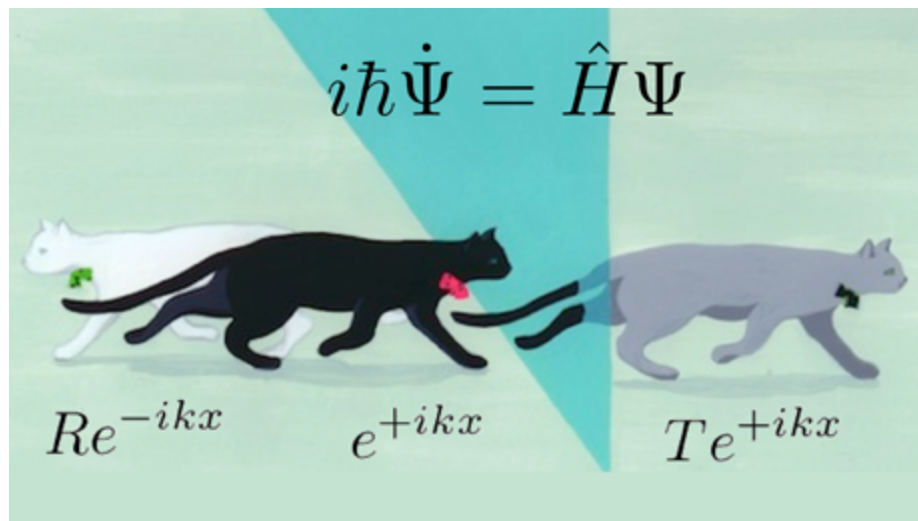


Atomic Structure and Spectra

Part I. Introduction to optical spectra



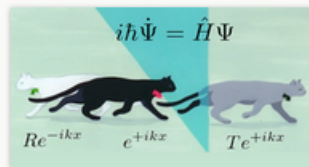
Atomic Structure and Spectra

coursera



Exploring Quantum Physics

by Dr. Charles Clark and Dr. Victor Galitski



Home

Video Lectures

Additional Materials

Discussion Forums

Homeworks and Assignments

Course Logistics

Syllabus

About Us

Additional Materials

Mathematical References

For those who may want to brush up on their mathematics before or during the courses, we present [a short crash course on the math](#)

Original scientific literature

Some lectures draw on material from original scientific literature, which we provide here for the convenience of students.

- [Atomic clocks and quantum computers](#)
- [The Bohr model of the atom](#)
- [Bose-Einstein condensation](#)
- [The discovery of deuterium](#)
- [The discovery of deuterium - a simplified account](#)
- [The green laser pointer](#)
- [The photoelectric effect](#)
- [Does quantum mechanics provide a complete description of physical reality?](#)
- [Young's double slit experiment and diffraction](#)

Atomic Structure and Spectra

The “white light” of the Sun is a mixture of colors.

