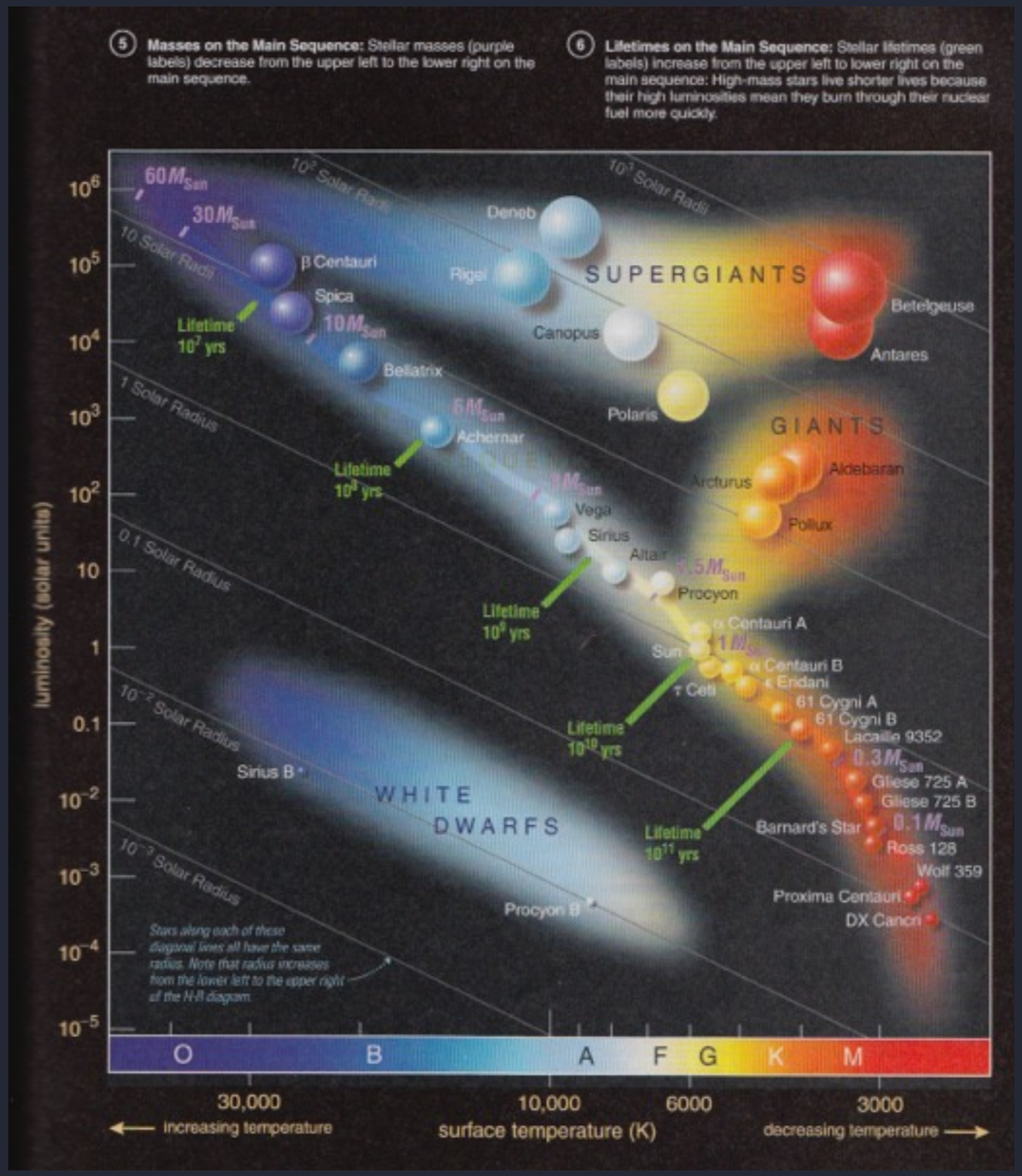
Astro 1: Introductory Astronomy



David Cohen

Class 11: Tuesday, February 25

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