



Gravity Day 7

(Death of Big Mass Stars)

How Long will the fuel last?

Mass/Gravity determine Star lifespan

□ Bigger nebula make bigger main sequence stars

□ **Big Mass** = $>8x$ sun's mass

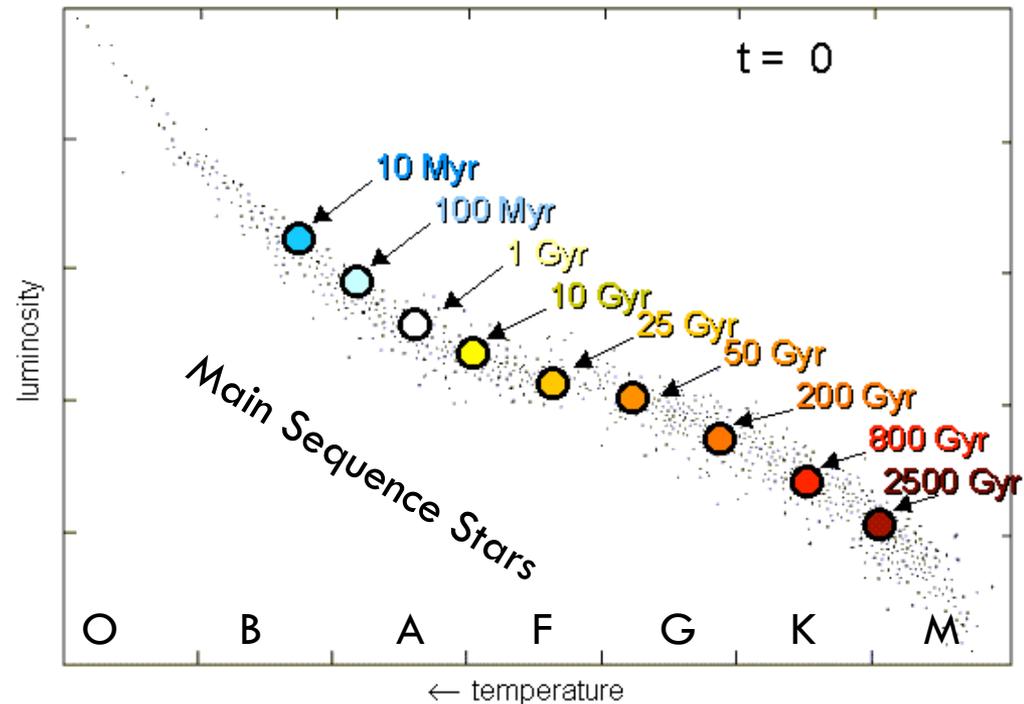
- ◆ blue, hot, bright
- ◆ use fuel quickly; short lives
- ◆ Millions of years

□ **Small Mass** = $<8x$ sun's mass

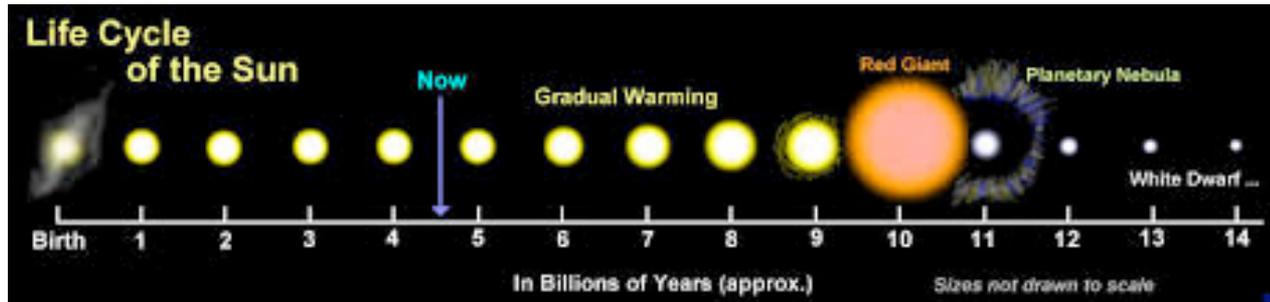
- ◆ red, 'cool', dim
- ◆ Use fuel slowly; long lives
- ◆ Billions-Trillions of years

