PHYSICS 636, SOLID STATE II: BOOKS

Christopher Henley, spring 2005

My basic "text" will be set of weekly lecture notes ("Modern models of Solid States"), which will be handed out as the semester goes on; I will try and make them available on the web (using an unlinked address I will tell you.)

No books were ordered at the bookstore this year; those who want some recommended texts can probably find them used via the internet. Books on this list with library call numbers are at Physical Sciences Library. I'm placing a few books on reserve at Physical Sciences Library (marked "(R)" on the list); the best of the others are mostly on 7-day circulation already. See me if you have trouble getting a book (maybe I have it myself!).

The following list begins with the texts most related to the course (most of which are on reserve), and afterward is organized by topic. Books with "*" are (or were) available in the LASSP research library on the 5th floor of Clark.

*Philip W. Phillips *Advanced Solid State Physics* (2002).
Westview Press (Perseus Books), $55.00 (paper)
(R)QC176 .P46x 2002

This is the first recent book that corresponds to the full course content of P636. I will point out the relevant sections in all reading assignments, but will not otherwise follow it. This has relatively simple introductions to many standard topics (including superconductivity), and more detailed stories about famous models, such as the spin-1/2 Kondo impurity, or the Luttinger liquid.

A. A. Abrikosov, *Fundamentals of the Theory of Metals* (1988)
(R)QC176.8.E4 A16 1988

Despite its title, this text covers (excellently) most topics of P636 – quantum transport, magnetism, and superconductivity. However, it was quite expensive ($\sim$ $90 paperback) and was lately out of print. A (licensed) photocopied edition was Prof. Brouwer's primary text for P636 last year (2004), and I suggest borrowing these copies from senior grad students; if there's sufficient demand this year, I'll consult with the Cornell bookstore about organizing another printing.

Laurent-Patrick Lévy, *Magnetism and Superconductivity*
Springer-Verlag (2000); trans. (S. Lyle) from French original (1998).
– This is appropriate, and in more detail, for most of my topics. Somewhat expensive at $\sim$ $65.
(R)QC753.2 .L49513x 2000

*Robert M. White and Theodore H. Geballe *Long Range Order in Solids* (1979).
This was originally published as Supplement 15 to the series, *Solid State Physics*), and is usually found there in libraries (look there for 2nd copy in LASSP library too)
QC173.S68 suppl. 15
– Rich in phenomenology of the hot experimental topics of 20 years ago, especially phase transitions. Sometimes more advanced in level than Phys 636. Not always self-contained in its derivations.

*P. W. Anderson, *Basic Notions of Condensed Matter Physics* (1984).
(R)QC 173.4.C65 A54 1984
– Philosophy about universal principles of broken symmetry, adiabatic continuity, and model building, useful for Part I of 636. Doesn't teach details, rather illuminates those you already know. Added reprints of important papers by P.W.A. and others. Special emphasis on the Kondo problem (also the renormalization group, not covered in 636.).

*P. W. Anderson, *Concepts in Solids* (1963).
Anderson's first version of the same story is crisper, a classic. (Chapters 3ff are related to P636).

Philip L. Taylor and Olle Heinonen, *A Quantum Approach to Condensed Matter Physics* (2002)

Original edition 1970, renovated recently with quantized Hall effect, mesoscopic transport, and density-functional theory. This covers many of our topics, at the level of the advanced chapters of Ashcroft & Mermin (and overlapping with A&M's content). My impression: clear writing, not too many equations, and good choice of the most important points.

Walter A. Harrison, *Solid State Theory* (1970).

QC 176.H32

– The first half of this book corresponds to P 635, the second to P 636. Fairly obsolete, but at $\sim$ \$14 new, it's the second best textbook bargain in condensed matter! (after Goodstein's *States of Matter*.)

*Neil W. Ashcroft and N. David Mermin, *Solid State Physics* (1976).

QC 176.A83

I presume you all have copies of Ashcroft & Mermin, which will be referred to on rare occasions.

Superconductivity texts

Michael Tinkham *Introduction to Superconductivity* (1975).

(R)QC 612.S8 T58 (NOT in LASSP library)

– Written by an experimentalist, this is **the** best entry to the basic theory and goes on to many applications of the (macroscopic) Ginzburg-Landau theory to experimental situations. My lectures on superconductivity evolved from Tinkham's presentation. Buy it, if you expect ever to work on superconductivity.

