Week 9
Evolution of high-mass

November 16

Low-mass star lifecycle overview

Each step ★ has observable difference in L & T

What causes these changes?

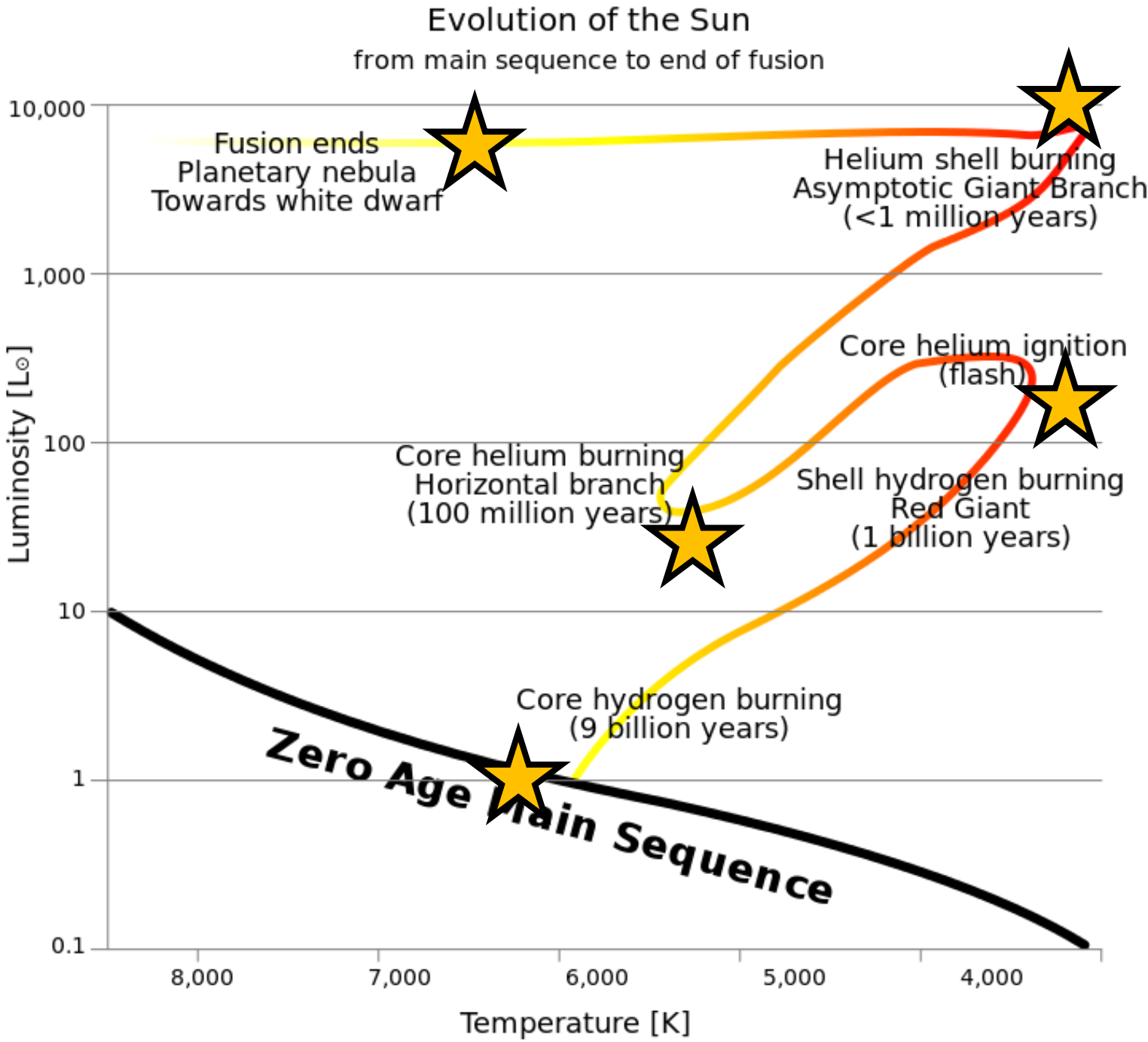
Changes in balance of:

- inward pull of gravity and
- outward pressure from core temperature

Why does balance change?

Changes in:

