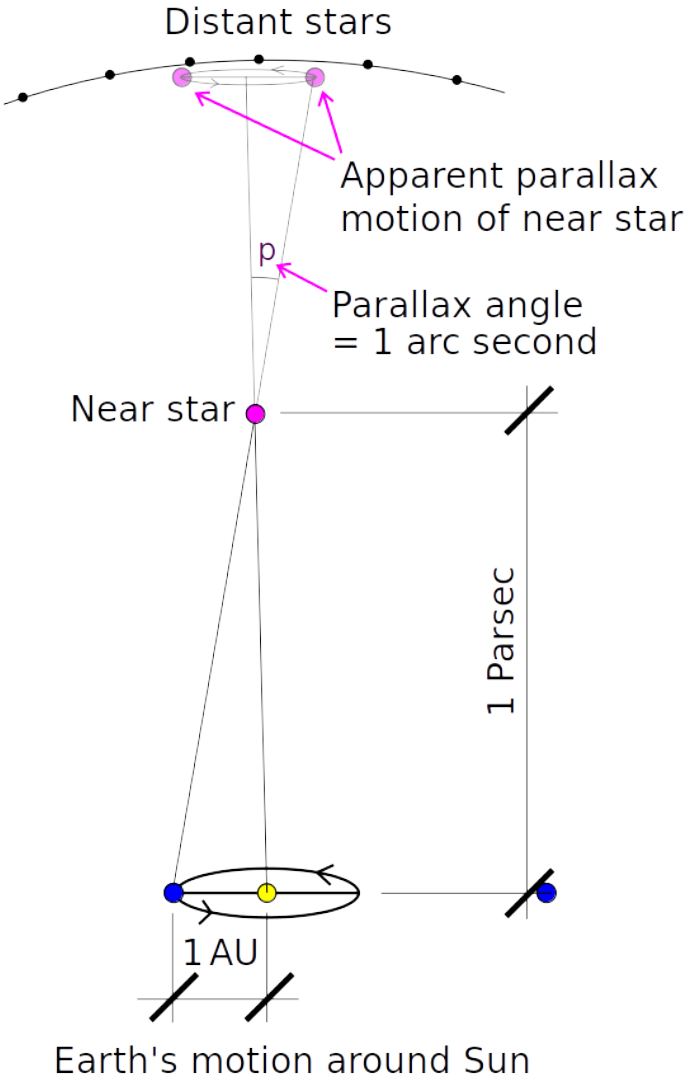
Introduction to Astronomy
AA 201
Fall Semester 2019

Instructor: Manoneeta Chakraborty
Email: manoneeta@iiti.ac.in
Extension: 839

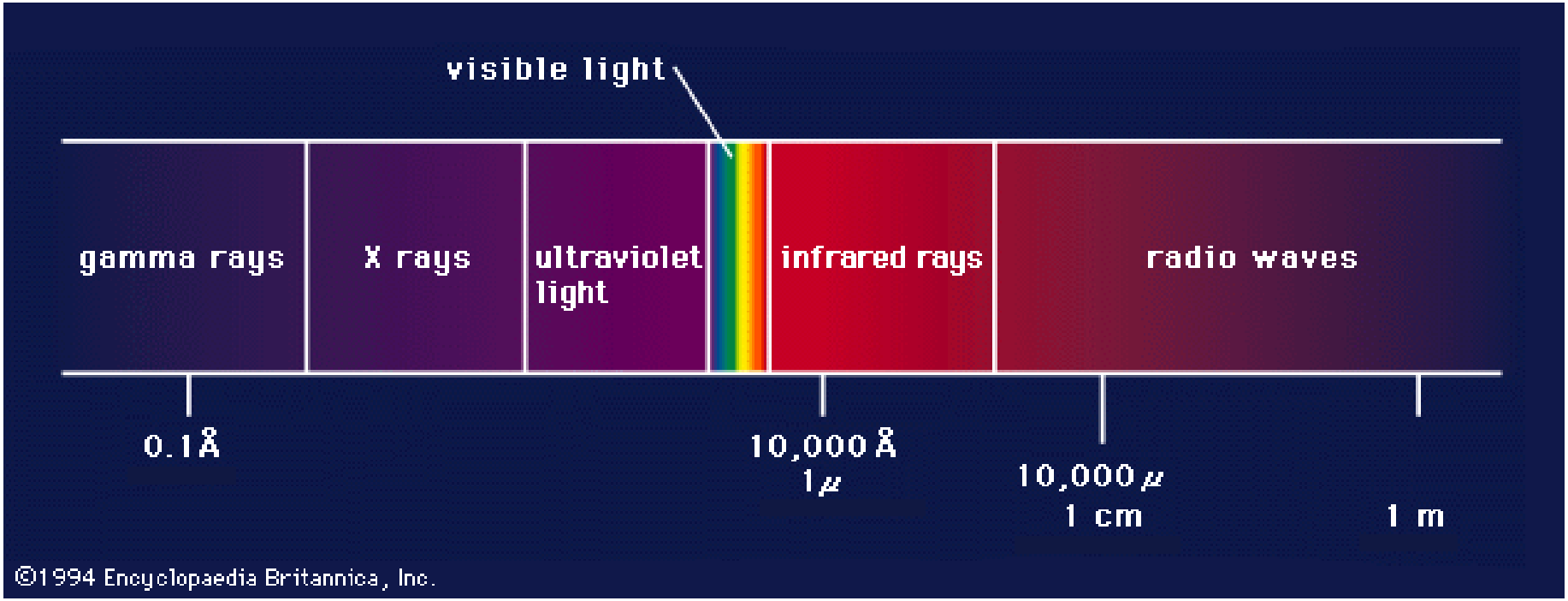
Course webpage:
http://www.iiti.ac.in/people/~manoneeta/courses/AA201_2019/