□ **Our sun** =

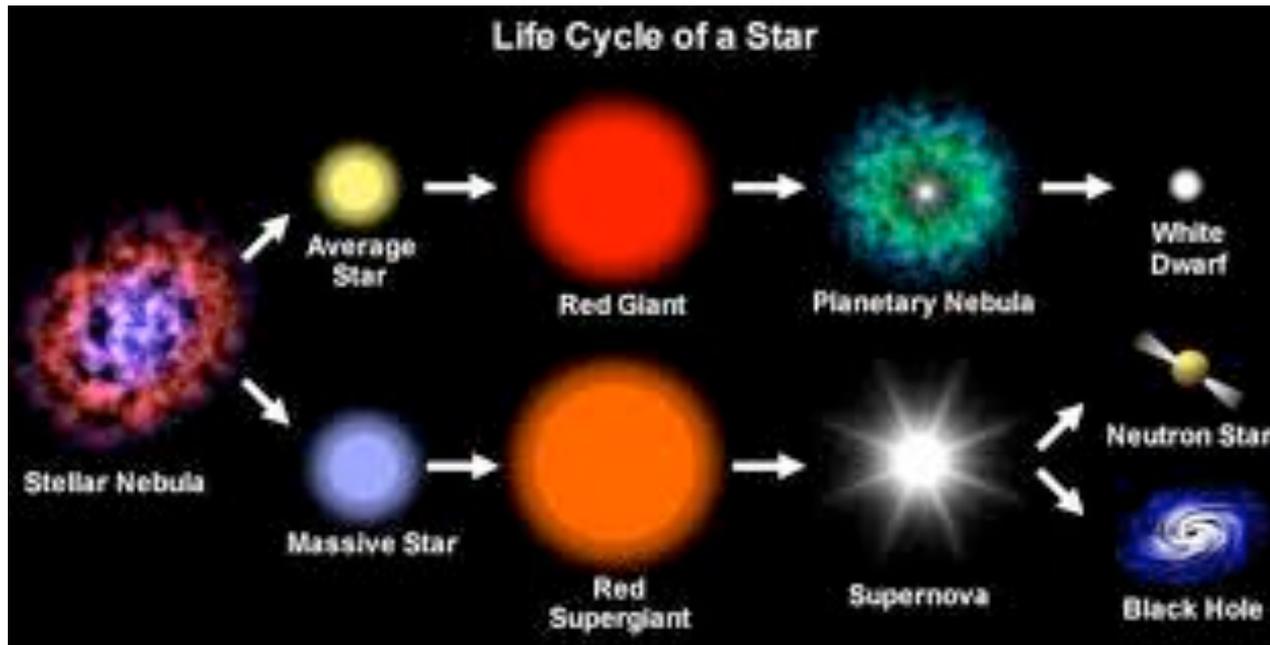
G class main sequence, orange & small



Life stages...it's all about mass!