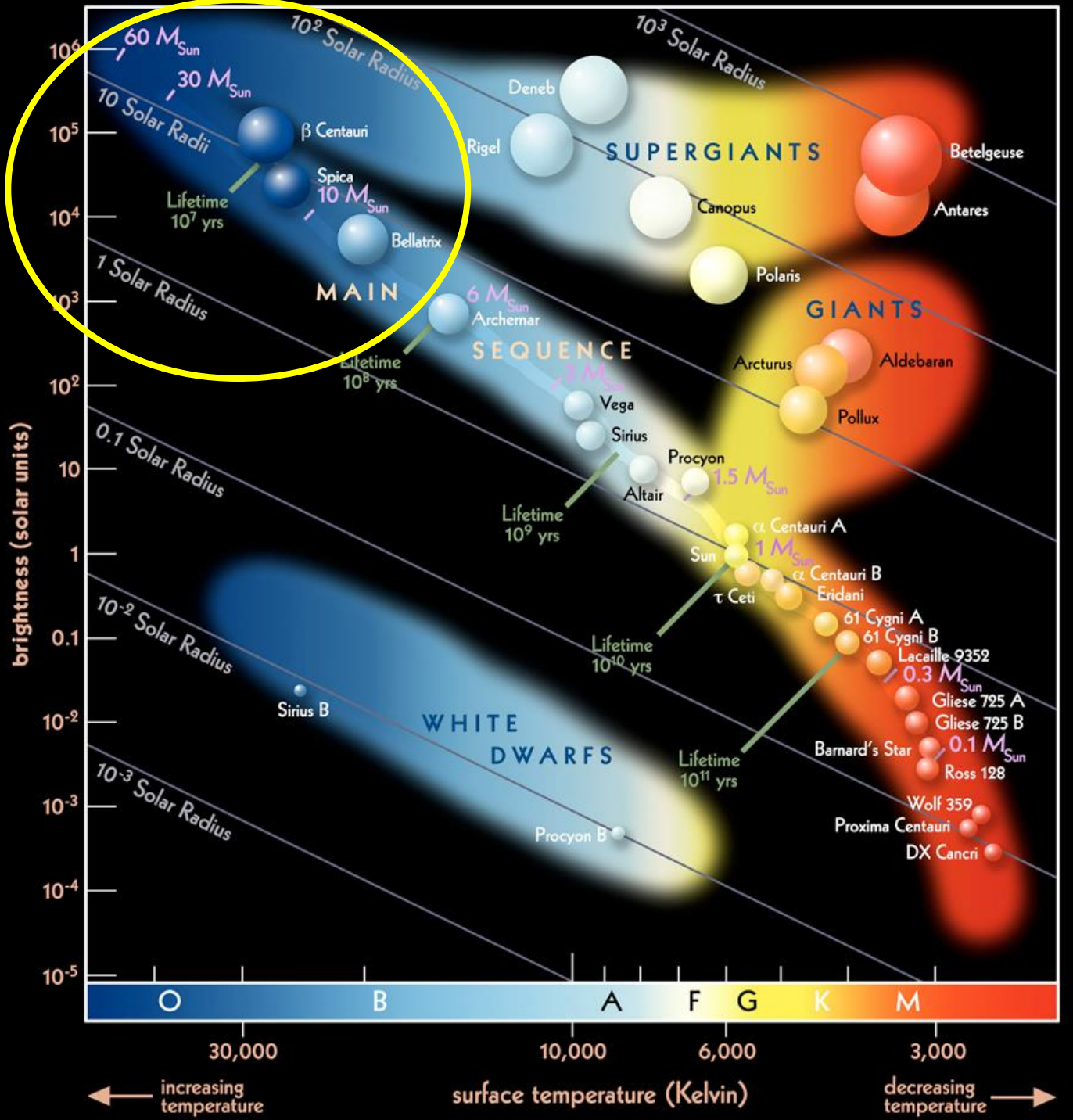
- Core composition/size
- Type of nuclear fuel (^{1}H or ^{4}He)



