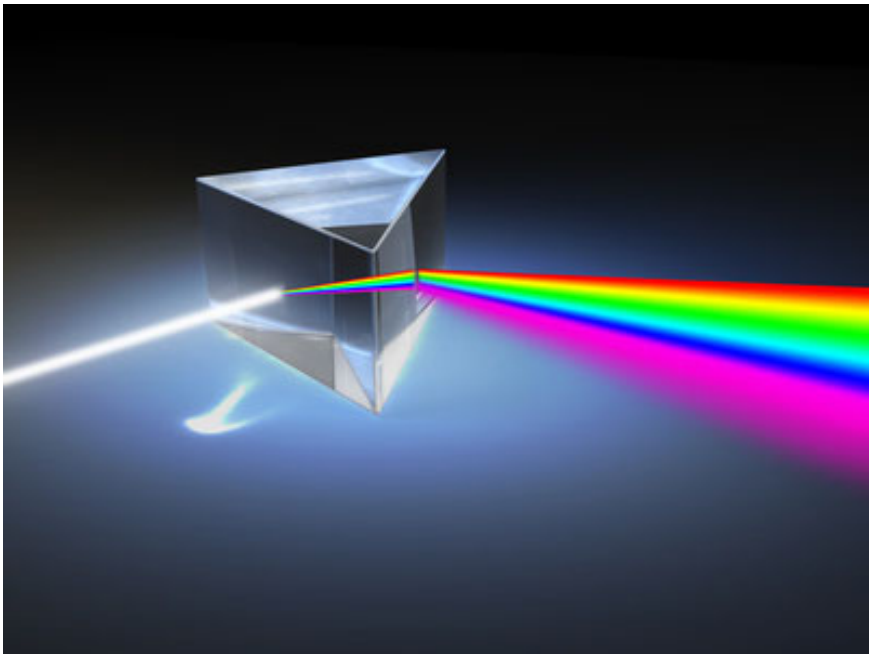
Spectroscopy

Dr. Marcel Drabbels



EPFL

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1 Introduction

1.1 General comments

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Documentation – Lecture notes, exercises, and solutions can be downloaded via Moodle.

Exercises - **Solving problems is an essential part of the course**. I encourage you not only to come to the exercise sessions, but also to work on the problems before you come.

Reference Books

Primary References:

- J. M. Hollas, *Modern Spectroscopy*
- C. H. Townes and A. L. Schawlow, *Microwave Spectroscopy*
- D. A. McQuarrie, *Quantum Chemistry*

Secondary References:

- G. Herzberg, *Molecular Spectra and Molecular Structure. I. Spectra of Diatomic Molecules*
- G. Herzberg, *Molecular Spectra and Molecular Structure. II. Infrared and Raman Spectra of Polyatomic Molecules*
- G. Herzberg, *Molecular Spectra and Molecular Structure. III. Electronic Spectra and Electronic Structure of Polyatomic Molecules*

This course will give you an introduction spectroscopy. In the time we have here we can only cover the basics, but once you understand these basics you will be able to go on and learn about more advanced topics on your own. It is therefore not important exactly how much material we cover in class. What I am most concerned about is that you understand the material that we do cover. If we don't get through everything that is no problem, as long as you understand what we discussed during class. My goal is that everyone understands the material. This puts also a certain burden on you, *i.e*. you should ask questions if a subject or point made is not clear to you. When you leave the classroom you should feel that you understand everything that I covered.

1.2 Usefulness of Spectroscopy

Spectroscopy can be broadly defined as the interaction of light with matter by which molecules make a transition from one quantum state to another. It is at work everywhere around us determining everything from the color of your clothes to the color of the sky. It is responsible for the lasers that scan the bar-codes at Migros, the ones that connect computers over the internet and the ones that determine the distance to the moon. Spectroscopy forms the basis for understanding problems like global warming and the ozone hole.

Spectroscopy provides innumerable ways to learn about chemistry in the research laboratory. One can use it to monitor how fast a reaction happens, to determine how chemistry proceeds on surfaces, to learn how energy flows within and between molecules, to assist in the synthesis of new molecules. It also provides the basis for remote diagnostics of chemical systems in the real world, such as combustion processes in automobile engines, chemistry in the atmosphere and cancer photo-therapy. It is essential in organic and inorganic chemistry for the identification for new compounds. It will also form the basis for understanding some of the TP experiments in the 6th semester.