Our Sun

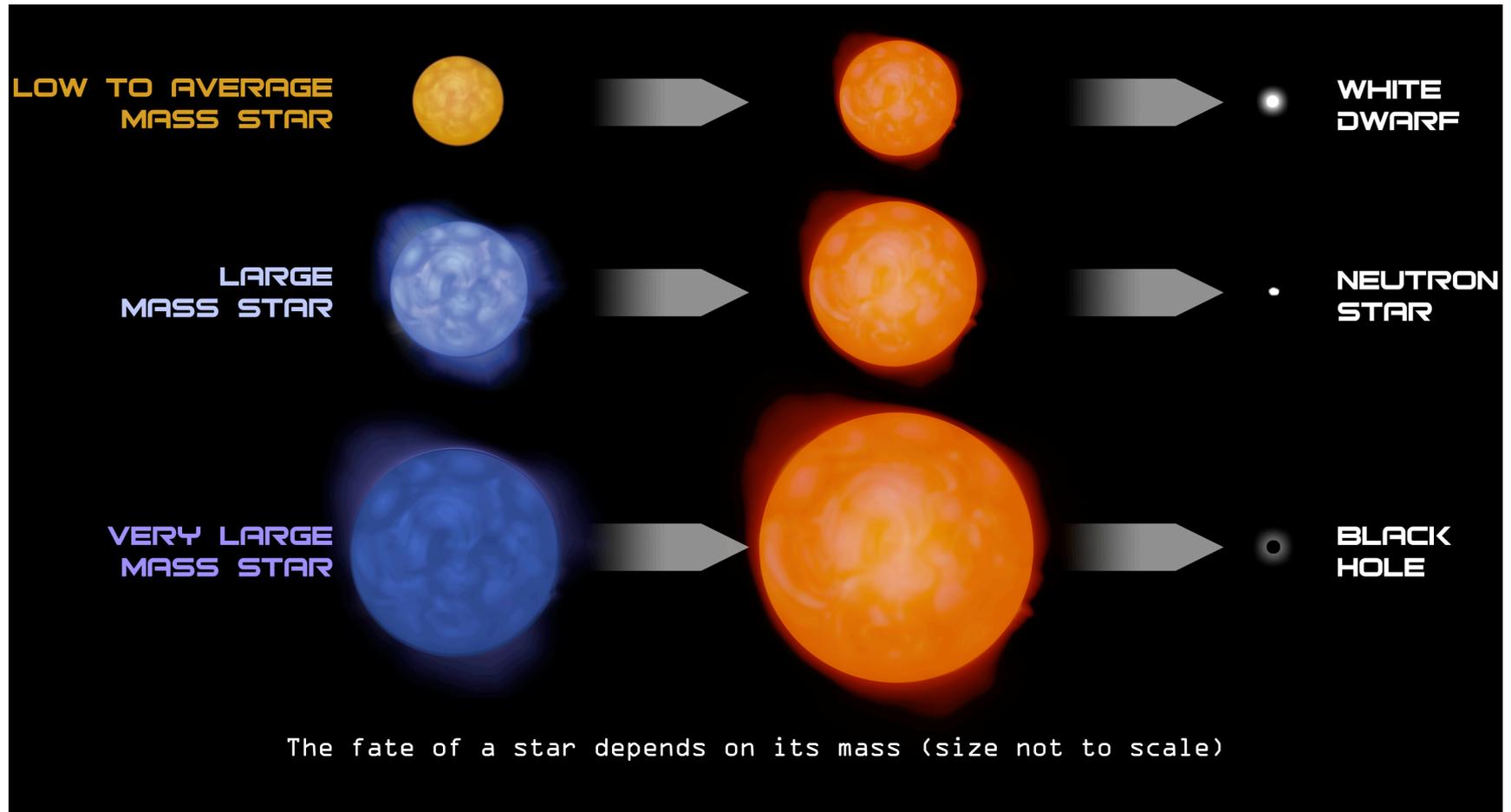


Small Mass

Big Mass

Biggest Mass

Bigger Main Sequence Stars ...make Bigger Red Giants



Supernova

- = Big mass star's outer layers explode during core's contraction as it fuses iron (Fe)
- Exploded atoms make a planetary nebula
- big stars have enough gravity to fuse up to iron
- Iron fusion absorbs heat & cools star - causing rapid core collapse
- Supernova energy = all energy of our sun's lifetime



Supernova found June 7, 2011

SN2011dh



BEFORE

AFTER

Stars MAKE atoms!

