

STAR TEMPERATURE AND SIZE

TEMPERATURE FROM THE LINE SPECTRUM: THE SPECTRAL CLASS

If λ_{peak} isn't known, thanks to the work of Cecilia Payne-Gaposchkin (1900-1979), the spectral class can be used to estimate the temperature. This is done by interpolation between the minimum and maximum temperatures of each spectral class:

$$\text{TEMPERATURE FROM SPECTRAL TYPE} \quad T = T_{\text{max}} - \left\{ (\text{subclass}) \times \left(\frac{T_{\text{max}} - T_{\text{min}}}{10} \right) \right\}$$

Here the subclass is the number given with the spectral type (e.g. the 2 in Sol's G2), T_{max} is the highest temperature in the spectral class and T_{min} is the lowest.

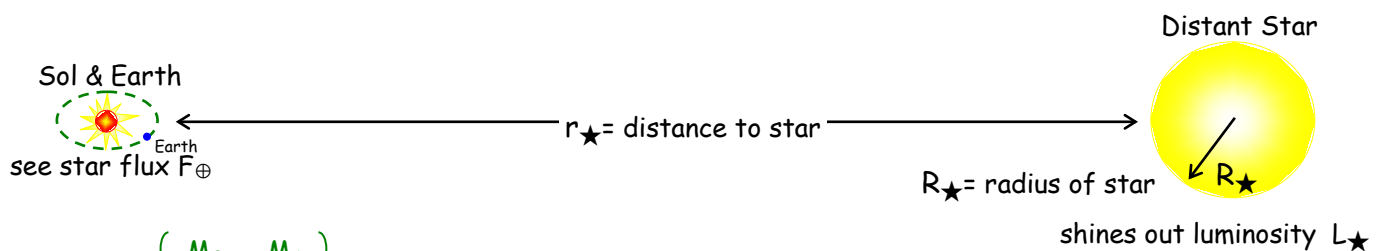
SIZE OF AN OPAQUE, SPHERICAL STAR: THE STEFAN-BOLTZMANN LAW:

The Stefan-Boltzmann law relates the luminosity of a star to its temperature and its emitting surface area ($4\pi R^2$)

$$\text{RADIUS FROM LUMINOSITY AND TEMPERATURE} \quad R_{\star} = \sqrt{\frac{L_{\star}}{4\pi\sigma T^4}}$$

where R_{\star} is the radius of the star in m, $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4$, $R_{\odot} = 6.96 \times 10^8 \text{ m}$, and $r_{\oplus} = 1.50 \times 10^{11} \text{ m}$.

STAR	FIELD GUIDE TO THE STARS AND PLANETS TABLE A2				CALCULATED					
	V	M_V	r_{\star} ly	Spec. Type	FG A3	LUMINOSITY		SIZE		
					T K	$L_{\star, \text{SOL}}$ In L_{sol}	L_{\star} In Watts	R_{\star} Billions of m	R_{\star}/R_{\oplus} (num- ber)	R_{\star}/r_{\oplus} %
Polaris (α UMi)	2.0	-4.1	431	F5 I						
Rigel (β Ori)	0.12	-6.6	773	B8 I						
Sirius (α CMa)	-1.46	1.5	9	A1 V						
Aldebaran (α Tau)	0.85	-0.8	65	K5 III						
Betelgeuse (α Ori)	0.5	-5.0	522	M2 I						
Procyon (α CMi)	0.38	2.8	11	F5 IV						



$$L_{\star} = 10^{\left(\frac{M_{\text{SOL}} - M_{\star}}{2.5} \right)}, \quad r_{\star, \text{m}} = r_{\star, \text{ly}} \times (9.46 \times 10^{15}) \text{ Meters}, \quad L_{\text{SOL}} = (3.83 \times 10^{26}) \text{ Watts}.$$