Distance

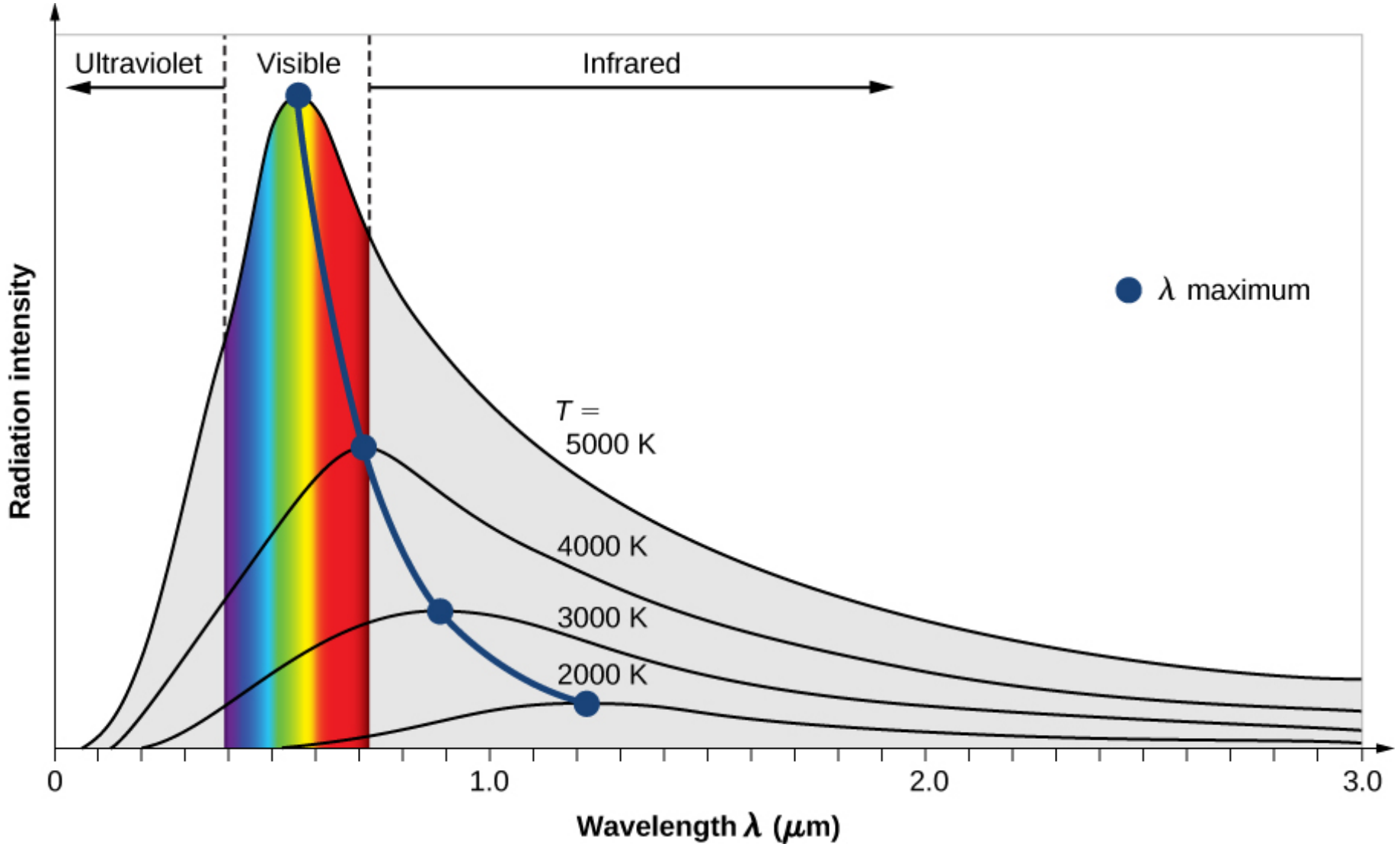
- Inside solar system: radio and laser imaging
- Nearby stars: Parallax
  - parsec (pc) = 3.26 light year
  - distance at which 1 AU subtends 1 arc sec
- Distant Objects: Standard Candles
  - type Ia supernova, cepheids
- Cosmological distances: redshift