- Atoms #1-Hydrogen, #2-Helium & -#3-Lithium formed during the Big Bang
- Atoms #4 Beryllium through #26 Iron formed by star fusion
- Atoms above Iron (Fe) formed in Supernova as atoms collide/fuse during explosion

All elements beyond Li from stars

1 H 1.0079																	2 He 4.0026						
3 Li 6.941	4 Be 9.0122																	5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
11 Na 22.990	12 Mg 24.305																	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80						
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29						
55 Cs 132.91	56 Ba 137.33	57-70 * Lu 174.97	71 Hf 178.49	72 Ta 180.95	73 W 183.84	74 Re 186.21	75 Os 190.23	76 Ir 192.22	77 Pt 195.08	78 Au 196.97	79 Hg 200.59	80 Tl 204.38	81 Pb 207.2	82 Bi 208.98	83 Po [209]	84 At [210]	85 Rn [222]						
87 Fr [223]	88 Ra [226]	89-102 ** Lr [262]	103 Rf [261]	104 Db [262]	105 Sg [266]	106 Bh [264]	107 Hs [269]	108 Mt [268]	109 Uun [271]	110 Uuu [272]	111 Uub [277]	112 Uuq [289]											
* Lanthanide series		57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04								
** Actinide series		89 Ac [227]	90 Th [232]	91 Pa [231]	92 U [238]	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [288]	102 No [289]								