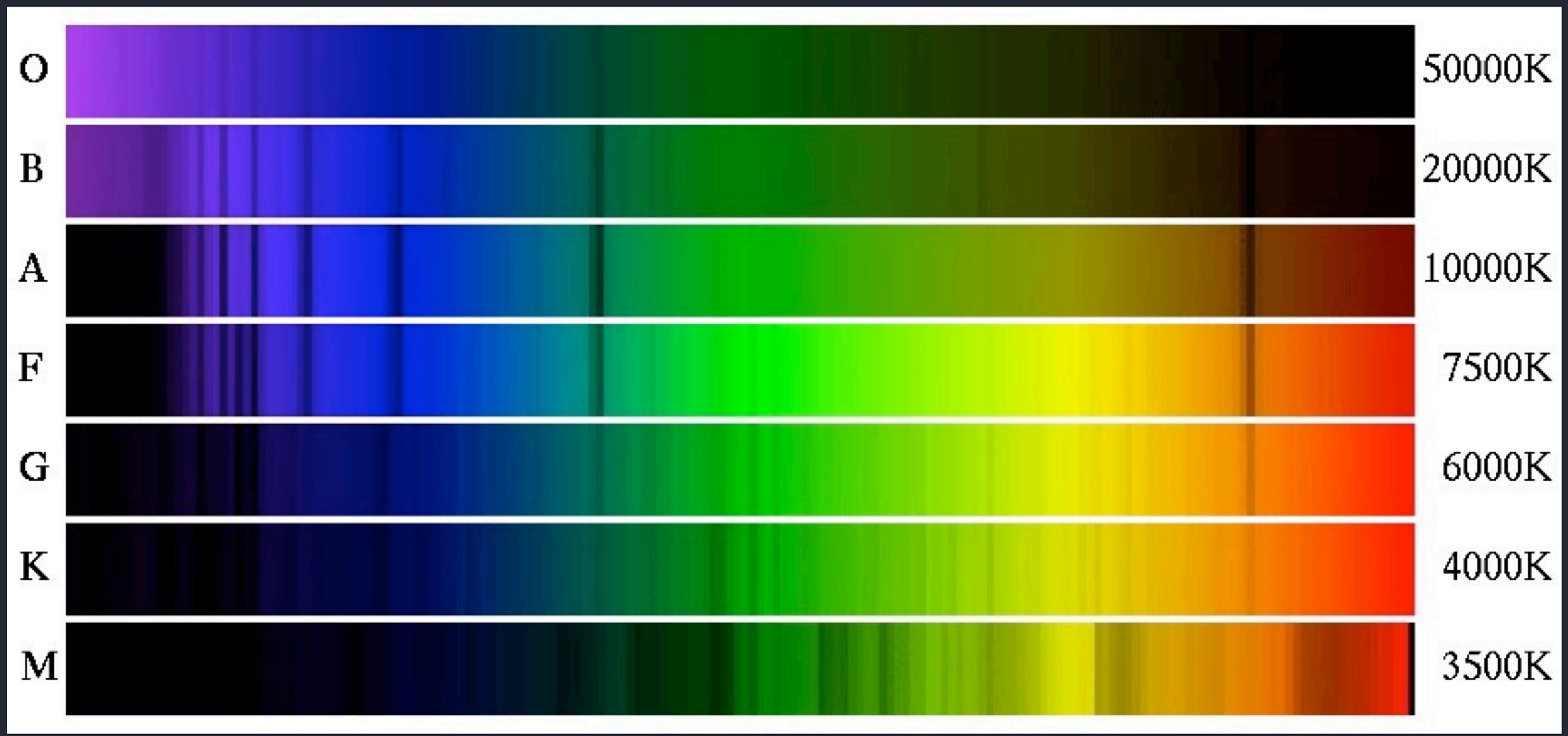
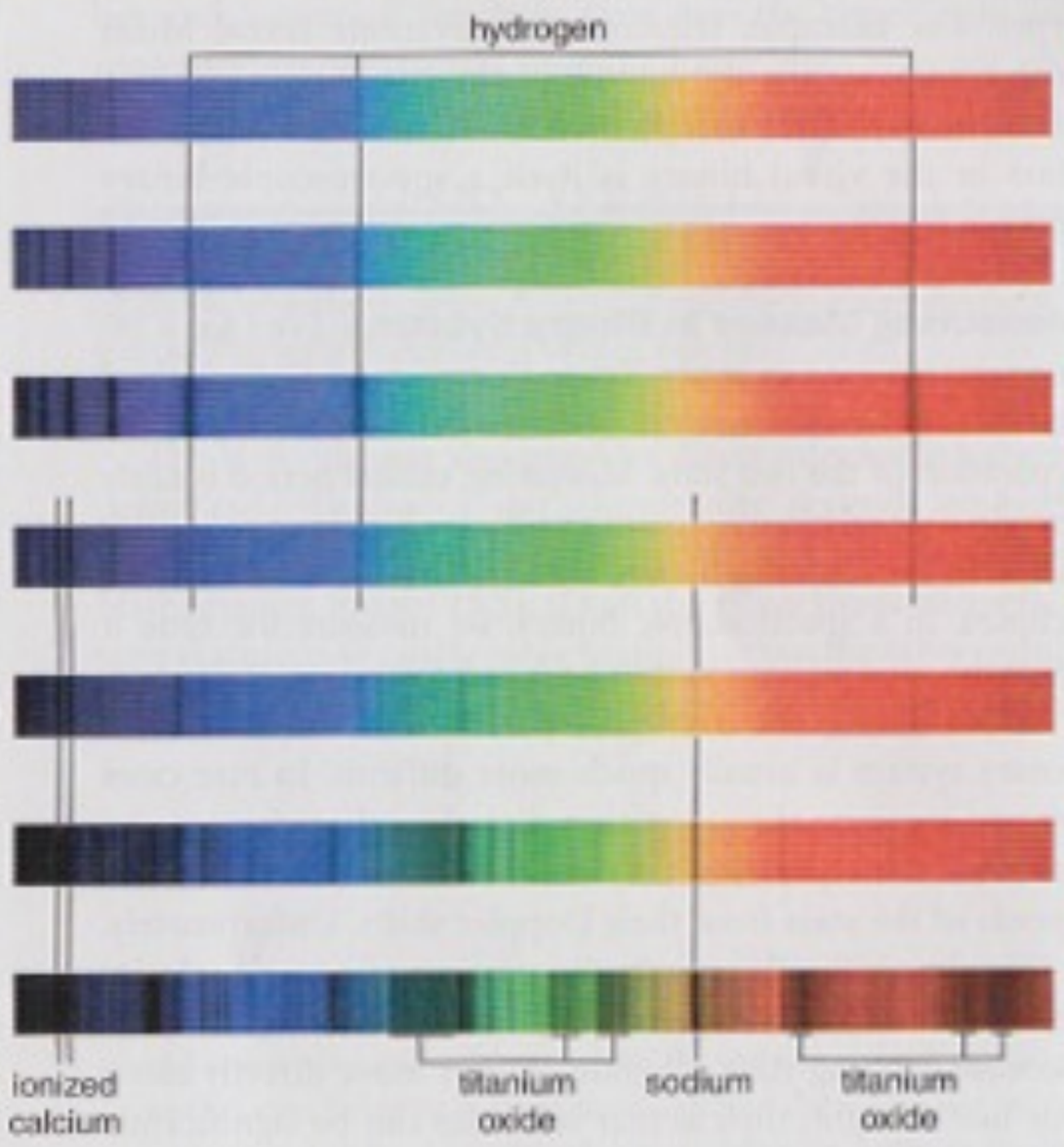
spectra of seven different stars: spectral types on the left, temperatures on the right