The electromagnetic spectrum

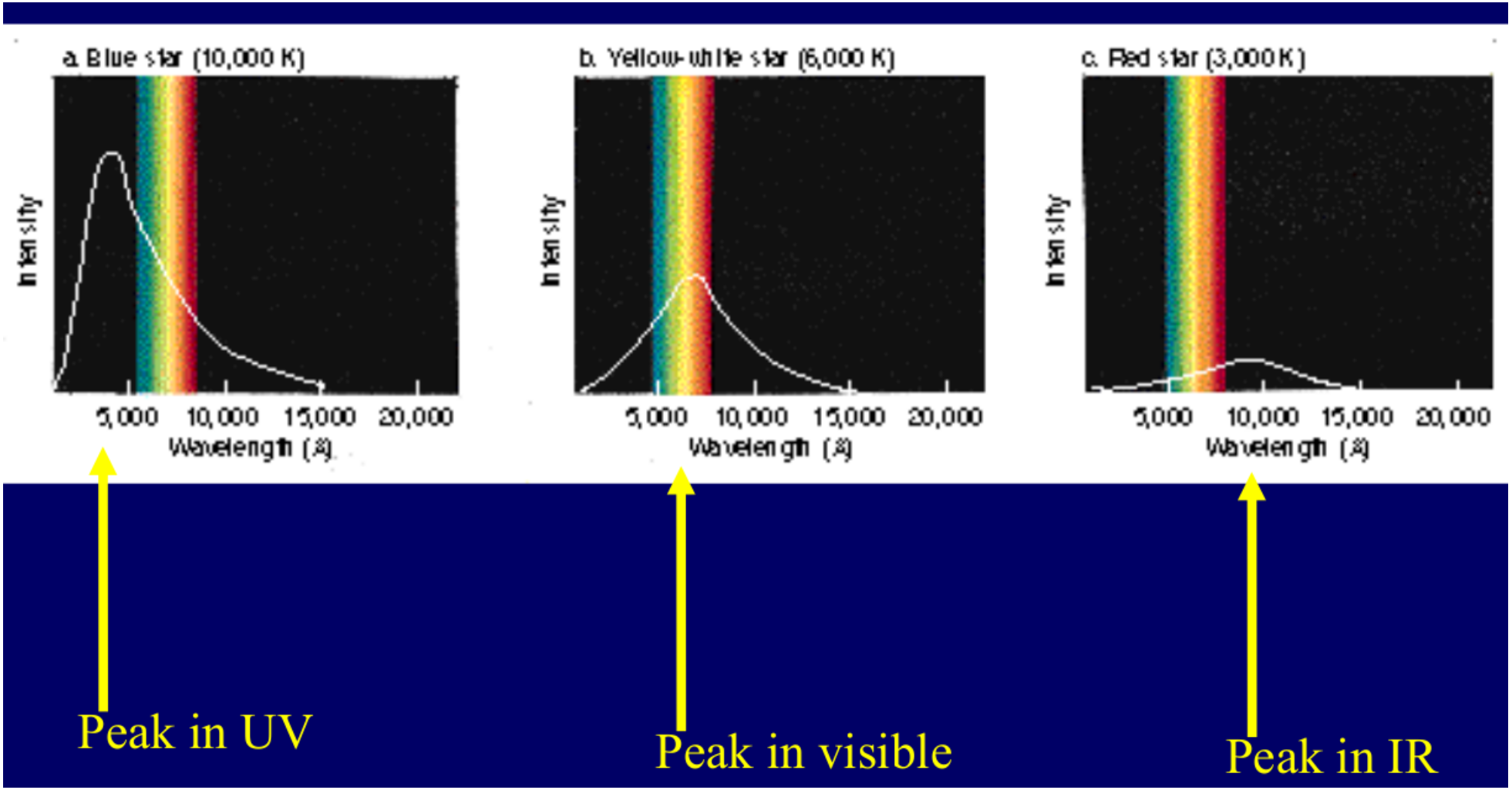


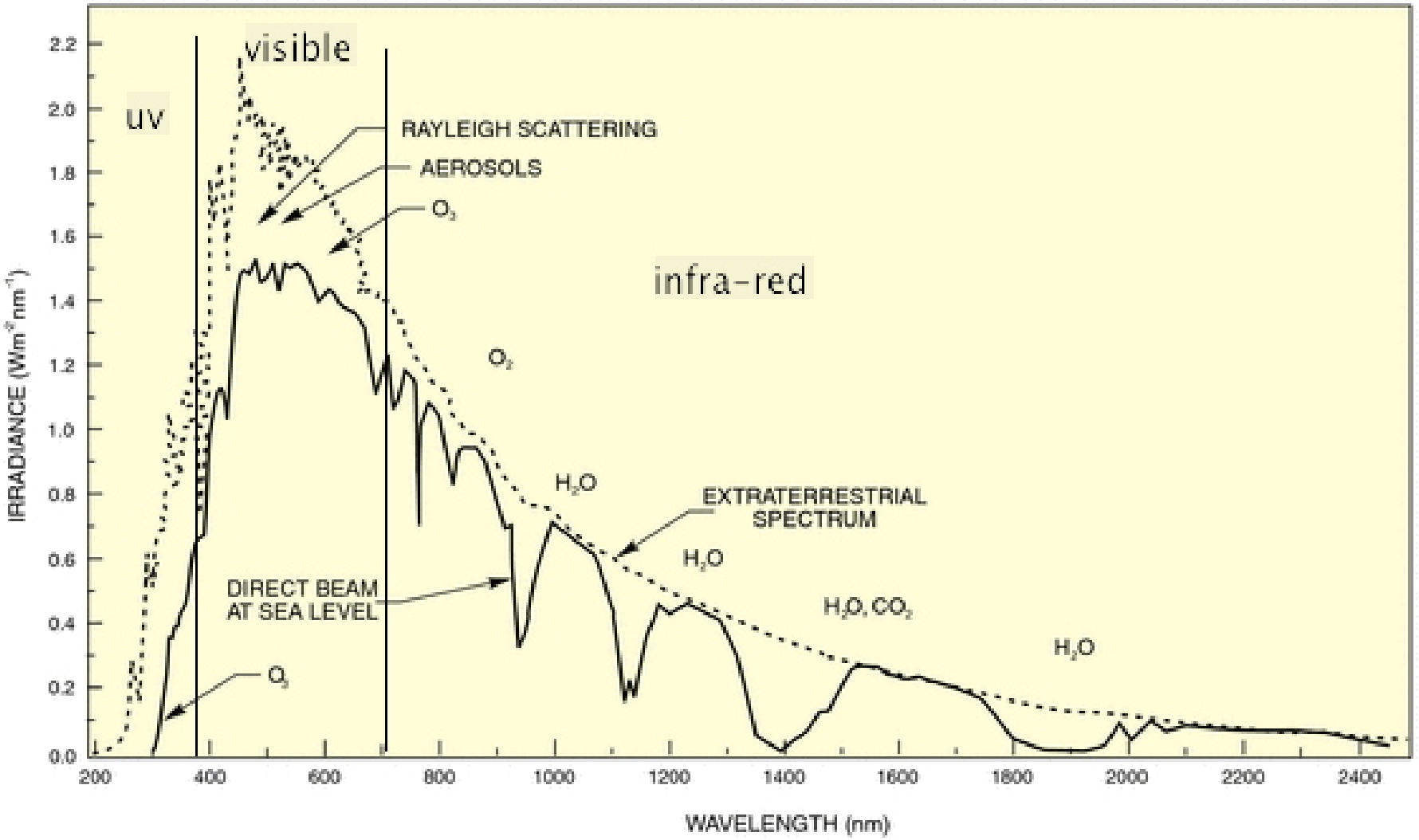
Blackbody Radiation

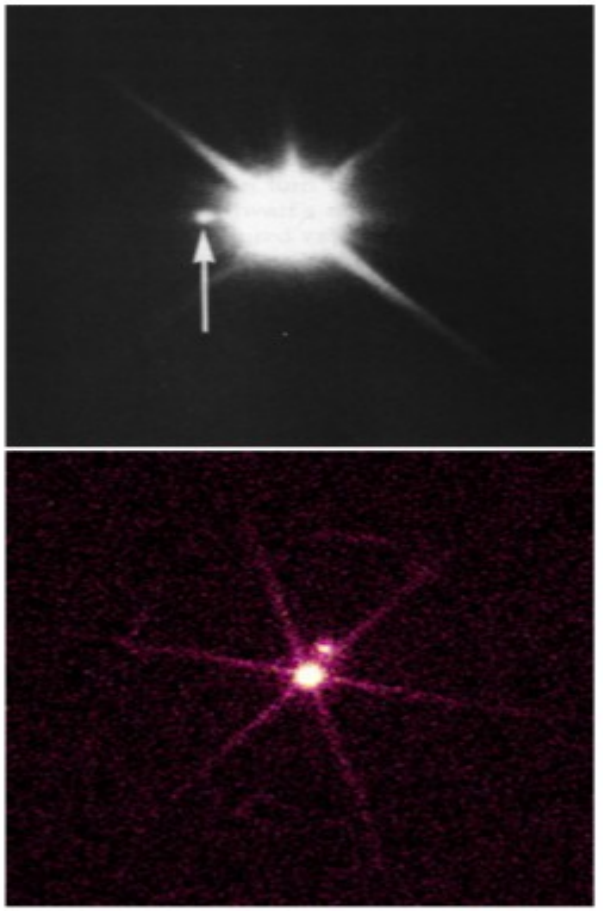


Temperature of stars

- Determined by type of EM radiation