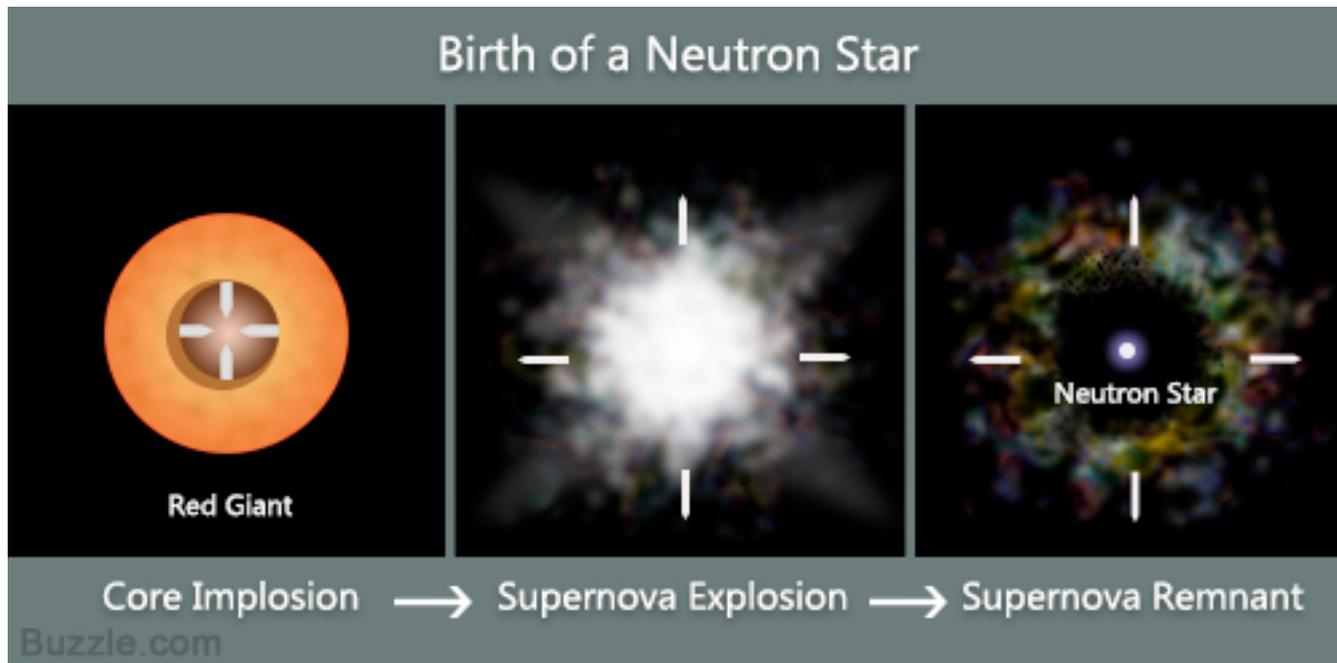
#1H, #2He,
#3Li made in
Big Bang

#4(Be) → #26(Fe)
made by star fusion

Bigger than Fe
made in
Supernova

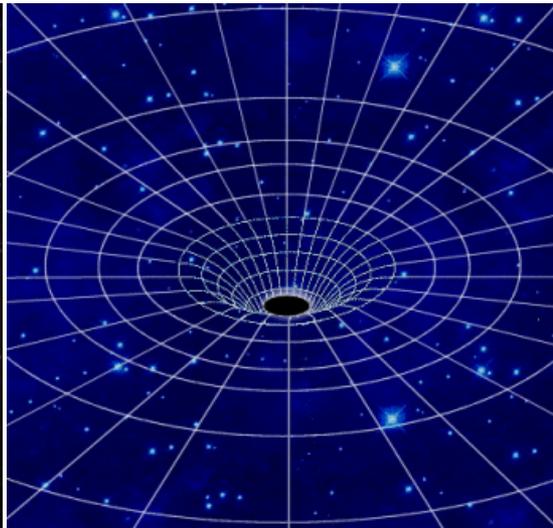
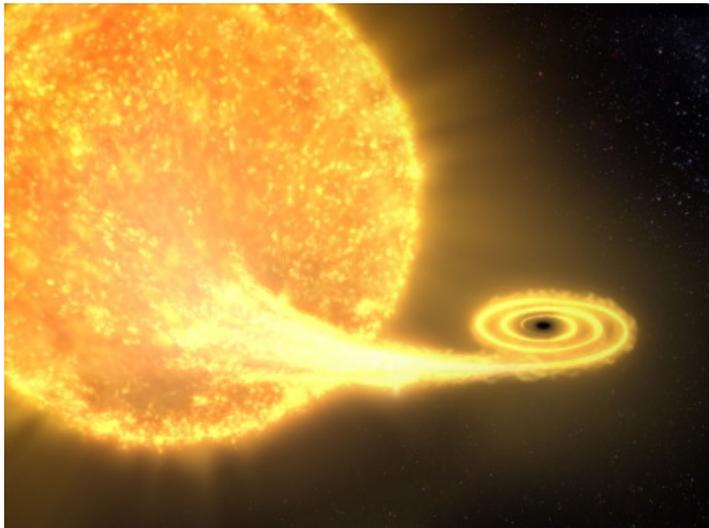
Death of Big Stars (9-20x solar masses)

- After supernova, no fusion to hold up gravity
- **Neutron Star** = dead core of big mass star crushed by gravity until atoms form neutrons
- Extremely dense- size of a city