Key Absorption Line Features	Brightest Wavelength (Color)	Typical Spectrum
Lines of ionized helium, weak hydrogen lines	<97 nm (ultraviolet)*	O
Lines of neutral helium, moderate hydrogen lines	97–290 nm (ultraviolet)*	B
Very strong hydrogen lines	290–390 nm (violet)*	A
Moderate hydrogen lines, moderate lines of ionized calcium	390–480 nm (blue)*	F
Weak hydrogen lines, strong lines of ionized calcium	480–580 nm (yellow)	G
Lines of neutral and singly ionized metals, some molecules	580–830 nm (red)	K
Strong molecular lines	>830 nm (infrared)	M



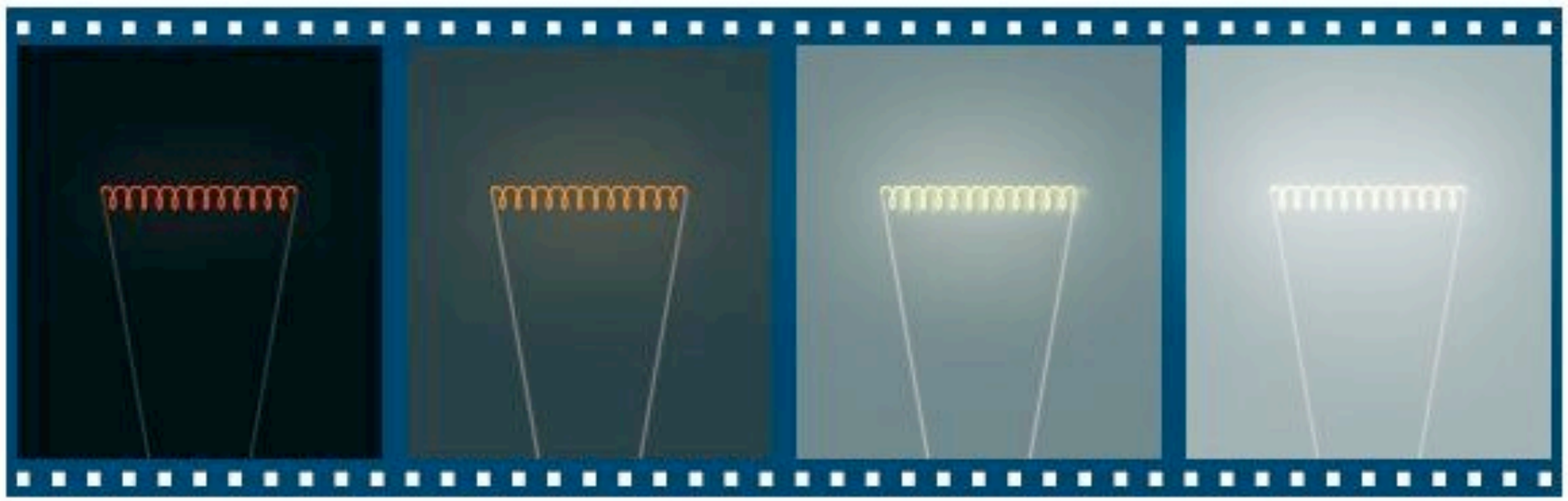
the underlying stellar spectrum is thermal, but with absorption lines superimposed