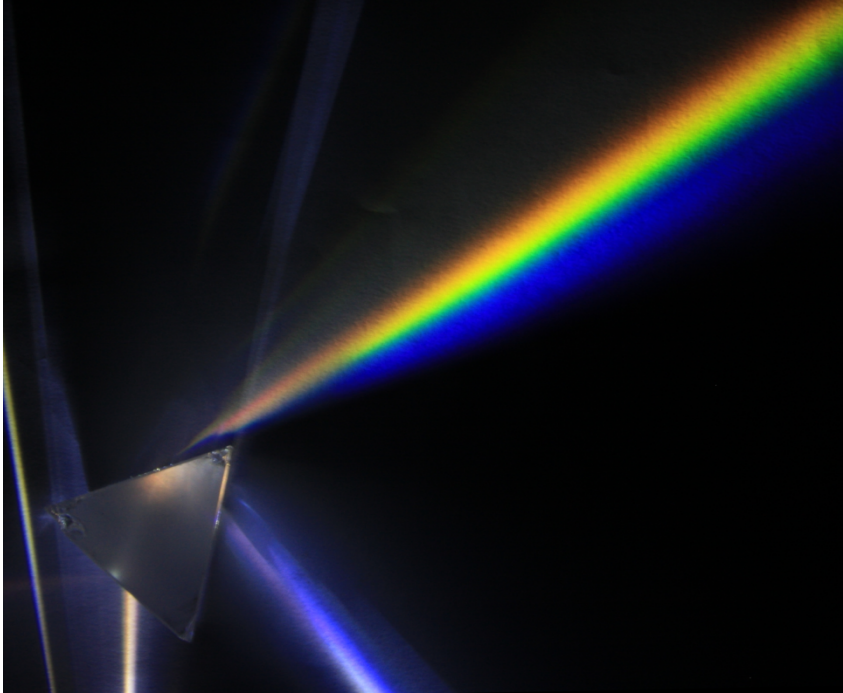


Eric Rolph/Wikimedia Commons

Atomic Structure and Spectra

Tools for controlled dispersion of light: **refraction** and diffraction

D-Kuru/Wikimedia Commons

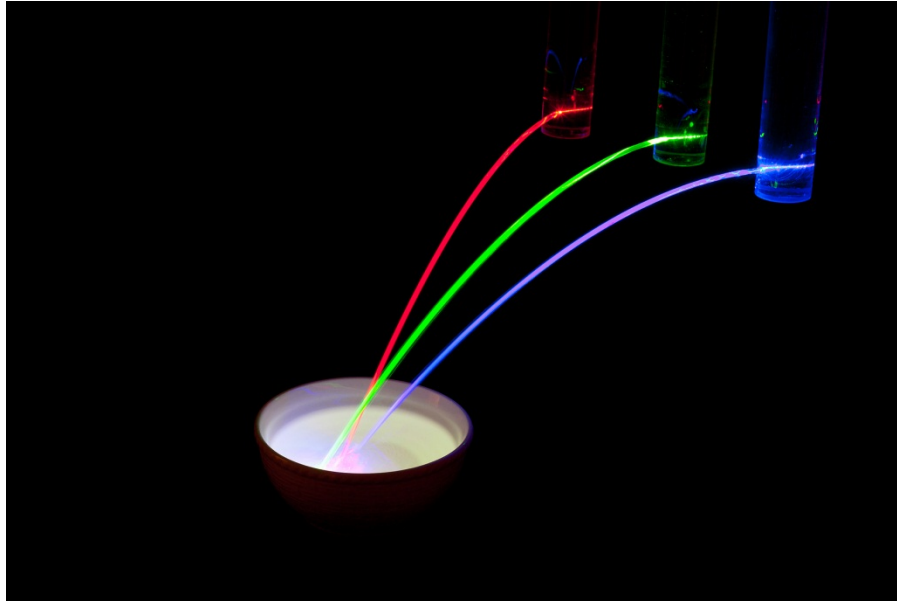


Isaac Newton (1666) used the **prism** to demonstrate that sunlight was a mixture of colors. The speed of light in a transparent medium depends upon its color. This causes the *dispersion* of the different colors in a beam.

Today we know that color is an index of the light's wavelength, λ , or equivalently its frequency, $\nu = c/\lambda$.

Atomic Structure and Spectra

Mixing of colors generates white light



©Alexander Albrecht

Light from three lasers, entrained in streams of water, scatters in ceramic bowl to give apparent white light.

These are our **reference lasers** for the course:

