Structure of Matter Course Guide
N.J.Ekins-Daukes
May 2016

An important part of physics concerns explaining why bulk matter is structured the way it is and behaves the way it does. Matter is made up of atoms, so we can try to understand its properties in terms of the behaviour of its atoms. Translating from atomic-scale (microscopic) behaviour to everyday-scale (macroscopic) phenomena is, however, extremely complicated, and this topic will occupy several courses throughout the Physics degree programme. Structure of Matter is the first of these. It aims to introduce you to some of the crucial ideas and concepts which you will meet again and again in subsequent years.

Lectures

There will be 13 lectures spread over 4 weeks this term - for this reason it is extremely important to keep up with the workload at the time of delivery (especially as there are only 13 days between the final lecture and the exam for this course). Each lecture aims to be fairly self-contained (though not always), and, after this initial introductory lecture, each has a number and a title. The titles and dates on which they take place are:

1. Atoms (5 May)
2. The ideal gas (7 May)
3. The first law of thermodynamics (8 May)
4. Thermodynamics of gases (12 May)
5. The Boltzmann law (13 May)
6. Distribution functions (14 May)
7. Equipartition of energy (15 May)
8. Forces between particles (19 May)
9. Non-ideal gases (20 May)
10. Phase changes (21 May)
11. Properties of fluids (22 May)
12. Other states of matter (27 May)
13. Revision lecture (29 May)

Problem sheets and assessed problems

There will be three problem sheets in total for this course, covering lectures 1-3, 4-6, and 7-12. Each will be released on the Friday of the first 3 weeks. The problem sets will also include a list of the main learning outcomes from the previous few lectures and supporting notes. They will usually contain conceptual questions.

Nb. some of the learning outcomes might include items from the problem sheets as well as the lectures and notes.
(for which no solutions are provided), *numerical* problems, *tutorial* questions and some *assessed* problems. Numerical answers will be released with the problem sheet, whilst full solutions will be released on the Wednesday of the following week.

**Support**

**Structure of Matter** is the first of several courses which study the properties of matter. For instance, in the Second Year there are four such courses: *Thermodynamics*, *Statistical Physics*, *Atomic Physics*, and *Solid State Physics*. All the subsequent courses will build on the basic concepts introduced here, for example, the connection between energy and temperature. This course assumes you are familiar with material from the First Year *Mechanics*, *Vibrations and Waves* and *Electricity and Magnetism* courses.

**Further reading**