to be arranged

This course will review field theory methods and Greens function approach to quantum
many-body systems. Subjects discussed will include interacting electron and phonon sys-
tems, magnetism and superconductivity, systems with disorder, low dimensional systems,
systems of ultracold atoms, nonequilibrium phenomena. Prerequisite: Applied Physics 295a
or equivalent.
Tentative Outline of Lectures

1. Introduction to Green’s functions. Schroedinger equation approach. Lippman-Schwinger equation.
2. Path integral approach to quantum mechanics.
4. The partition function for Many-particle system. Functional integrals for Bose particles.
6. Analytic properties of Green’s functions. Linear response theory. Relation to experiments: STM, ARPES, RSXS.
10. Fermi edge singularity problem.
11. Disordered fermionic systems.
Useful books


• *Methods of quantum field theory in statistical physics*, A.A. Abrikosov, L. P. Gorkov, I.E. Dzyaloshinski, Dover publications (1963)