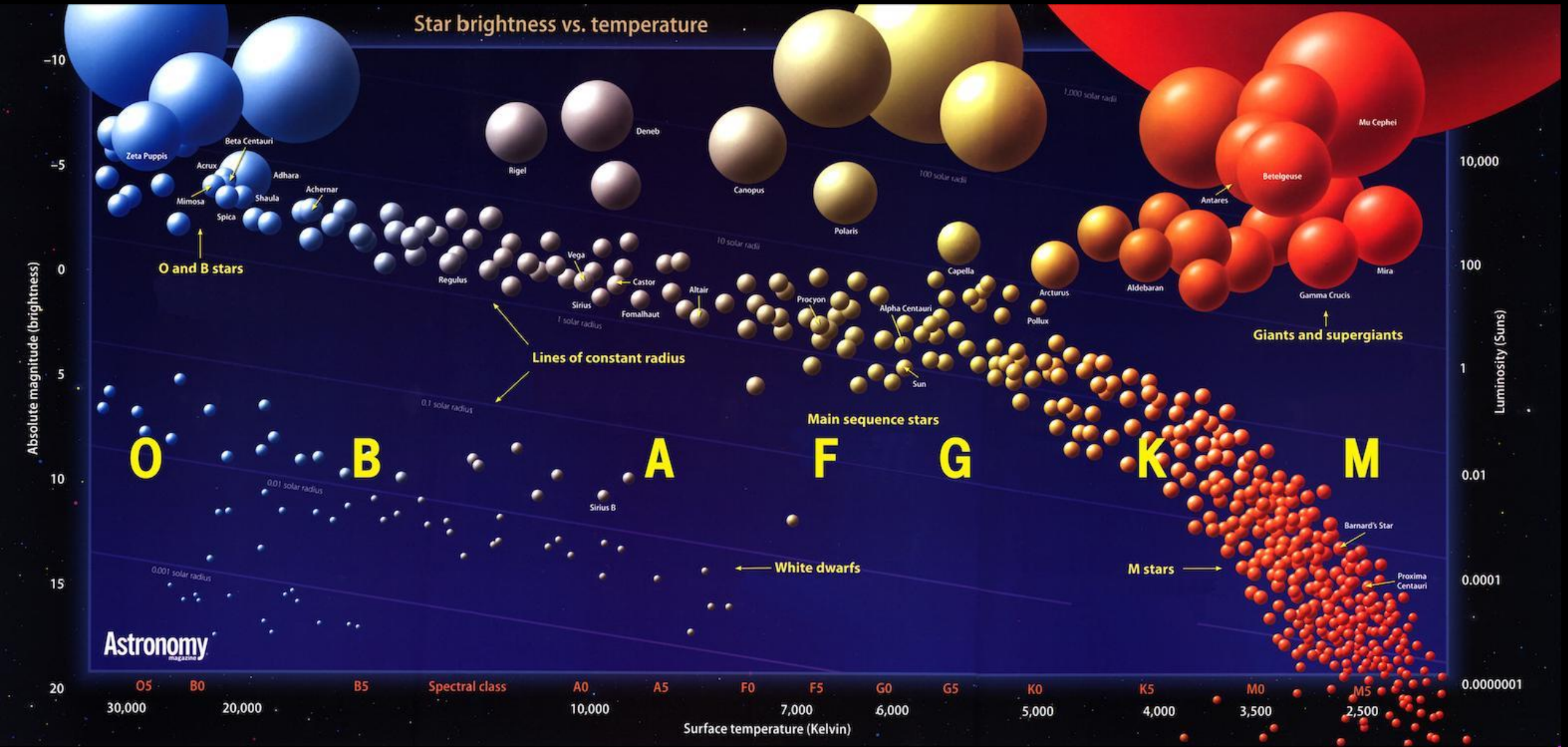
What about high-mass stars?

- Mass > $8M_0$

- High T
- High L
- Large radius (~10 R_0 while on main sequence)



What about high-mass stars?

