

## Atomic and nuclear physics

Atomic shell

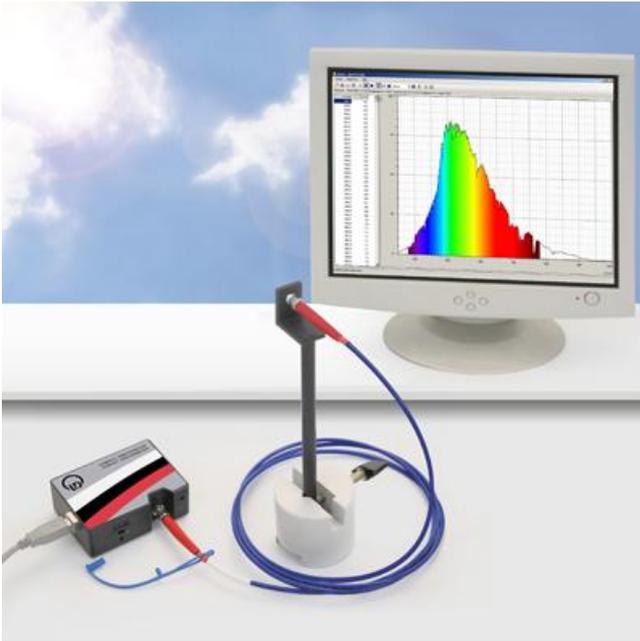
*Emission and absorption spectra*

Recording Fraunhofer lines  
with a compact  
spectrometer

### Description from SpectraLab (467 250)

For loading examples,  
please use the SpectraLab help.

## Recording Fraunhofer lines



### Experiment description

Fraunhofer lines are dark lines in the sun's spectrum. They were first systematically studied by Joseph von Fraunhofer. Such lines are created because gasses in the photosphere, i.e. the sun's visible surface, absorb a portion of the sun's light. Thus the Fraunhofer lines make it possible to draw conclusions about the chemical composition and temperature of the photosphere. In this experiment, a spectrum of the sun or sky will be recorded and the wavelengths of absorption lines will be determined.

### Required equipment

1	Compact spectrometer, physics	467 251
	or	
1	Compact UV spectrometer, physics	467 261
1	Fibre holder	460 251
1	Saddle base	300 11
1	PC with Windows 2000/XP/Vista/7/8	

### Experiment setup (see picture)

Direct the fibre holder with fibre optic waveguide toward the sky.

### Performing the experiment

- Activate  to begin a new measurement.
- Select the **Intensity I1** display.
- Start the measurement with .
- Align the fibre optic waveguide to maximise intensity. Adapt the integration time, either directly or with  or , such that maximum intensity lies between 75 % and 100 %.
- Put a light-tight cover over the fibre optic waveguide's entrance slit to measure the background spectrum.
- Open the **Offset I0** display.
- The displayed spectrum will be removed from subsequent measurements as the background spectrum.
- Change back to the **Intensity I1** display.
- Remove the cover over the fibre optic waveguide's entrance slit.
- Use the  control to stop the measurement or save the spectrum with .
- If desired, record further spectra, e.g.
  - in different skyward directions
  - comparing sky to clouds
  - at different times of day

## Evaluation

The measured spectrum shows a broad distribution with many minimums. To determine the wavelength of a minimum, a vertical line can be drawn and the wavelength read.

The minimums correspond to the absorption lines of various elements. The most prominent lines are listed in the table below along with their respective elements. For the most part, absorption occurs in the sun's photosphere. The lines A, B, a, y and Z occur due to absorption of O<sub>2</sub> in the earth's atmosphere.

Other absorption lines or bands (including those at 720 nm and 810 nm) can be traced to water vapour in the earth's atmosphere.

Symbol	Element	Wavelength (nm)
y	O <sub>2</sub>	898.765
Z	O <sub>2</sub>	822.696
A	O <sub>2</sub>	759.370
B	O <sub>2</sub>	686.719
C	H <sub>α</sub>	656.281
a	O <sub>2</sub>	627.661
D <sub>1</sub>	Na	589.594
D <sub>2</sub>	Na	588.997
D <sub>3</sub>	He	587.565
E <sub>2</sub>	Fe	527.039
b <sub>1</sub>	Mg	518.362
b <sub>2</sub>	Mg	517.270
b <sub>3</sub>	Fe	516.891
b <sub>4</sub>	Fe	516.751
b <sub>5</sub>	Mg	516.733
c	Fe	495.761
F	H <sub>β</sub>	486.134
d	Fe	466.814
e	Fe	438.355
G'	H <sub>γ</sub>	434.047
G	Fe	430.790
G	Ca	430.774
h	H <sub>δ</sub>	410.175
H	Ca <sup>+</sup>	396.847
K	Ca <sup>+</sup>	393.368
L	Fe	382.044
N	Fe	358.121
P	Ti <sup>+</sup>	336.112
T	Fe	302.108
t	Ni	299.444

## Note

Many Fraunhofer lines are already drawn into the above described examples. These examples make it easy to create templates for one's own measurements. To do this, simply delete the spectrum with  after loading the example. The drawn lines will remain in place. Subsequently a new spectrum can be recorded with .