visible
uv
infra-red
RAYLEIGH SCATTERING
AEROSOLS
O_3
O_2
H_2O
EXTRATERRESTRIAL SPECTRUM
H_2O
DIRECT BEAM AT SEA LEVEL
H_2O, CO_2
H_2O
O_3
IRRADIANCE ($Wm^{-2}nm^{-1}$)
WAVELENGTH (nm)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400



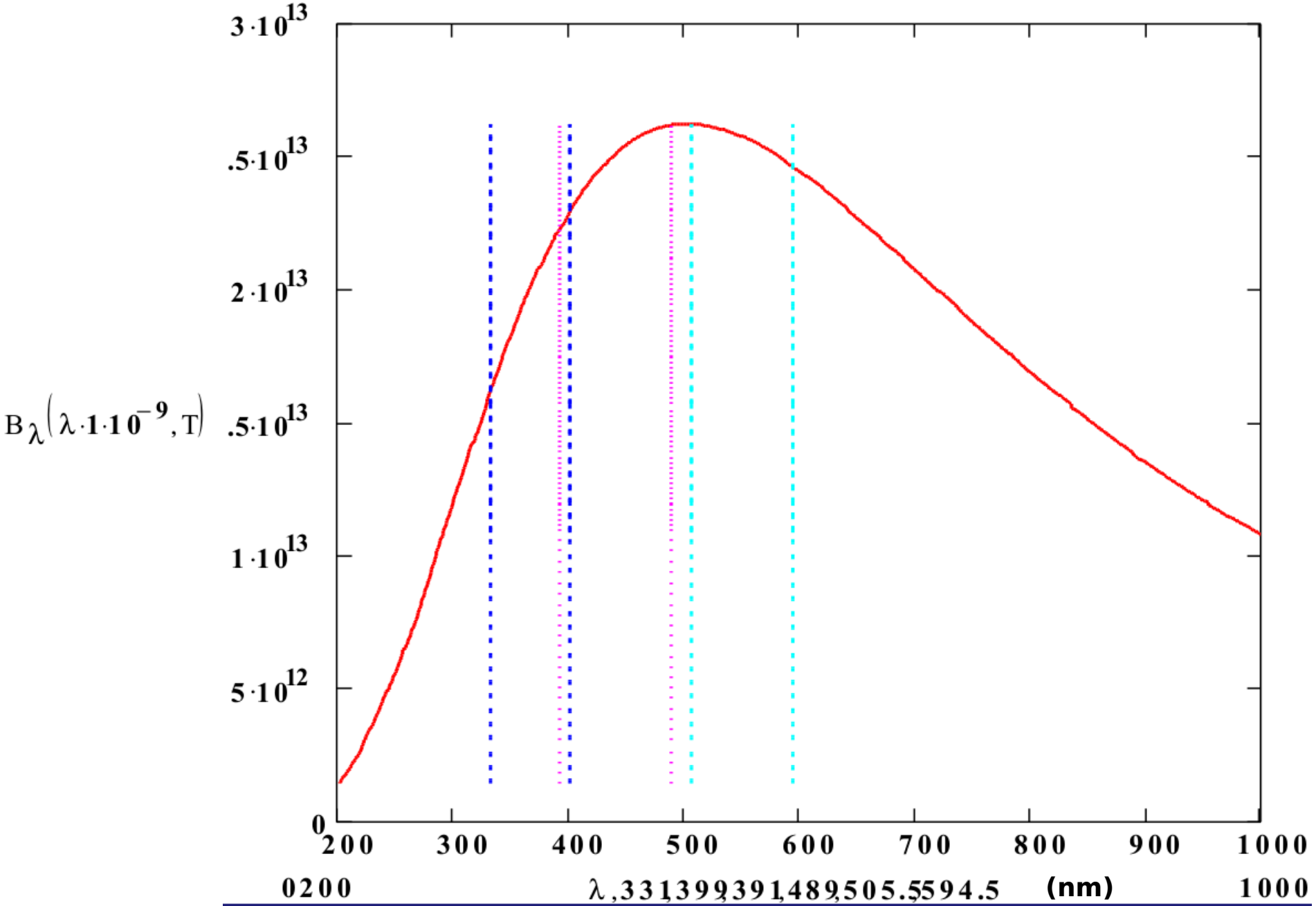
Optical (top) and X-ray (bottom) images of Sirius A and B, which are an A-type star and a white dwarf. The optical image is dominated by the main sequence star, the X-ray image by the white dwarf.