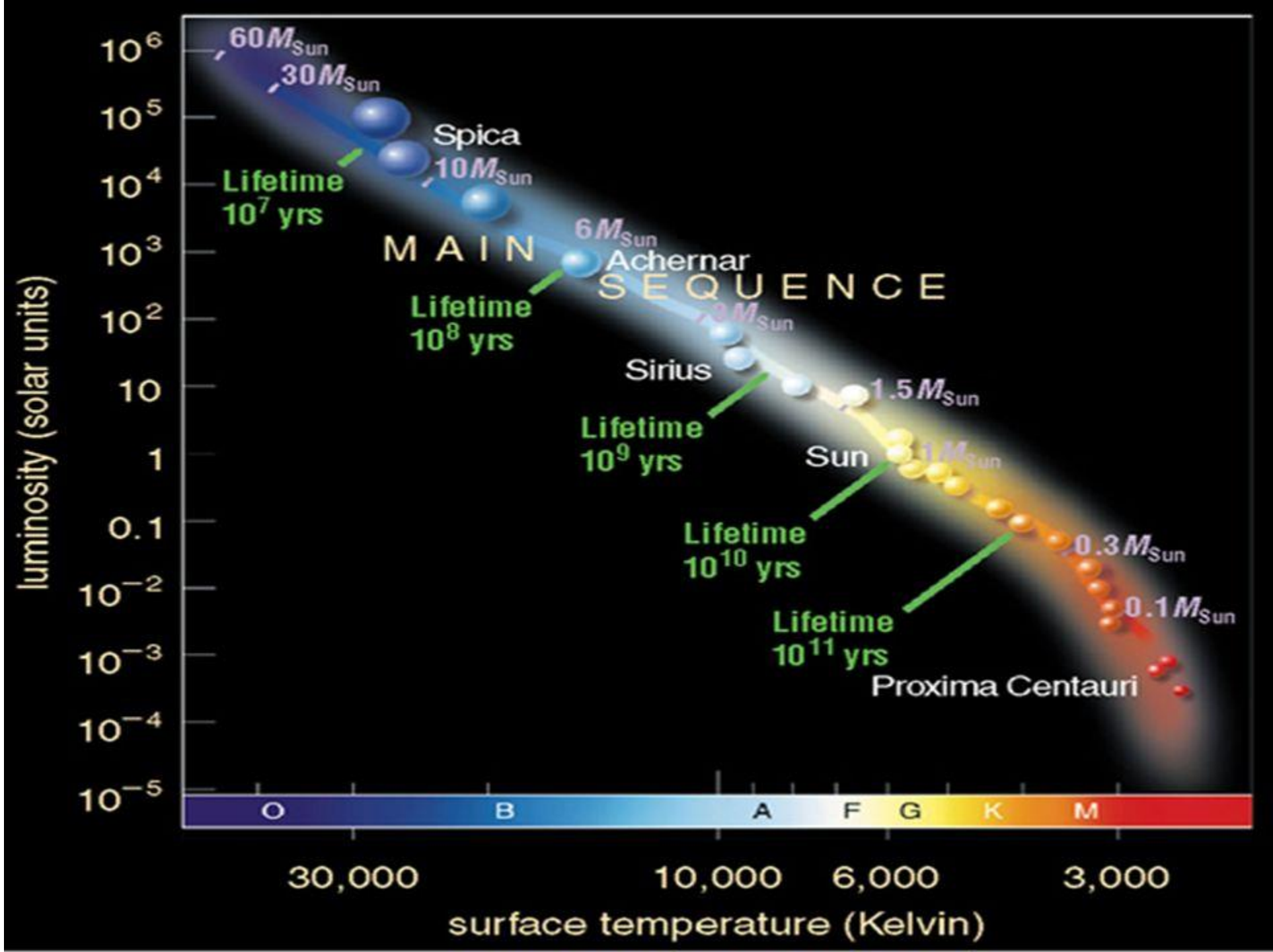



Earth Moon
Mercury

Lifetimes of stars

