

Zeeman Effect

Summary:

To understand the atomic physics involved in the Zeeman effect and to measure the Zeeman splitting of the red cadmium spectral line as a function of applied magnetic field. Hence, to determine the value of the Bohr magneton.

Learning Goals:

- Understand the effect of a magnetic field on magnetic dipole moments and hence that atom's energy levels.
- Understand the operating principles of a Fabry-Perot interferometer.
- Determine the value of the Bohr magneton.
- Understand the polarisation of the components of the split spectral line.

Output:

In this experiment, a Fabry-Perot interferometer, a cadmium spectral lamp and an electromagnet will be used to observe Zeeman splitting. From the splitting data the Bohr magneton can be verified.

To demonstrate to the marker that you have achieved the learning goals, please present the following:

- Calibration curve for Magnetic field and Voltage.
- Observe Zeeman splitting using the Farby-Perot rings.
- Discuss how the Fabry-Perot interferometer operates.
- Obtain a value for the Bohr magneton.

Continuous wave NMR

Summary:

Nuclear magnetic resonance (NMR) is a powerful experimental technique that has extensive applications, not only in Physics but in Chemistry, Biochemistry and Medicine. This lab will provide a fundamental understanding of magnetic resonance. The lab will reintroduce terms from quantum mechanics such as Larmor frequency and relate it to an experimental system.

Learning goals:

- Explain magnetic spin resonance and familiarisation with Larmor frequency in an experimental setting.
- Experimentally measure the magnetic moments and explain the apparatus and methods used to extract the data.

Output:

In the lab, you will apply a continuous radiofrequency (RF) magnetic field to the sample and detect energy absorbed by the magnetic dipoles. This signal is applied by a spectrometer with a modulated signal and understanding how the modulation changes the signal detected is crucial in the analysis of the data.

To demonstrate to the marker that you have achieved the learning goals, please present the following:

- An explanation of how the field modulation is used to detect a signal and how it was executed with reference to a diagram of the apparatus.

Measure the magnetic moments of hydrogen, fluorine and an unpaired electron and comment on any discrepancies with accepted values. Discuss what analysis was needed in order to extract the magnetic moments and methods of improvement