Stars Glow by *Thermal Emission* of Light

Stars emit light according to the Planck Function (blackbody).

$$\lambda T = 0.00290 \text{ m-K}$$

$$\text{Flux at Surface} = \sigma T^4$$



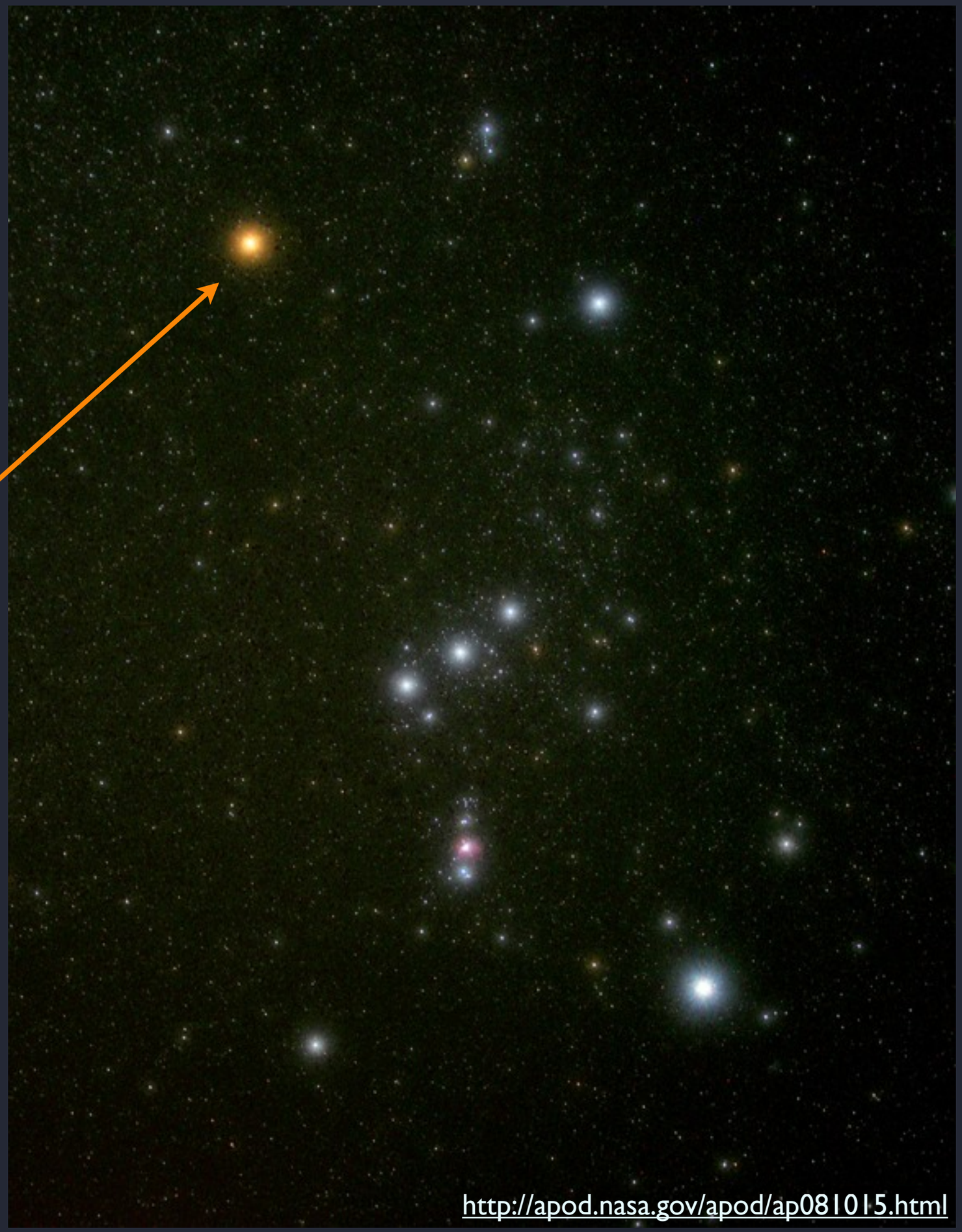
Cool
Red & Faint

Warmer

Hot

Hotter
White & Bright

Betelgeuse: luminous and red (cool)