THE MEANING OF MAGNITUDES

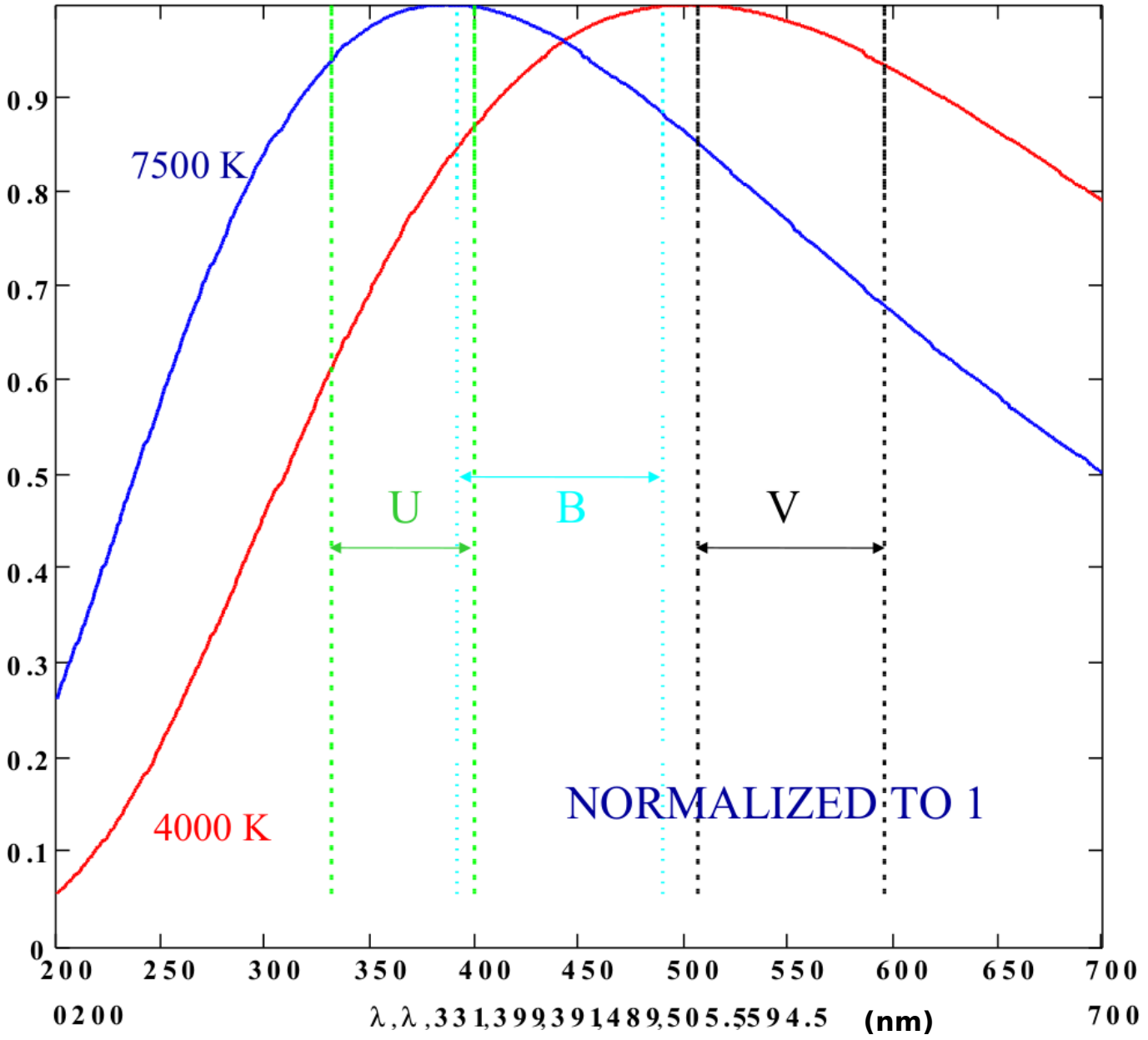
This difference in magnitude...	*...means this ratioin brightness*
0	1 to 1
0.1	1.1 to 1
0.2	1.2 to 1
0.3	1.3 to 1
0.4	1.4 to 1
0.5	1.6 to 1
1.0	2.5 to 1
2	6.3 to 1
3	16 to 1
4	40 to 1
5	100 to 1
10	10,000 to 1
20	100,000,000 to 1