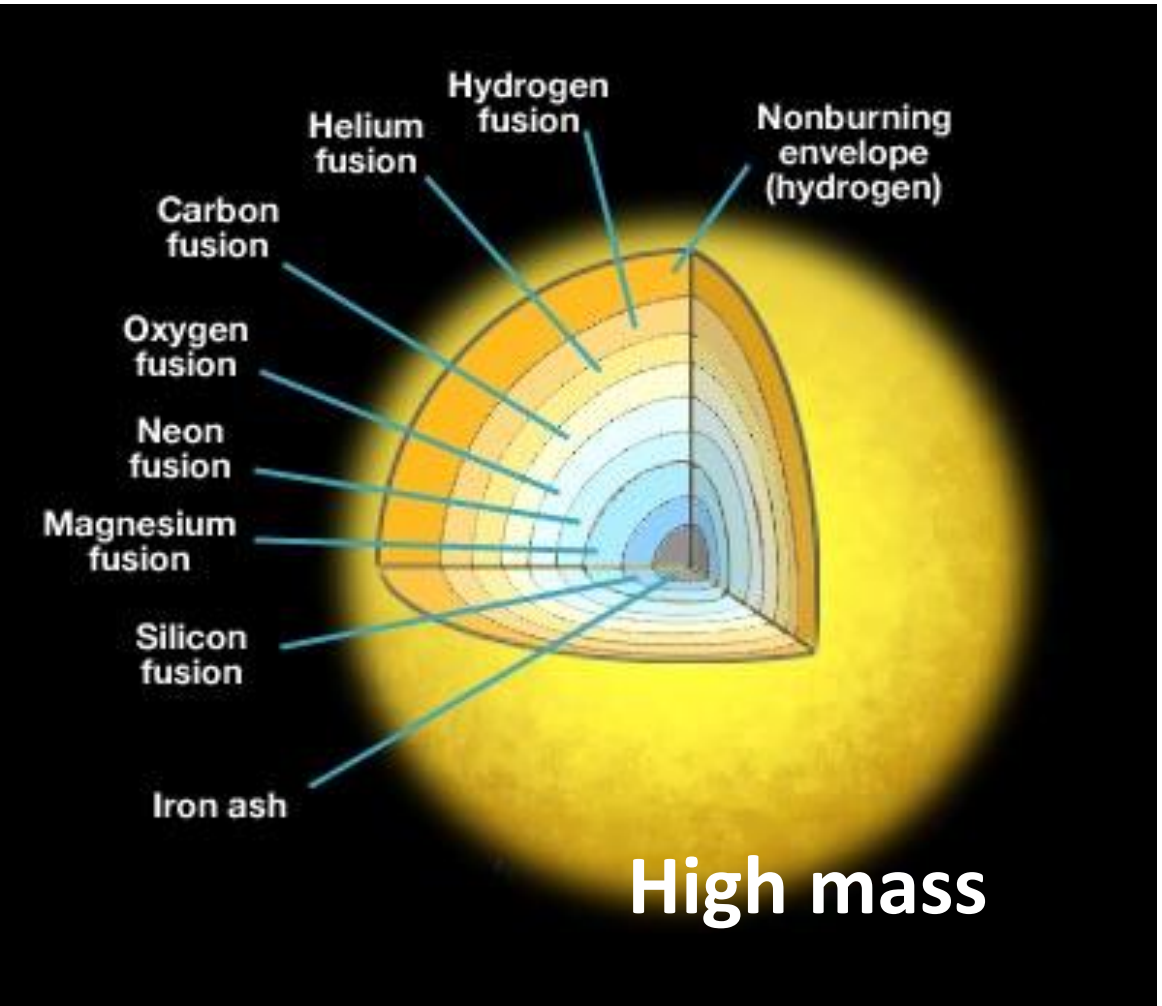
Big stars have much shorter lives

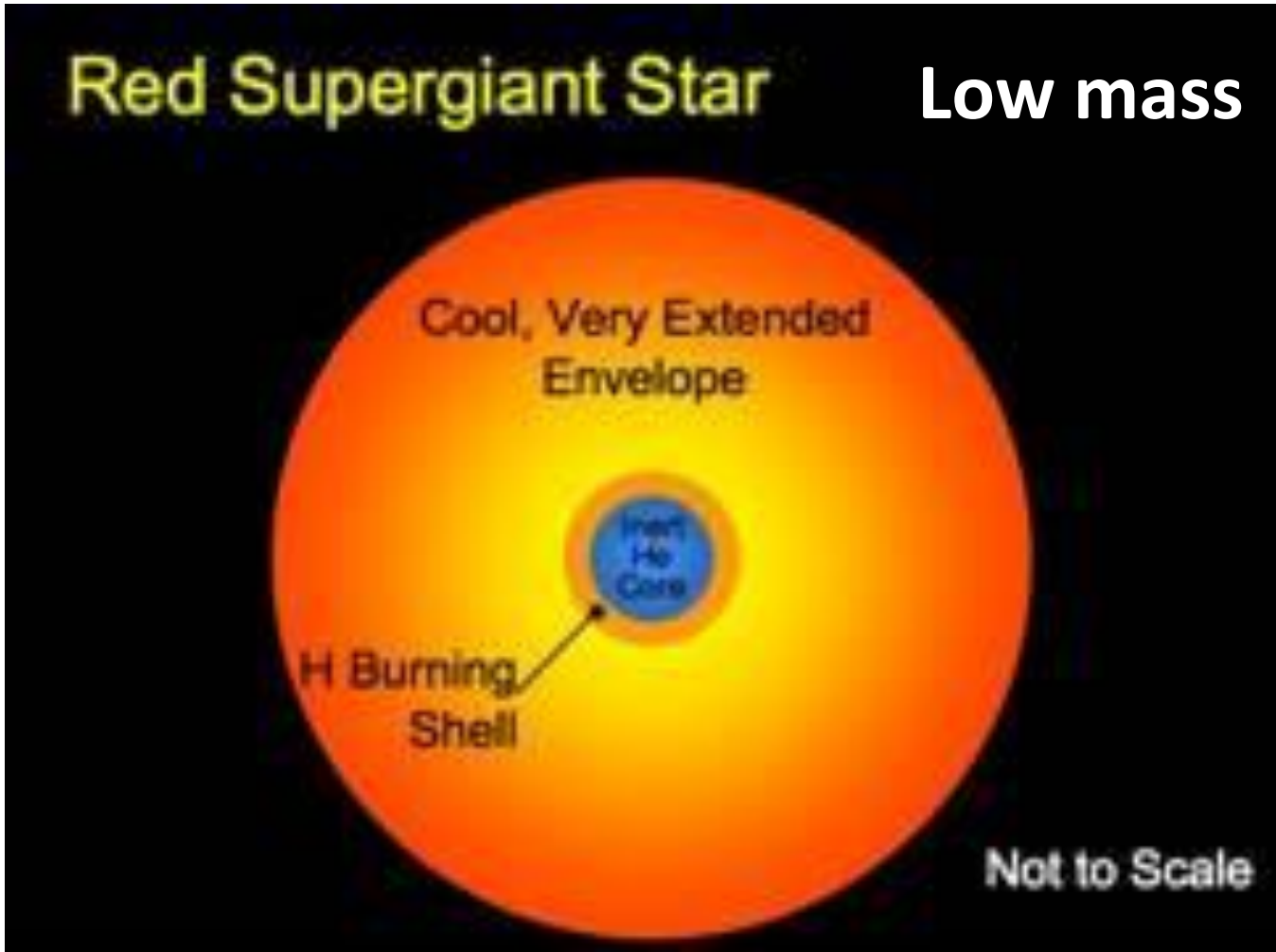
Why?