R

$\lambda = 650 \text{ nm}$

The common red laser pointer

G

$\lambda = 532 \text{ nm}$

The DPSS green laser pointer

V

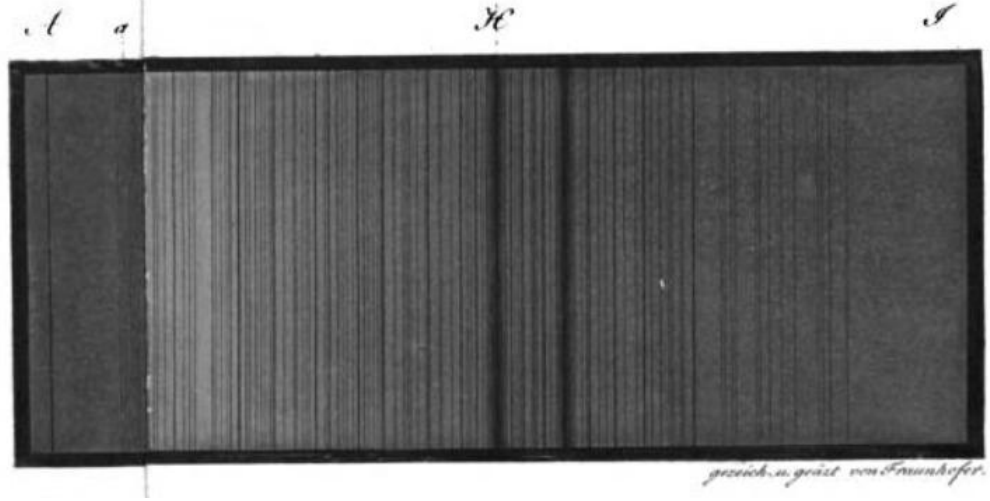
$\lambda = 405 \text{ nm}$

The Blu-Ray laser

Atomic Structure and Spectra

Tools for controlled dispersion of light: **refraction** and diffraction

Wikimedia Public Domain



Fraunhofer 1814

In 1814, Joseph von Fraunhofer discovers **dark lines** in sunlight using a highly dispersive prism.

Atomic Structure and Spectra

Tools for controlled dispersion of light: refraction and **diffraction**

$\lambda = 650 \text{ nm}$

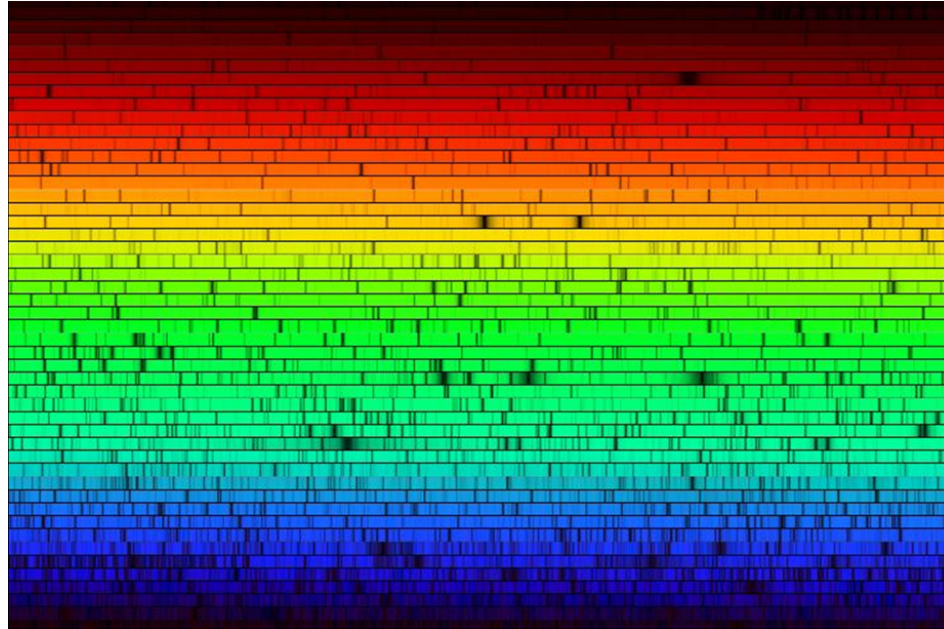
R

$\lambda = 532 \text{ nm}$

G

$\lambda = 405 \text{ nm}$

V



Nigel Sharp, National Optical
Astronomical Observatories

When seen under high resolution, there are numerous **dark lines** in the spectrum of the Sun. This pattern was decoded using the techniques we discuss this week.