## Note guide for Stars Part I – Brightness and Distance

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| Wien’s Law – Temperature (Hotter is bluer – shorter wavelength)λmax = 2.90 x 10-3 mk Tλmax = Peak black body wavelengthT = The star’s surface temperature in Kelvins | **Example:** A star has a surface temperature of 5787 K, what is its λmax? |
| Total Power Output (In Watts, i.e. if the star were a light bulb)Luminosity: L = σAT4Luminosity L = The star’s power output in Wattsσ = Boltzmann constant (5.67 x 10-8W/m2K4)A = The star’s surface area = 4πr2T = The star’s surface temperature in Kelvins | **Example:** Our Sun has a surface temp of about 5787 K, and a radius of 6.96 x 108 m. What is its Luminosity? |
| Apparent Brightness (The intensity in W/m2)Apparent Brightness: b = L 4πd2b = The apparent brightness in W/m2L = The star’s Luminosity (in Watts)d = The distance to the star (in m) | **Example:** Our Sun puts out about 3.87 x 1026 Watts of power, and we are 1.50 x 1011 m from it. What is the apparent brightness of the Sun from the Earth? |
| Apparent Magnitude (not in data packet – A strange backwards logarithmic scale)Apparent Magnitude: m = 2.5log10 (2.52 x 10-8W/m2/b) b = The apparent brightness in W/m2m = The star’s Apparent Magnitude | **Example:** What is the apparent magnitude of a star with an apparent brightness of 7.2x10-10 Wm-2? What is that of a star with an apparent brightness of 7.2x10-12 Wm-2? |

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| Absolute Magnitude (The actual brightness of the star independent of our distance to the star)Absolute Magnitude: m - M = 5 log10(d/10)M = The Absolute Magnituded = The distance to the star in parsecsm = The star’s Apparent Magnitude | **Example:** The Sun has an apparent magnitude of -26.8, we are 1.5x108 km or 4.9 x 10-6 pc from the sun. What is the sun’s absolute magnitude? |

**Hertzsprung-Russell (H-R) diagrams**

 

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| **Example:** How far is a B0 that has an m of 8? |  |
| **Hot** stars are: **B**ig, **B**right, **B**rief and **B**lue**Cool** stars are:  **D**iminuitive, **D**im, and **D**urable and um… re**D** | (Oh Be A Fine Girl Kiss Me)**Spectral Types****O** – 30,000 - 60,000 K, ionized H, weak H lines, spectral lines arespread out. O types are rare and gigantic.**B** – 10,000 - 30,000K, H lines are stronger, lines are less spread out(Rigel, Spica are type B stars)**A** – 7,500 - 10,000K, strong H lines, Mg, Ca lines appear (H and K) (Sirius, Deneb and Vega are A type stars)**F** – 6,000 - 7,500K, weaker H lines than in type A, strong Ca lines (Canopus (S.H.) and Polaris are type F)**G** – 5,000 - 6,000K, yellow stars like the sun. Strongest H and Klines of Ca appear in this star.**K** – 3,500 - 5,000K, spectrum has many lines from neutral metals.Reddish stars (Arcturus and Aldebaran are type K stars)**M** - 3,500 or less, molecular spectra appear. Titanium oxide linesappear. Red stars (Betelgeuse is a prominent type M)Suffixes 0 (hottest) - 9 (coolest) so O0, O1…O9, then B0, B1… |