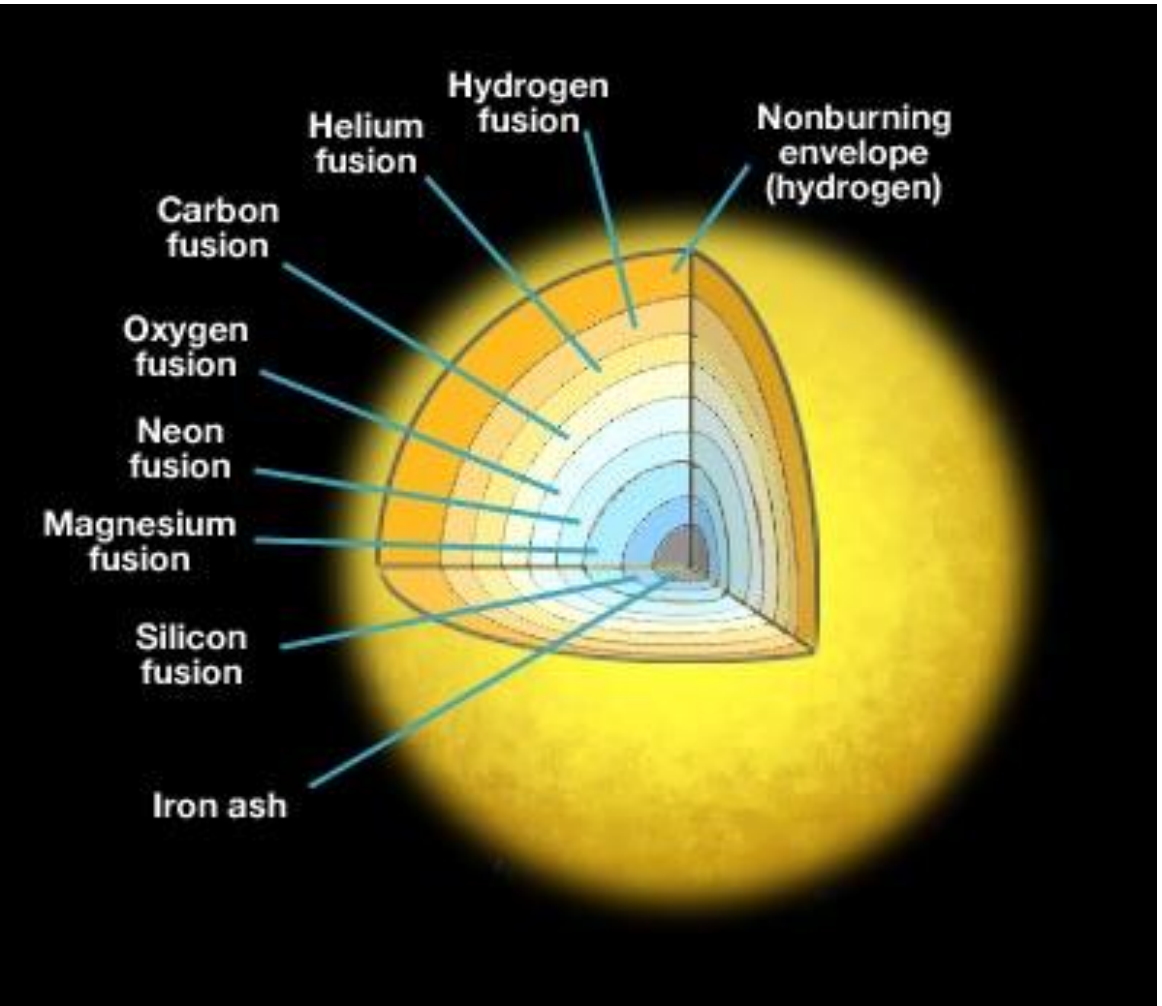
http://w.astro.berkeley.edu/~dperley/univage/clusterhranim.gif

