

READING LIST

Lectures on *Weakly and Strongly Correlated Quantum Systems*

**John Chalker, Oxford University**

**Preparation**

The most important thing is to be familiar with the use of creation and annihilation operators in quantum mechanics. This is covered in many books, including:

E. K. U. Gross, E. Runge, and O. Heinonen  
Many-particle Theory (Adam-Hilger).

R. P. Feynman  
Statistical Mechanics (Addison-Wesley)  
*Chapter 6 of this book provides quite a compact treatment of the main ideas.*

H. J. Lipkin  
Quantum Mechanics: new approaches to selected topics  
*Chapter 5 of this book covers the main ideas.*

E. Merzbacher  
Quantum Mechanics (Wiley)  
*Chapters 20 and 21 treat many-particle systems.*

For some more inspirational reading, see R. B. Laughlin's Nobel Prize lecture, on *Fractional Quantization*, in Rev. Mod. Phys. **71**, 863-874 (1999).

**Reference**

I hope that the following reading list will be useful after the Summer School has finished.

General Texts:

P. W. Anderson *Concepts in Solids*, Benjamin (1963).  
Perhaps the best place to start reading about quantum-mechanical aspects of solid state physics at a graduate level.

C. Kittel *Quantum Theory of Solids*, Wiley (1963).  
(N.B. *not* the undergraduate text by the same author). Reasonably simple treatment of many of the longer-established topics.

P. W. Anderson *Basic Notions in Condensed Matter Physics*, Benjamin (1984).  
An advanced discussion of some of the important ideas in the subject.

Some Reviews and Monographs:

D. Pines and P. Nozieres *The Theory of Quantum Liquids, Volume 1*, Addison Wesley (1989). A standard account of Fermi liquids.

S. M. Girvin *The Quantum Hall Effect: Novel Excitations and Broken Symmetries* Lectures delivered at Ecole d'Ete Les Houches, July 1998; cond-mat/9907002  
A reasonably recent review of quantum Hall physics.

Books and articles emphasising techniques:

For an up-to-date view of the subject, see lecture notes by Alex Altland (Köln) and Ben Simons (Cambridge), on *Quantum Field Theory in Condensed Matter Physics*. These are currently available at [http://www.thp.uni-koeln.de/~alexal/qft\\_ss01.ps](http://www.thp.uni-koeln.de/~alexal/qft_ss01.ps), and will, I hope, appear in due course as a book.

A. Auerbach *Interacting Electrons and Quantum Magnetism*, Springer (1994).  
A reasonably gentle introduction to a range of current theoretical ideas.

J. W. Negele and H. Orland *Quantum Many-Particle Systems*, Addison Wesley (1987).  
A treatment of many-body theory based on path integrals.

A. A. Abrikosov, L. P. Gorkov and I. E. Dzyaloshinski *Methods of quantum field theory in statistical physics*, Dover (1975).  
One of the standard references for many body theory based on Green functions and diagrammatic calculations. Affordable.

G. D. Mahan *Many-Particle Physics*, Plenum (1990).  
A very detailed treatment of Green function techniques in many body theory.

A. M. M. Tsvetlik *Quantum Field Theory in Condensed Matter Physics*, Cambridge (1995).  
An overview of more recent and advanced ideas than those covered by Abrikosov, Gorkov and Dzyaloshinski or by Mahan.

A clear introduction to bosonization is given by J. von Delft and H. Schoeller, in: *Bosonization for Beginners — Refermionization for Experts*, cond-mat/9805275 or *Annalen Phys.* **7**, 225-305 (1998).

## Lectures on *Statistical Physics*

**Martin Evans, Edinburgh University**

The course overviews the topics of Phase Transitions & Collective Phenomena and Stochastic Dynamics.

Some students will have attended full courses in these areas in their M.Phys. or during their first year of postgraduate studies. These students may well have already gone further than the scope of the present course; others, may not have seen any statistical mechanics beyond Boltzmann, Fermi-Dirac and Bose-Einstein distributions and that will have been a few years ago. For the latter cohort, the best preparation would be to dig out your statistical mechanics notes and remind yourselves of the concepts of Boltzmann distribution, free energy and phase transitions; also random walks.

I found the following texts most useful when I was preparing these lectures

Yeomans, J. M.. - *Statistical mechanics of phase transitions*. - Oxford : Clarendon Press, 1992

Goldenfeld, Nigel. - *Lectures on phase transitions and the renormalization group*. Reading, Mass.; Wokingham : Addison-Wesley, Advanced Book Program, 1992.

Cardy, John L.. - *Scaling and renormalization in statistical physics*. - Cambridge : Cambridge University Press, 1996. - (Cambridge lecture notes in physics ; 5)

## Lectures on *Superconductivity*

**James Annett, Bristol University**

Annett, J. F. *Superconductivity, Superfluids and Condensates* (Oxford Master Series in Condensed Matter Physics, 2004)

## Lectures on *Soft Condensed Matter*

**Julia Yeomans, Oxford University**

Reading: a good, gentle intro is

Jones, Richard *Soft Condensed Matter* (Oxford Master Series in Condensed Matter Physics, 2002)

## Lectures on *Electronic Structure*

**Ian Morrison, Salford University**

Texts I have partially based the course on are:

- Atomic and Electronic Structure of Solids - Efthimios Kaxiras (Cambridge, 2003)
- A Quantum Approach to Condensed Matter Physics - P.L.Taylor and O.Heinonen (Cambridge, 2002)

Also of interest are:

Electronic Structure of Materials - A.P.Sutton (Oxford, 1993)

Solid State Physics - Ashcroft and Mermin

Introduction to Solid state physics - Kittel

Density Functional Theory of Atoms and Molecules - Parr and Yang (OUP, 1989)