http://apod.nasa.gov/apod/ap081015.html

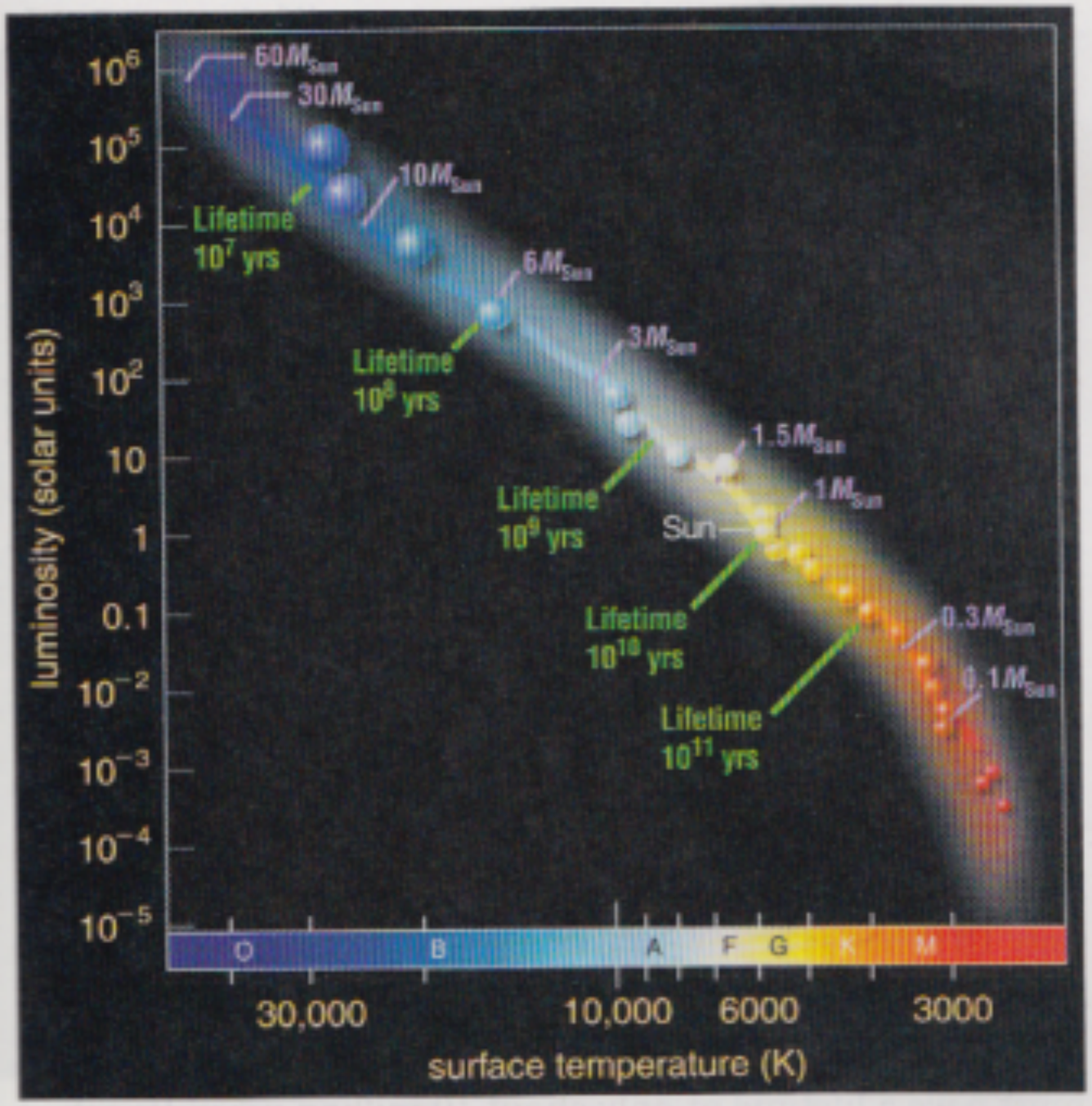


FIGURE 15.11 The main sequence from Figure 15.10 is isolated here so that you can more easily see how masses and lifetimes vary along it. Notice that more massive hydrogen-burning stars are brighter and hotter but have shorter lifetimes. (Stellar masses are given in units of solar masses: $1M_{Sun} = 2 \times 10^{30}$ kg.)

