INTRODUCTION TO PHYS412 FOR 2021

ADVANCED SOLID STATE PHYSICS (AND NANOTECHNOLOGY)

Lecturer: Simon Brown *(~18 lectures)*
Room ER417

Solid state physics and nanotechnology are among the most important subjects in modern physics – they underpin the understanding of modern electronic devices and are the basis of many, many new physics discoveries (check out the list of Nobel prizes in the last 30 years e.g. graphene, the quantum Hall effect, integrated circuits). At the core of these subjects is the behaviour of the electrons in materials, which can be understood using quantum mechanics.

*The aim of this course is for you to learn about **band structures** i.e. the electronic properties of metals and semiconductors, and especially the concepts of **k-space** and the Fermi surface. These allow us to understand the main properties of many materials and are essential for an understanding of most current research in solid state physics / nanotechnology. The final section of the course focuses on modern devices (e.g. transistors, semiconductor lasers) that use the understanding we will have developed.*

Textbooks

(Introduction to) Solid State Physics by:

Hook & Hall	(Recommended – a bit easy)
Note: e-book available on library website	
Ashcroft & Mermin	(Recommended – a bit hard)
Myers	(Recommended – a bit easy)
Kittel	(Not recommended by me!)

SHORT COURSE OUTLINE

	No. of lectures
▪ Band Theory	~ 12
▪ Low Dimensional Semiconductors and Devices	~ 6

Because of the small class size the format and timetable of the lectures will be relatively informal.

Notes

1) I am going to operate the lectures as discussion classes. You will need to read the assigned portion of the lecture notes *before* each class. You will get credit for *showing* that you have done the pre-reading, and for *active* participation in the class.

This does *not* mean that you have to have understood everything. But if you have tried to understand the material you will be able to be clear about what the tricky points are, and to ask good questions.

2) Often you will find that the exercises highlighted in the lecture notes are very similar to the assignment problems, so don't throw your notes/working away!

3) I intend to teach 3 lectures a week for at least a few weeks of term 1. This means that

- we will finish the course in May (at the latest), and
- we will be going *fast* – **you will need to be really focused to keep up**

Assessment

Participation	10%
3 Assignments	7% each
1 Test: (*Probably on Tuesday 23 March*)	9%
Total Internal Assessment	*50%*
Exam	50%