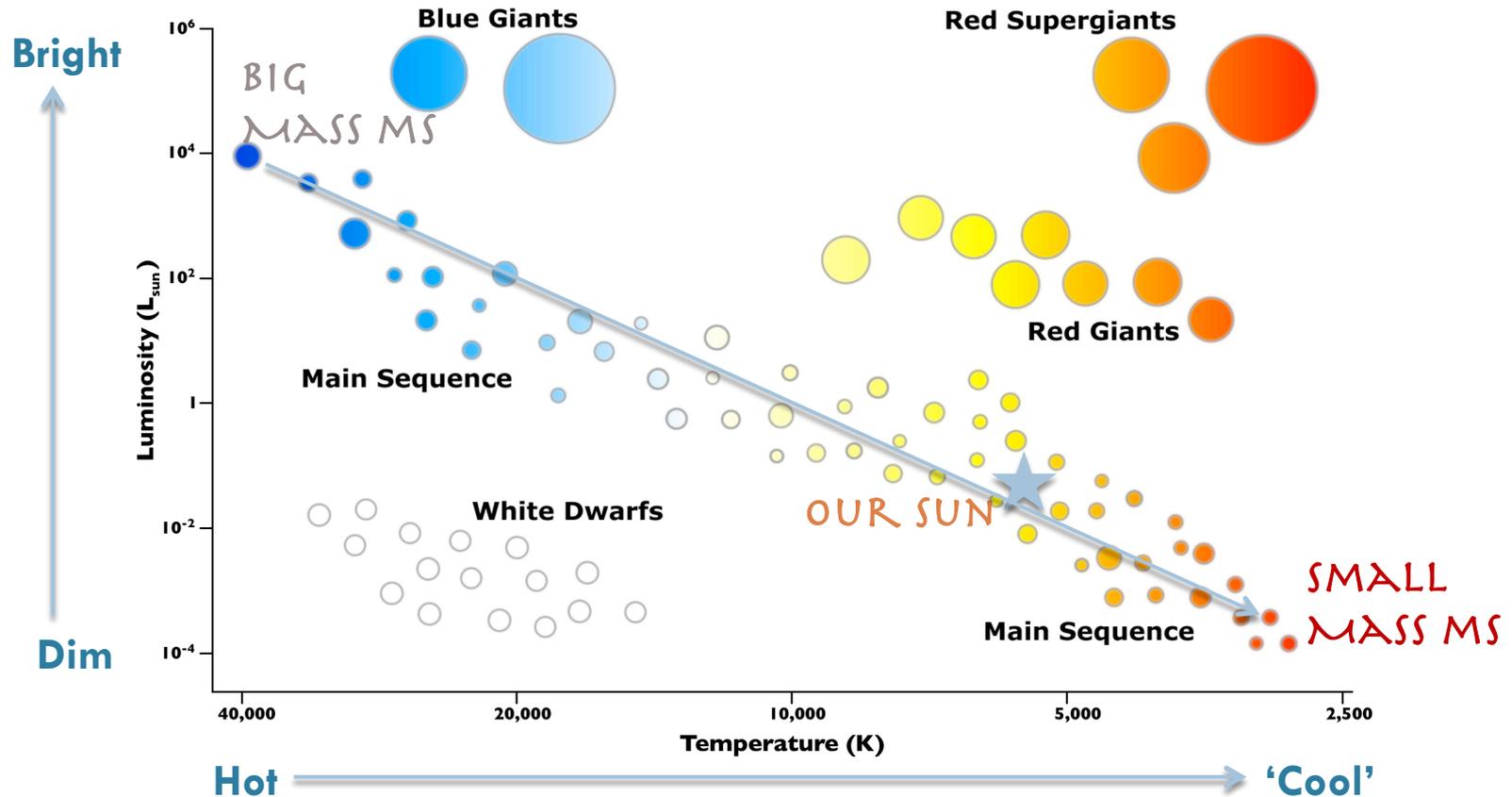


Death of most massive stars (20+ solar mass)

- After supernova, no fusion to hold up gravity
- **Black Hole**= dead core of biggest mass stars crushed by gravity down to a point (singularity)
- Gravity so strong, light can't escape



HR Diagram-graph of temp vs luminosity that reveals star life cycle stages.



[Video-Full Lifespan of Star 5min](#)

Apparent and Absolute Magnitude

An Analogy:



A



B

Cars A and B are identical. A's headlights appear brighter because it is closer.



A



B

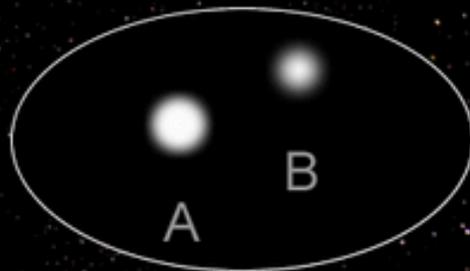
Cars A and B are at the same distance. A's headlights appear brighter because they are intrinsically brighter.

An Example:



A

B



Observer sees

An observer sees two stars. Star A appears brighter than Star B because it is closer to her.

Absolute magnitude is the brightness a star would have at a distance of 10 parsecs. If stars A and B were both 10 parsecs away from the observer, Star B would appear brighter than star A.