Magnitudes

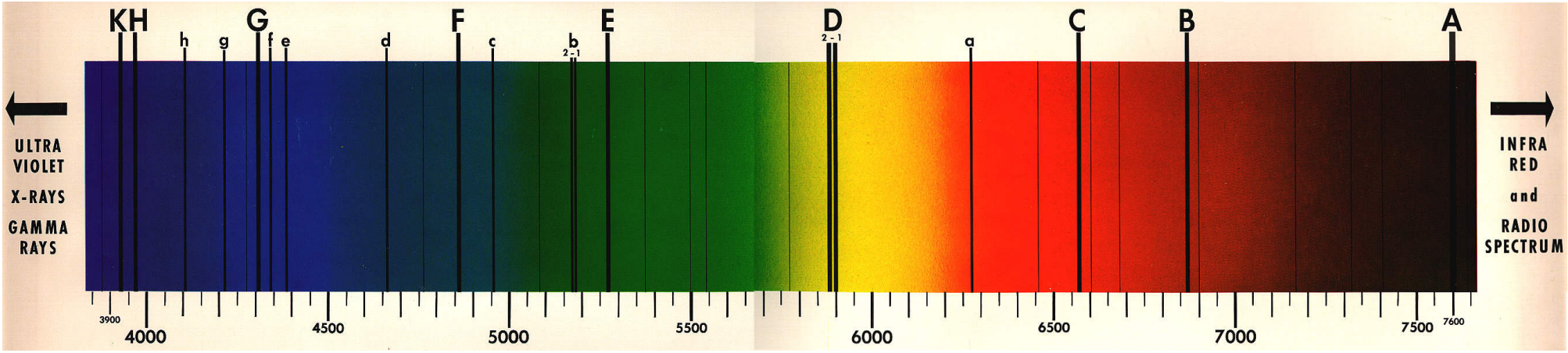
UBV filters: color index

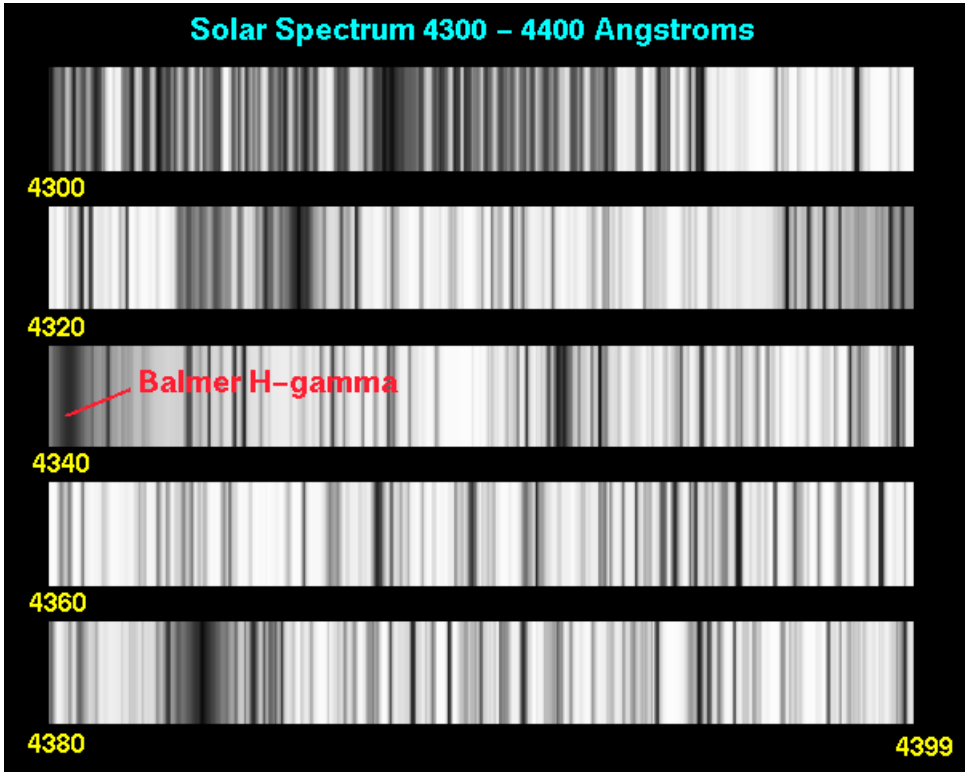


UBV: color indices for different T



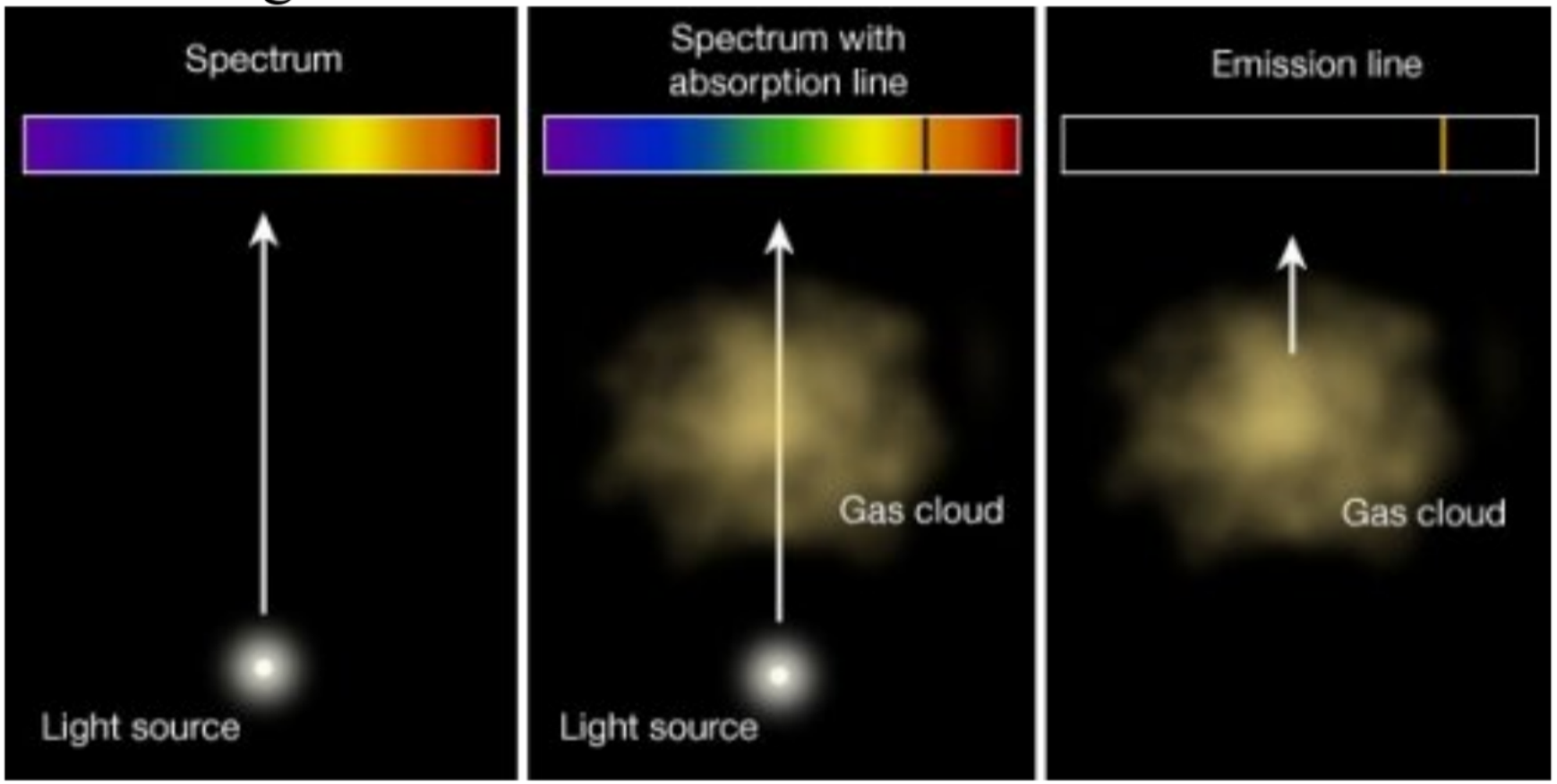
Solar Spectra





Kirchhof's Law

- Hot solid or dense gas, → continuous spectrum (eg Blackbody)
- Cool diffuse gas in front of a blackbody → absorption lines
- Hot diffuse gas → emission lines



Doppler shift

- Spectral lines allow for the measurement of radial velocities
- At low velocities, $v_r \ll c$
  - Classical Doppler effect
    - *Radial velocity*, v_r
    - *Heliocentric correction* for Earth's motion, up to ~29.8 km/s, depending on direction.
- Example: H_α is 6562.80 Å
  - Vega is measured to be 6562.50 Å
  - Coupled with the *proper motion*
    - Can determine total velocity

$$z = \frac{\lambda_{obs} - \lambda_{rest}}{\lambda_{rst}} = \frac{\Delta\lambda}{\lambda_{rest}} = \frac{v_r}{c}$$

$$\Delta\lambda = \frac{v_r}{c}\lambda_{rest}$$

$$v_r = c\frac{\Delta\lambda}{\lambda_{rest}} = -14\,\frac{km}{\sec}$$

$$v_\theta = r\mu = 13\,\frac{km}{s}$$

$$v = \sqrt{v_r^2 + v_\vartheta^2} = 19\,\frac{km}{s}$$