

Tentative Syllabus for Many Body Physics

Many Body Physics (T Th W 9:00-10:20 in room 202, Coates Hall) is a one-semester advanced course intended for second-year physics graduate students. Several texts can accompany this course (please see my course web page for a complete list). I prefer Piers Coleman's on-line text, and will roughly follow his exposition. Please download it at <http://www.physics.rutgers.edu/~coleman/mbody.html>. I also find that *Methods of Quantum Field Theory in Statistical Physics*, by Abrikosov, Gorkov and Dzyaloshinski (AGD, Dover) is an excellent reference as is *Quantum Many-Particle Systems* by Negele and Orland (NO, Addison Wesley). Another useful (and rather formal) reference is *Quantum Theory of Many Particle Systems*, by Fetter and Walecka (Dover). You will also find *Many-Particle Physics*, by Jerry Mahan to be useful.

Lecture videos will also be available on the course web page.

Rough Outline of the Course The first few weeks of the course will focus on basics of why we must abandon first quantized wavefunction based formalism for second quantization and Green functions. The next few weeks will be used to develop the many-body formalism. Next, I plan to illustrate this formalism by discussing the usual hierarchy of approximations (RPA, FLEX, parquet, dynamical mean field, DCA), or the theory of superconductivity, etc. To a large extent, the latter part of the course will be driven by the research needs of the students.

Grading and Important Dates

The course will be graded on the homework, class participation and the presentations. I encourage you to work together on all assignments, and I expect only one homework or class project to be handed in in paper format from all of you. Also, I expect that you will all participate in homework presentations. The class presentations should rotate between students (so that the same student is not always presenting, etc.) and I will select one of you to be the lead for each homework/presentation.

The 2015 calendar is linked on the main course web page.