August 15th, 2011

Tentative Syllabus
Physics 7141: Many-Particle Quantum Mechanics - Fall 2011

Professor Carlos Sa de Melo (carlos.sademelo@physics.gatech.edu)
• *Office:* N112, 1st floor Howey.
• *Office Hours:* 3:00–5:00pm Wednesdays, or by appointment.

Text: *Suggested books*
1) "Methods of Quantum Field Theory in Statistical Physics", by Abrikosov, Gorkov and Dzyaloshinski.
2) "Quantum Theory of Many-Particle Systems", by Fetter and Walecka.
3) "Functional Integrals in Quantum Field Theory and Statistical Physics" by Popov.

Topics to be covered to describe the many-body quantum mechanics of interacting bosons and fermions are:

1) First and Second Quantization
2) Diagrammatic Perturbation Theory at Zero and Finite Temperatures
3) Green's Functions
4) Statistical Physics of Many-Particle Systems
5) Broken Symmetry and Landau Classification of Phase Transitions
6) Theory of Quantum Fluids
7) Bose-Einstein condensation (BEC), Helium-4 and ultra-cold bosons
8) Interacting Fermi Systems: Fermi Liquid Theory
9) Superconductivity and Superfluidity
10) Variational Methods for Superconductors and Magnetic Systems
11) Path and Functional Integral Methods

Other (possibly) useful material:
As topics are covered, additional references will be provided in class for follow-up reading, including some recent review articles. I will make the effort to connect theory and experiment as much as possible, as Physics is truly an experimental science.

Grading:
Grades will be based on problems sets, a written term paper on topics to be provided and an oral presentation based on the term paper.

Tentative exam dates:
There will no quizzes or exams in this course, but we will have weekly problems sets assigned. The problem sets are to be returned at the scheduled dates and are due in class.

Course Policies:

1. **Honor-code:** Students are allowed to consult with one another and to seek other resources, but each student must turn in their *own* original work. Violations of the Honor Code will be treated on a case-by-case basis, but students should understand that potential consequences can be severe, including dismissal from Georgia Tech (see links at www.honor.gatech.edu).

2. **Due Dates:** The topics of the term paper and the scheduling of the oral presentation will be announced in class, and will be due at the end of the semester. The due dates for problem sets are one week after each set is handed out.