

Ch. 5 The Interaction of Light + Matter p.111

§5.1 Spectral Lines

1860 Kirchhoff + Bunsen "Chemical Analysis by Spectral Observations"
Kirchhoff's Laws: (1) Hot dense object or gas produces continuous spectrum w/ no lines.

(2) Hot diffuse gas produces bright lines (emission lines)

(3) Cool diffuse gas in front of continuous source produces dark lines (absorption lines).

(Young + Freedman 13re Fig. 39.14)

Applications of Stellar-Spectra Data p.112

Atoms emit + absorb at wavelengths corresponding to differences between energy levels for that element.

(Serway/Jewett 7re F42.1)

(F5.1) (actually another image of Fraunhofer lines)
(+ modern version)

He found in solar-spectrum 1868, found on Earth 1895.

Doppler-shift, low- v approx. (eq. 4.39)

$$\frac{\lambda_{\text{obs}} - \lambda_{\text{rest}}}{\lambda_{\text{rest}}} = \frac{\Delta\lambda}{\lambda_{\text{rest}}} = \frac{v_r}{c} \quad (v_r = \text{radial recession velocity})$$

Ex. 5.1.1 $\lambda_{\text{rest}}(\text{H}\alpha) = 656.281 \text{ nm}$, $\lambda_{\text{obs}}(\text{vesp}) = 656.251 \text{ nm} \Rightarrow$
 $v_r = -13.9 \text{ km s}^{-1}$

proper motion: $\mu = 0.35077'' \text{ yr}^{-1} \Rightarrow v_{\theta} = r\mu = 12.9 \text{ km s}^{-1}$
 $v = \sqrt{v_r^2 + v_{\theta}^2} = 19.0 \text{ km s}^{-1}$

Spectrographs p.113

(F5.2) Explain briefly

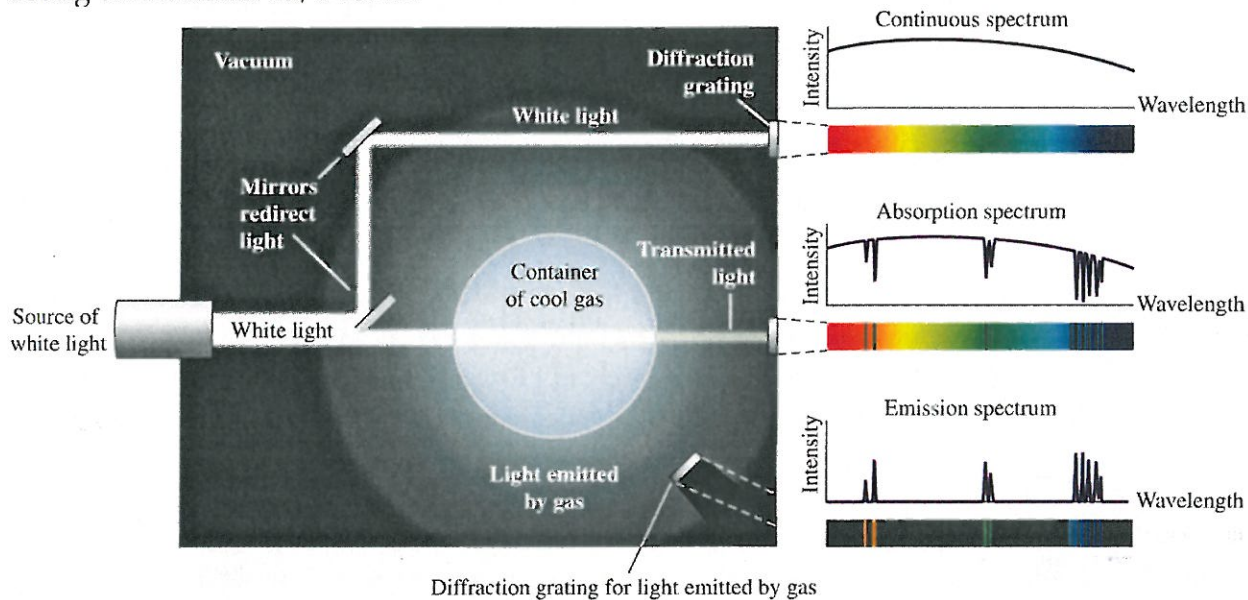
Detailed spectroscopy can be used to find abundances, T , P , ρ ,
 B (Zeeman splitting)

