Reading:

C&O:
(Skip Ch. 4)

Read Ch. 5  (skip: Compton Effect)

Ch. 4 Crowell
A spectrograph uses a prism or grating to split light up into different wavelengths.
Modern spectra are recorded digitally as plots of intensity vs. wavelength.
Spectrum of the Sun

The Sun emits light at UV, Visible and Infrared wavelengths.
Like the Sun, most stars's spectra show dark absorption lines
Spectroscopy

Build your own spectrograph out of a CD!

Spectroscopy

We can spread the light of a star out into its component colors.
We find that these spectra fall into three categories:

- Continuum -- Rainbow
- Absorption -- Dark Lines
- Emission -- Bright Lines
We can compare a star’s spectrum to lab experiments.

The type of spectrum tells us about the star.
Video on discovery of spectral lines: https://vimeo.com/113614651
Absorption Spectrum
Measuring Velocities

Stars move through space in all directions.

We can define a star’s velocity vector $\mathbf{V}$, in two ways:

1.) with a $x,y,z$ coordinate system based on the Milky Way Galaxy

   $[V_x, V_y, V_z] = [U,V,W]$  

   (see Croswell, p.40)

   (where $x$-axis is the direction to the galactic center)

2.) with a spherical coordinate system $[v_\theta, v_r]$ where:

   $v_r =$ radial velocity: speed along the line of sight to the star
   $v_\theta =$ tangent velocity, related to proper motion $\mu$).

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\mu \equiv \frac{d\theta}{dt} = \frac{v_\theta}{r}.
\]
Proper motion can be measured by observing a star’s location for several years.

Radial velocity is usually measured using the Doppler effect.

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\frac{\lambda_{\text{obs}} - \lambda_{\text{rest}}}{\lambda_{\text{rest}}} = \frac{\Delta \lambda}{\lambda_{\text{rest}}} = \frac{v_r}{c},
\]