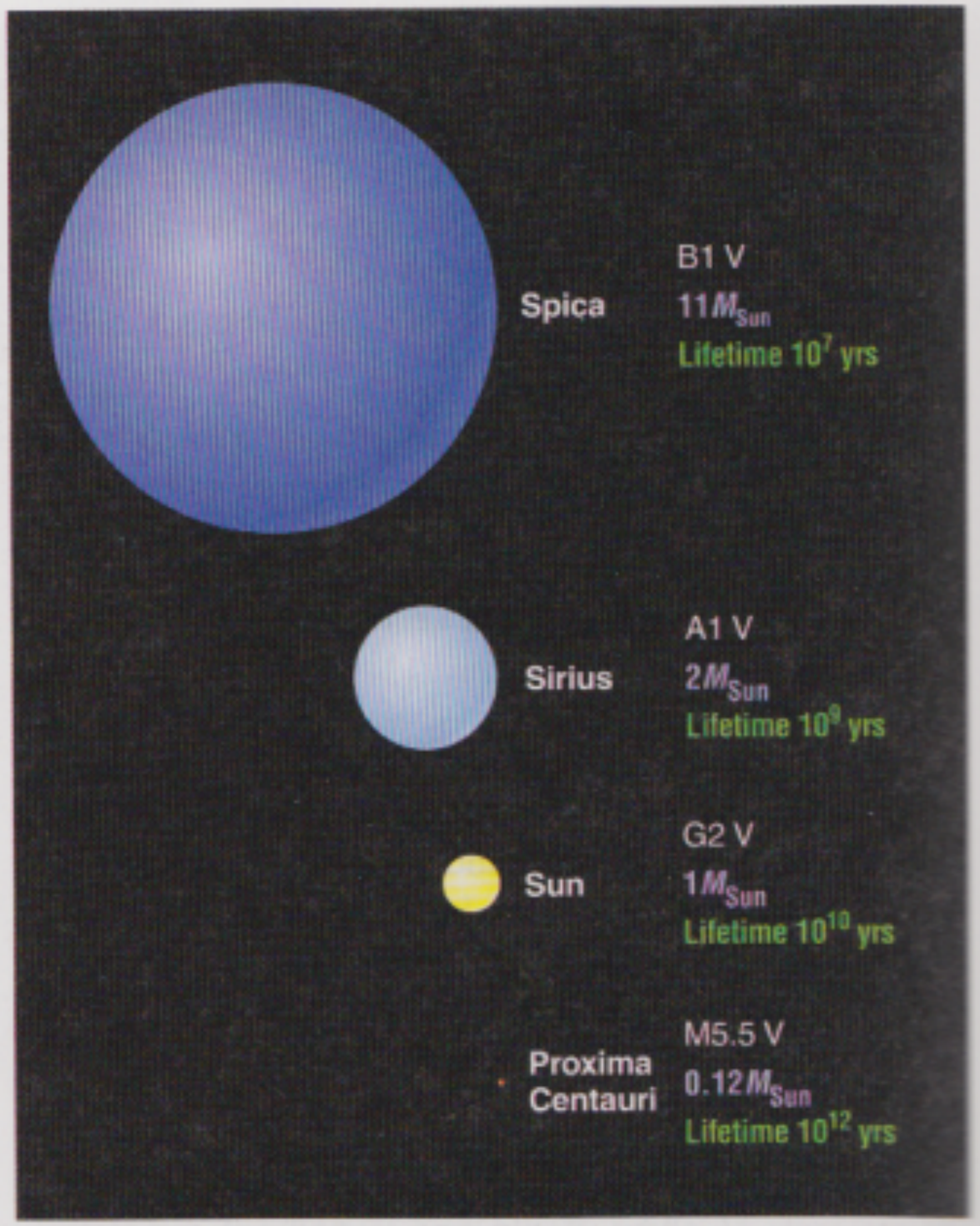
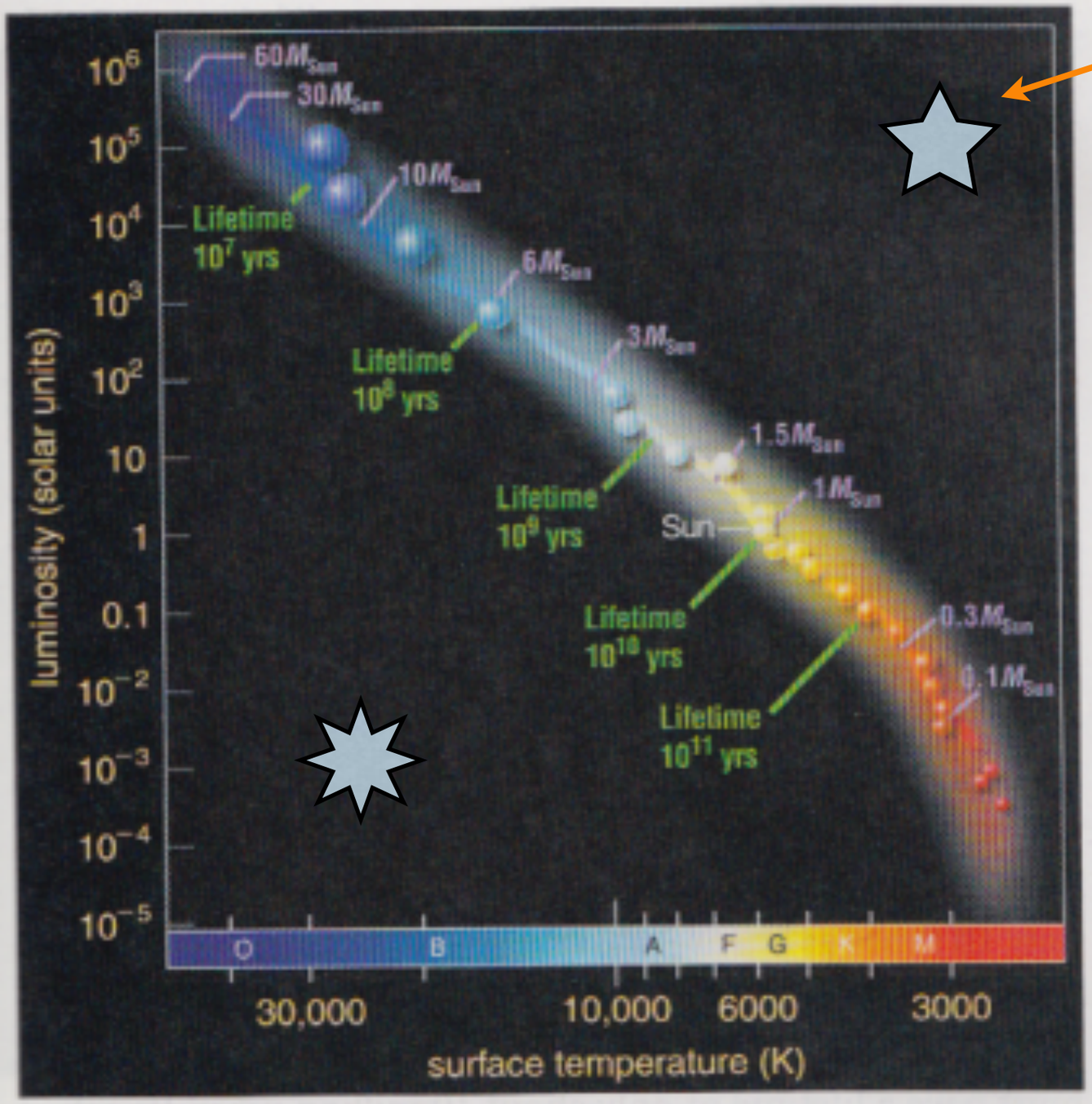