High-mass stars use higher mass elements as nuclear fuel

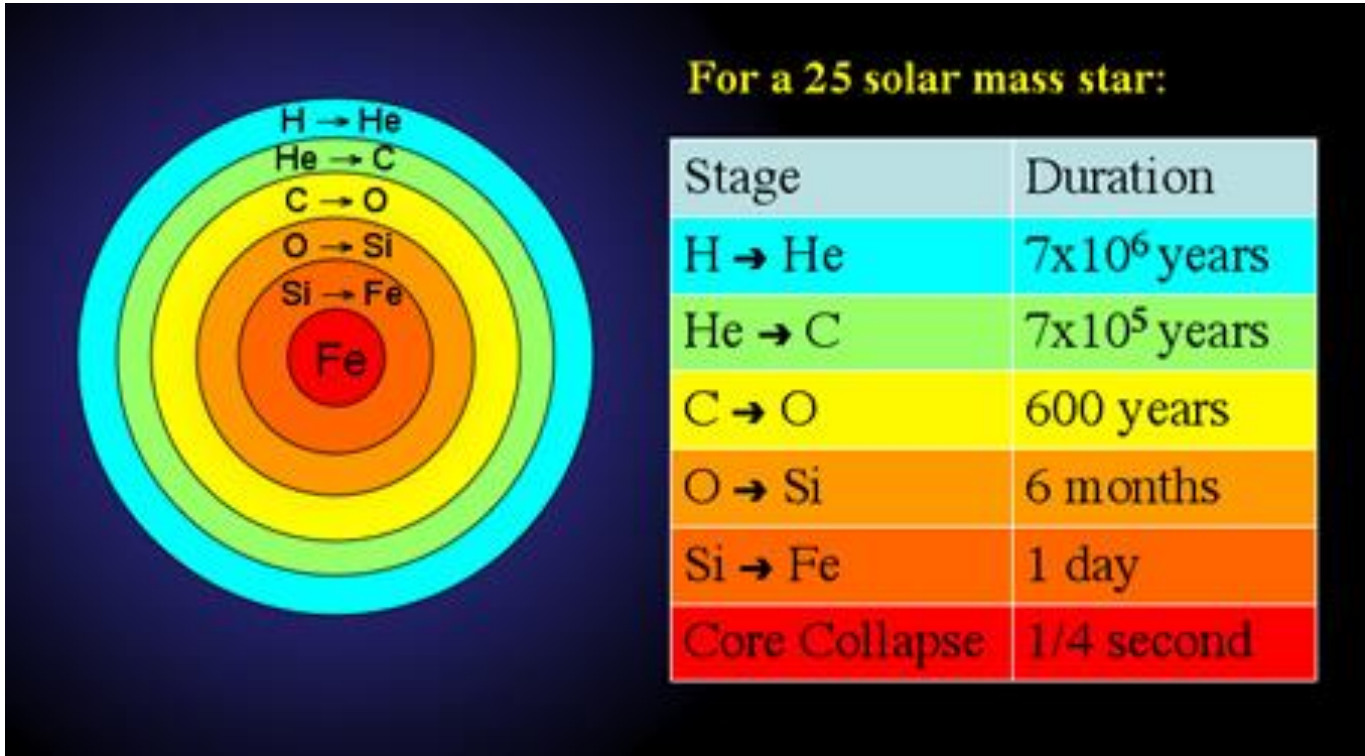




Fusion in high-mass stars

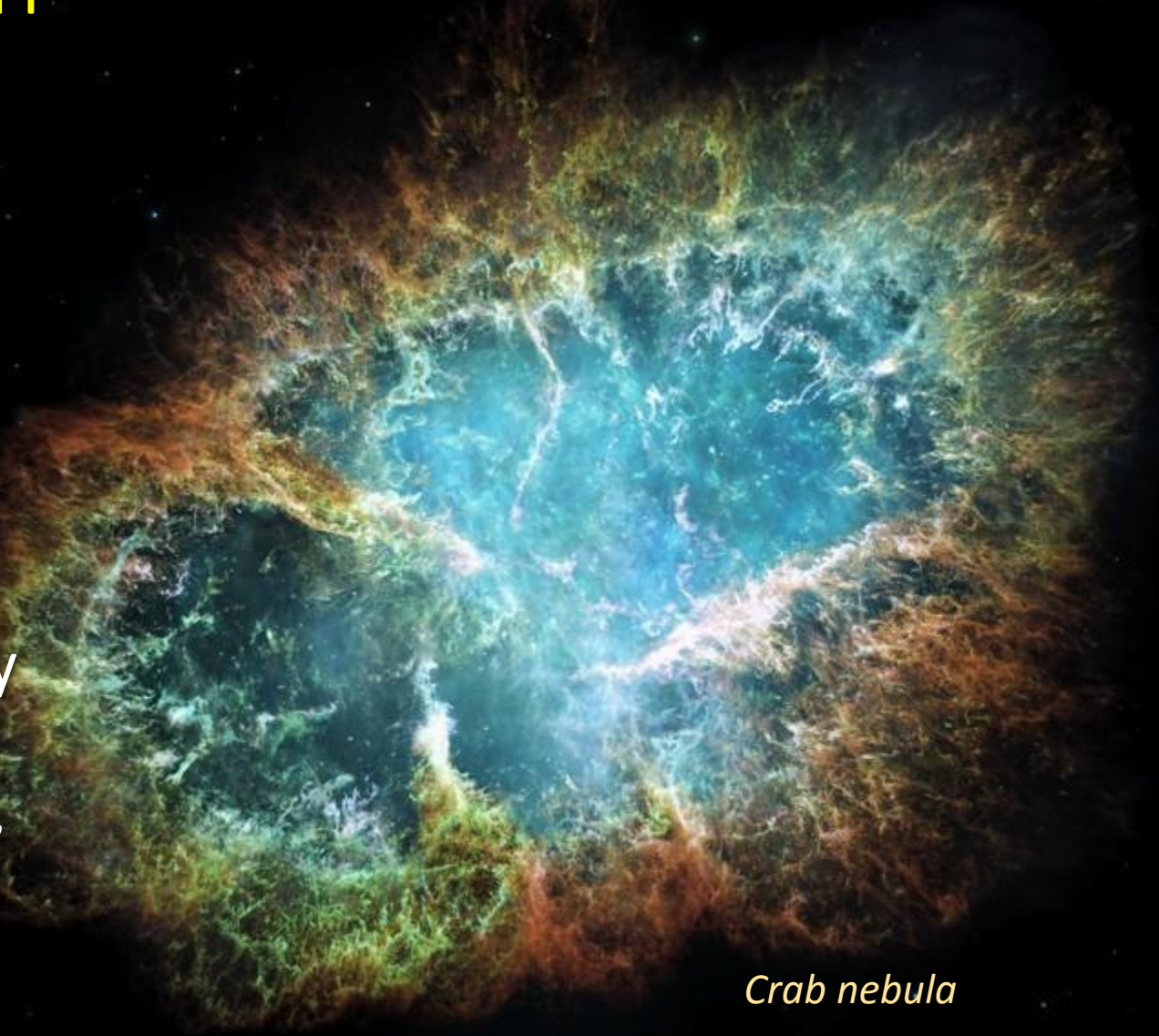


- Go through burning elements in series of steps to make new cores over time



Rapid collapse of iron (Fe) core leads to supernova explosion

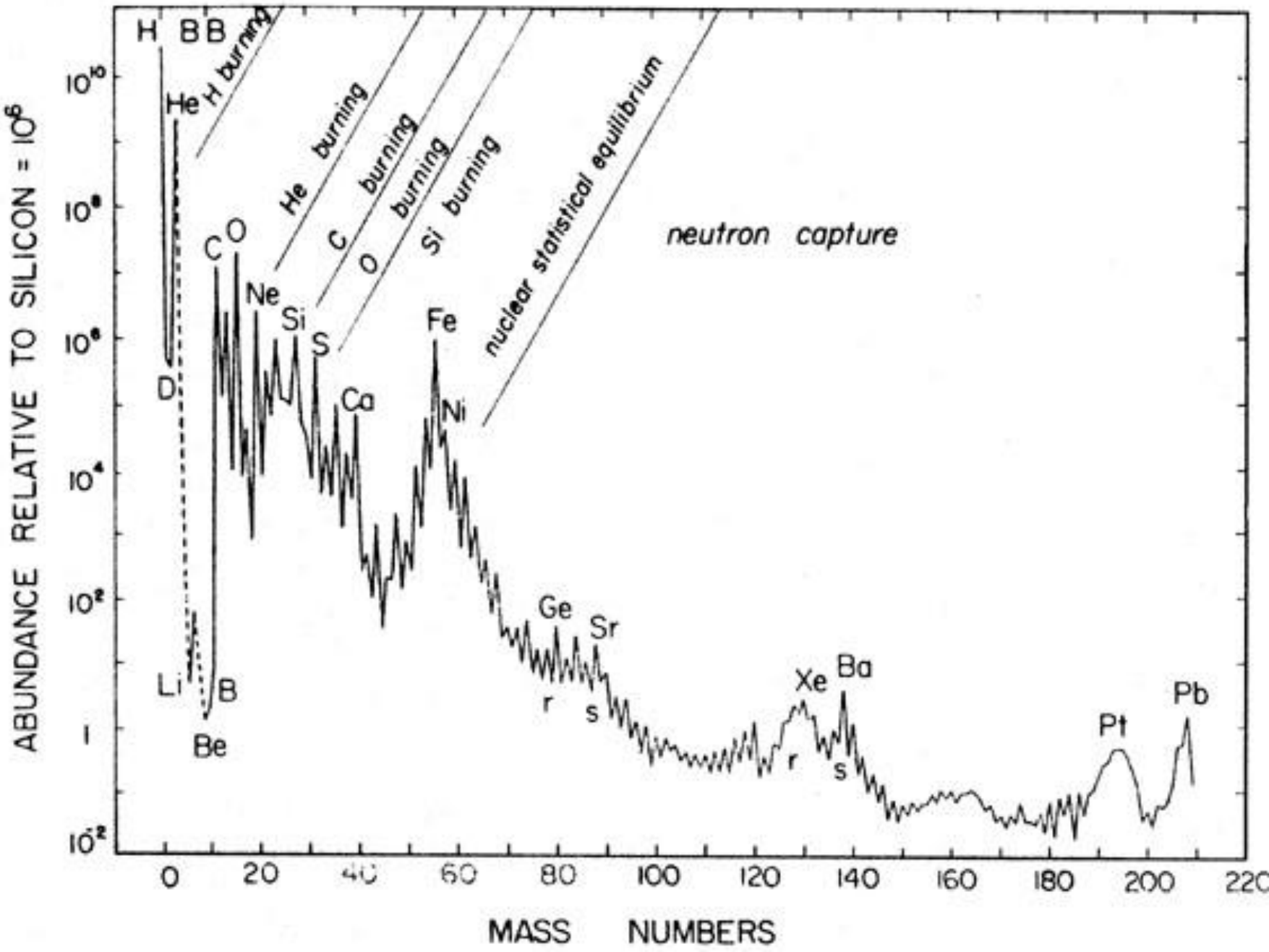
- Expands at 10000 km/s
- Releases all the elements into space
- Explosion has such high energy it can fuse heavy elements like Fe into even heavier elements, like Au, Pb all the way to U



Crab nebula

Thank you nuclear fusion

All the elements we know ofand are made of were manufactured in stars and released to space in supernova events



Comparing lives of low and high mass stars