J. R. Schrieffer, *Theory of Superconductivity* (1963).

QC 612.S8.S37 – Very, very clear presentation of the *microscopic* theory. Very self-contained: Greens functions are introduced in the middle, in a pedagogical chapter.

*Pierre Gilles de Gennes, *Superconductivity of Metals and Alloys* (1966)

QC 612.S8 G33 1966

– The other classic book on superconductivity; my impression is it has tidbits not in Tinkham or Schrieffer, but is less of a text book.

*ed. R. D. Parks, *Superconductivity, vol. I and vol. II* (1969).

QC 611 S948 (7-day loan)

– The very well-known collection of review articles summarizing the state of the art at the end of the 60's, the golden age of superconductivity. It is THE basic reference for more detailed and advanced questions than those asked in this course or found in the textbooks.

J. B. Ketterson and S. N. Song, *Superconductivity* (1999).

– This text includes detailed derivations of some recent topics.

Magnetism texts

Robert M. White, *Quantum Theory of Magnetism, 2nd ed.* (1983).

– This text, with Yosida's, is my reference for the magnetism topics. Its only drawback is occasionally to misplace the emphasis or indulge in derivations rather than highlight the physical ideas.

Kei Yosida *Theory of Magnetism* (1996).

(R)QC 753.2.Y6713x 1996

– This text and White's are the best graduate texts on the sort of magnetism topics usually covered in Physics 636. Yosida's flavor is sometimes outdated since the original Japanese edition was written circa 1970.

*Patrik Fazekas *Lecture Notes on Electron Correlation and Magnetism* (1999)

– The best up-to-date text on magnetism, centered on the Hubbard model.

*Assa Auerbach, *Interacting electrons and quantum magnetism* (1994)
QC 176 .8 .E4 A94x 1994
– Also a field theory slant, at a more elementary level. (Starts at same point as 636, develops path integrals but not Greens functions). Quantum magnetism survey.

*Daniel C. Mattis, *The Theory of Magnetism, vol. I* (1987).
QC 753.2.M44
– Introduces microscopics of magnetism. Ancient ($\sim$ 1966) version may be better.

Stephen Blundell *Magnetism in Condensed Matter* (2001)
– Current and complete in coverage of magnetism topics; at senior undergraduate level.

*ed. G. T. Rado and H. Suhl, *Magnetism, vols. I – V (series, 1963 – 1973)*
QC 753 .R13
– Roughly the analog of the Parks superconductivity volumes, but for magnetism. (The golden age of magnetism was also the 60's.)

General (or structural) texts

P. M. Chaikin and T. C. Lubensky, *Principles of Condensed Matter Physics* (1995)
QC 173 .454 C48x 1995 (I will place this on 7-day reserve!)
– A good text with broad coverage of topics – but all from the $\hbar = 0$ realm, so it belongs more with P 653 than P 636. Very strong on symmetry breaking, elasticity theory, and long-wavelength dynamics.

Gerald Burns, *Solid State Physics* (1985).
QC176.B96 S72
– Starts out elementary, but the ending (chapters 13-18: optical properties, structural phase transitions, magnetism, superconductivity, surface science) has great overlap with 636. Abundant experimental information, but awkwardly organized and written.

A. Isihara, *Condensed Matter Physics* (1991).
QC 173.4.C65 I85x 1991
– A good choice of topics: fermi liquids, heavy fermions, electron-hole droplets, quasi-1D systems, quantum Hall effect, and quantum transport. But somehow doesn't really explain any topic.

Eduardo Fradkin, *Field theories of condensed matter systems* (1991)
QC611.98.H54 F73x 1991
– Best general view of recent condensed matter field-theoretical models. A bit beyond our level. Relevant to quantized Hall effect, quantum antiferromagnets (incl. spin chains), exotic high-T_c theories, Luttinger liquids, Kondo effect, and Hubbard models.

*John W. Negele and Henri Orland, *Quantum Many-particle Systems* (1988)
QC174.17.P7 N38
– Also a field theory view, but with more emphasis on techniques (especially Green's functions, and also path integrals). Not experimental facts.

*John M. Ziman, *Principles of the Theory of Solids* (1972).
QC 176.Z71 P9 1972
– Sometimes idiosyncratic in presentation, but careful and thoughtful.

O. Madelung, *Introduction to Solid State Theory* (1978)
QC176.M18 1978
– Text in basic solid state, containing derivations that others skip. Also useful for quantum transport (Anderson localization, etc.)