FIGURE 15.12 Four main-sequence stars shown to scale. The mass of a main-sequence star determines its fundamental properties of luminosity, surface temperature, radius, and lifetime. More massive main-sequence stars are hotter and brighter than less massive ones but have shorter lifetimes.

star sizes (radii) vary on the main sequence, but only by a factor of 20 or 30

this is where Betelgeuse is



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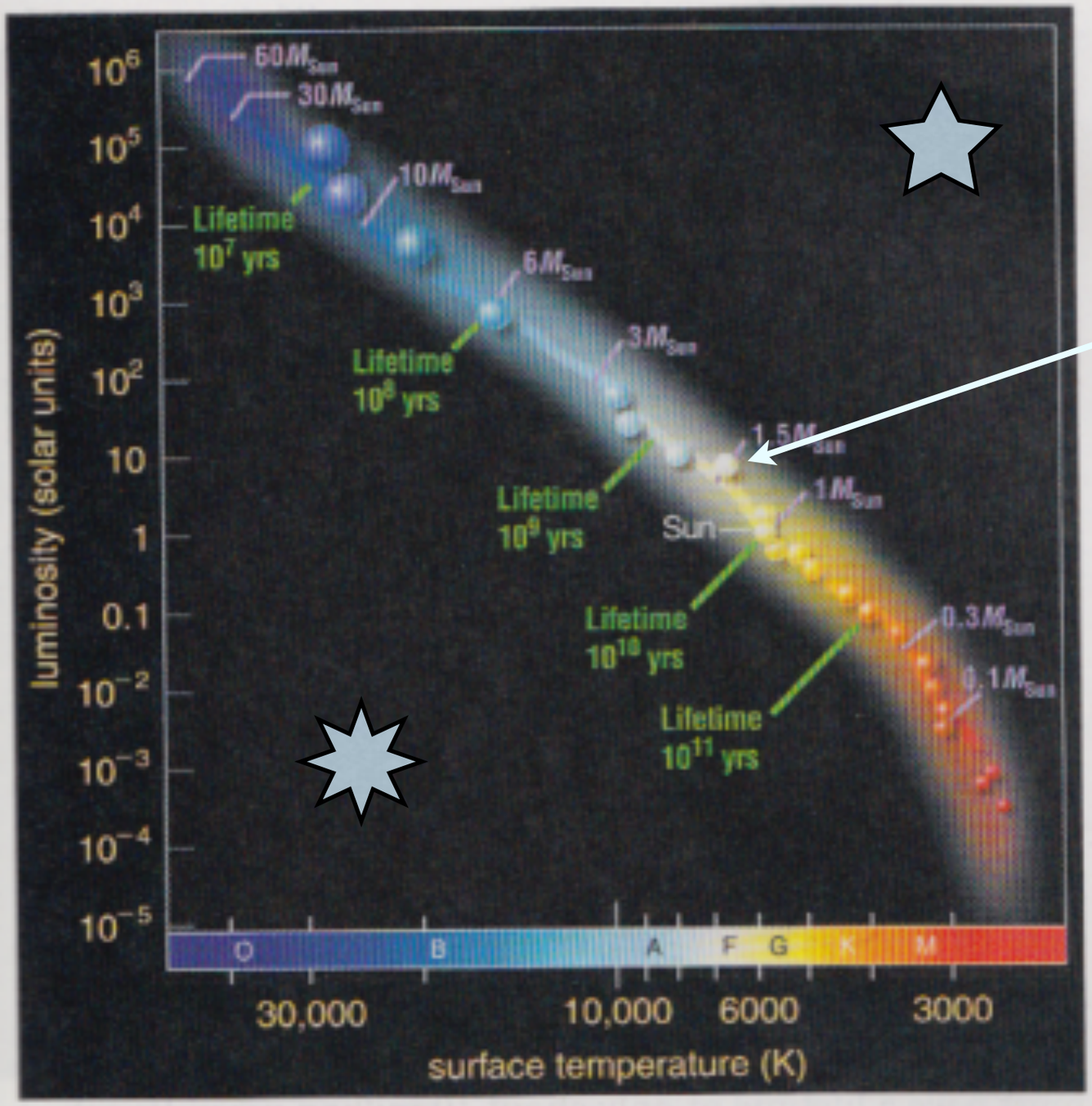