End of §5.1

5.15

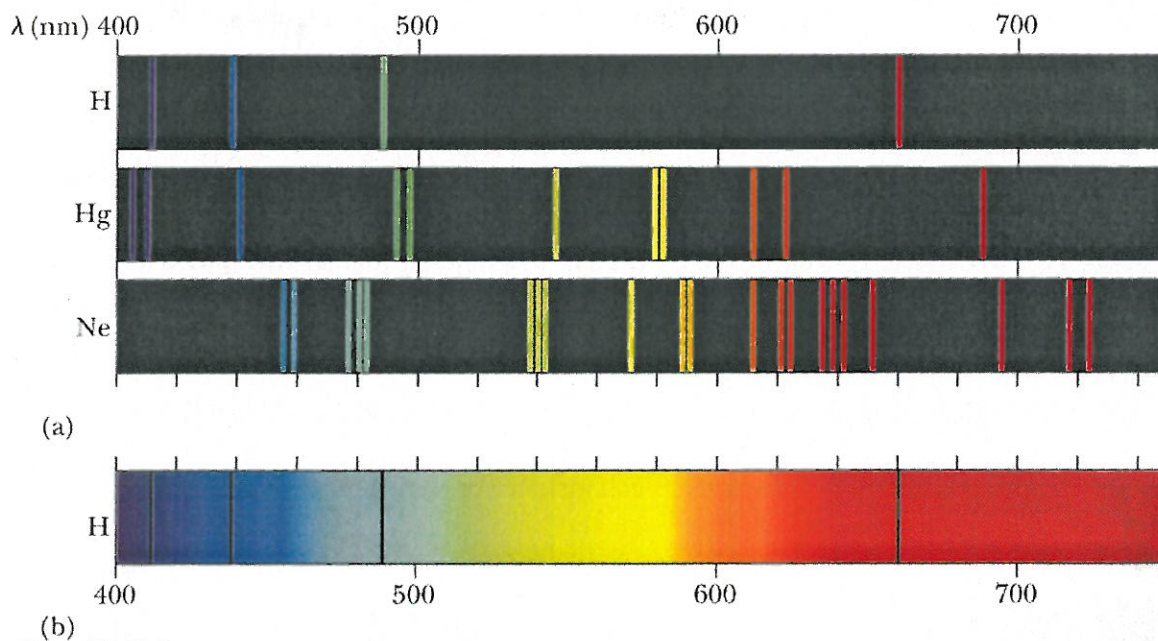
1/16/18

Young & Freedman 13/e F39.14



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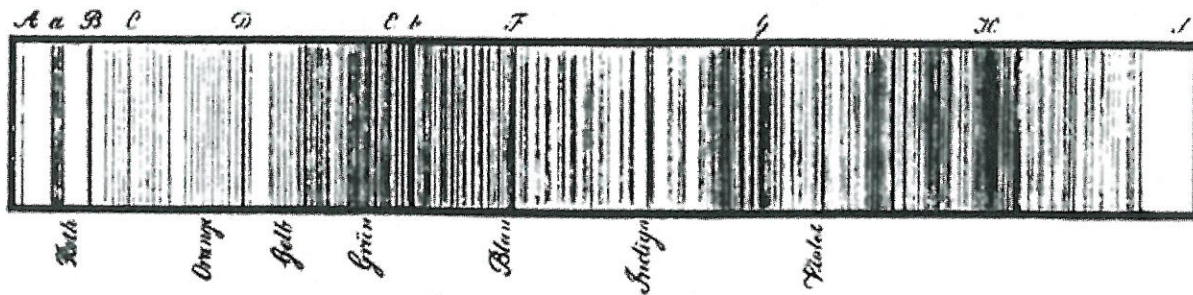
Serway/Jewett 7/E



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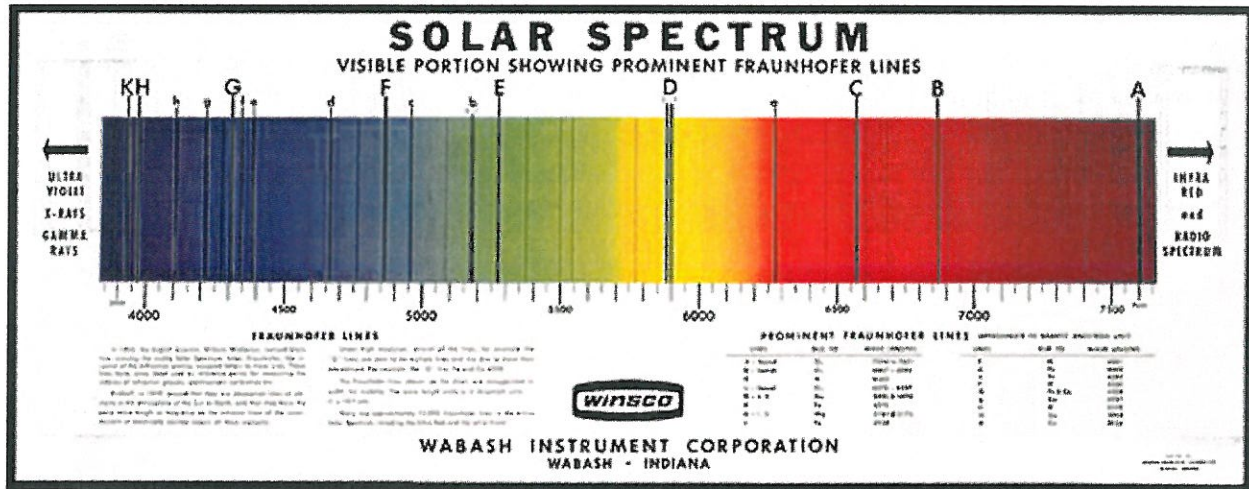
Fig. 42-1, p. 1216

Fraunhofer lines



Zu Fraunhofer's Abh. Denkschr. 1814-15.

modern version



F5.2 Spectrograph
Light from
telescope