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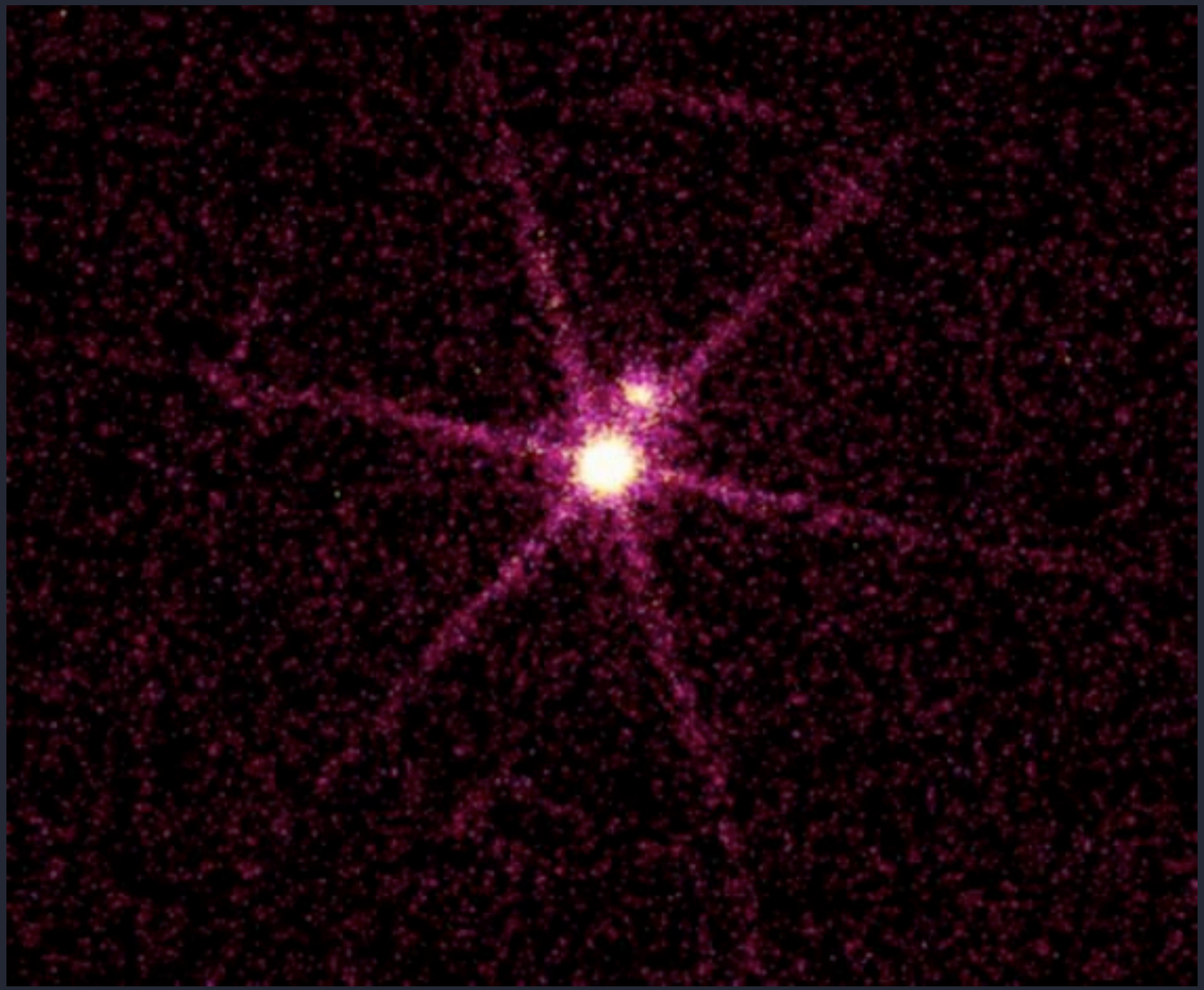
you can find the radii of the indicated stars by comparing their L and T to that of the Sun

Sirius A and B (with an X-ray telescope) - B is a white dwarf



(5) **Masses on the Main Sequence:** Stellar masses (purple labels) decrease from the upper left to the lower right on the main sequence.

(6) **Lifetimes on the Main Sequence:** Stellar lifetimes (green labels) increase from the upper left to lower right on the main sequence: High-mass stars live shorter lives because their high luminosities mean they burn through their nuclear fuel more quickly.