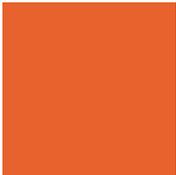


Session 7: Stars and Their Lives (Part II)



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The Main Concepts...

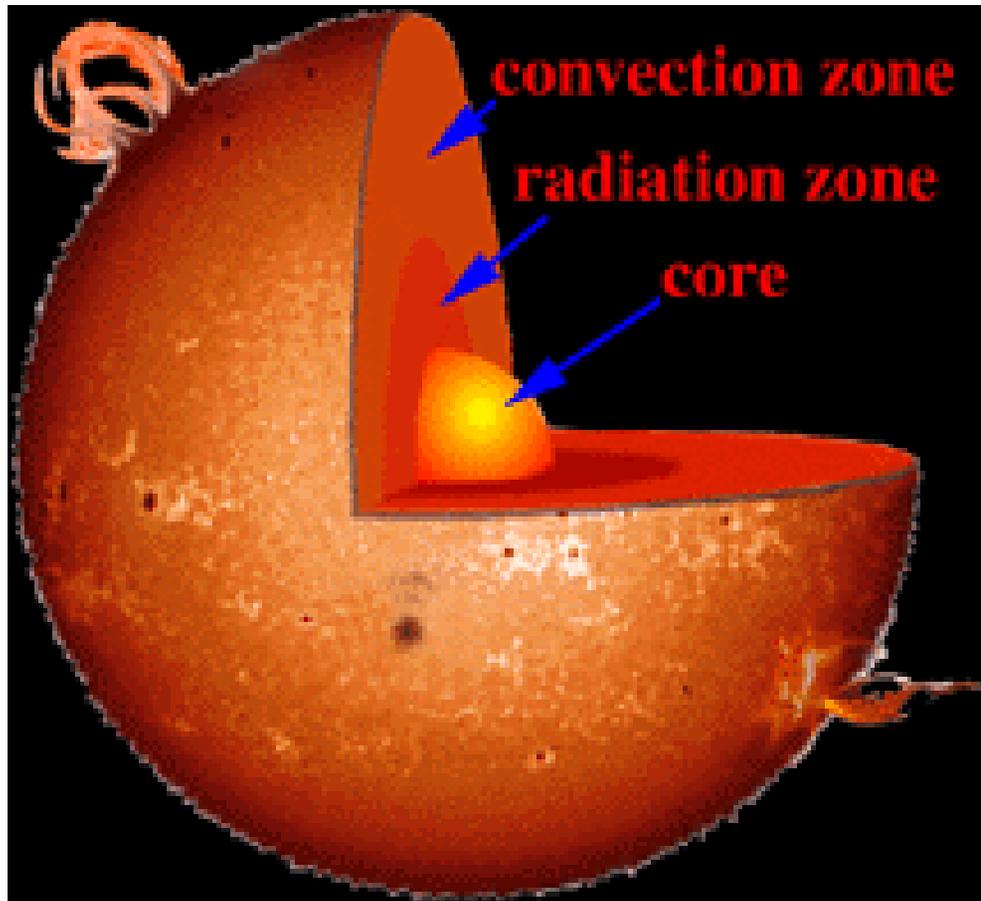
1. Stars generate energy by “cooking” elements in their cores.
2. Many of the elements that we find in the world are made inside of stars. They are released when the stars explode in supernova explosions.



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How Do Stars Make Energy?



Sun generates energy in its core by “cooking” hydrogen to form helium



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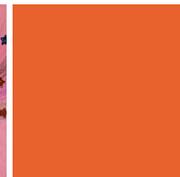


Nuclear Fusion

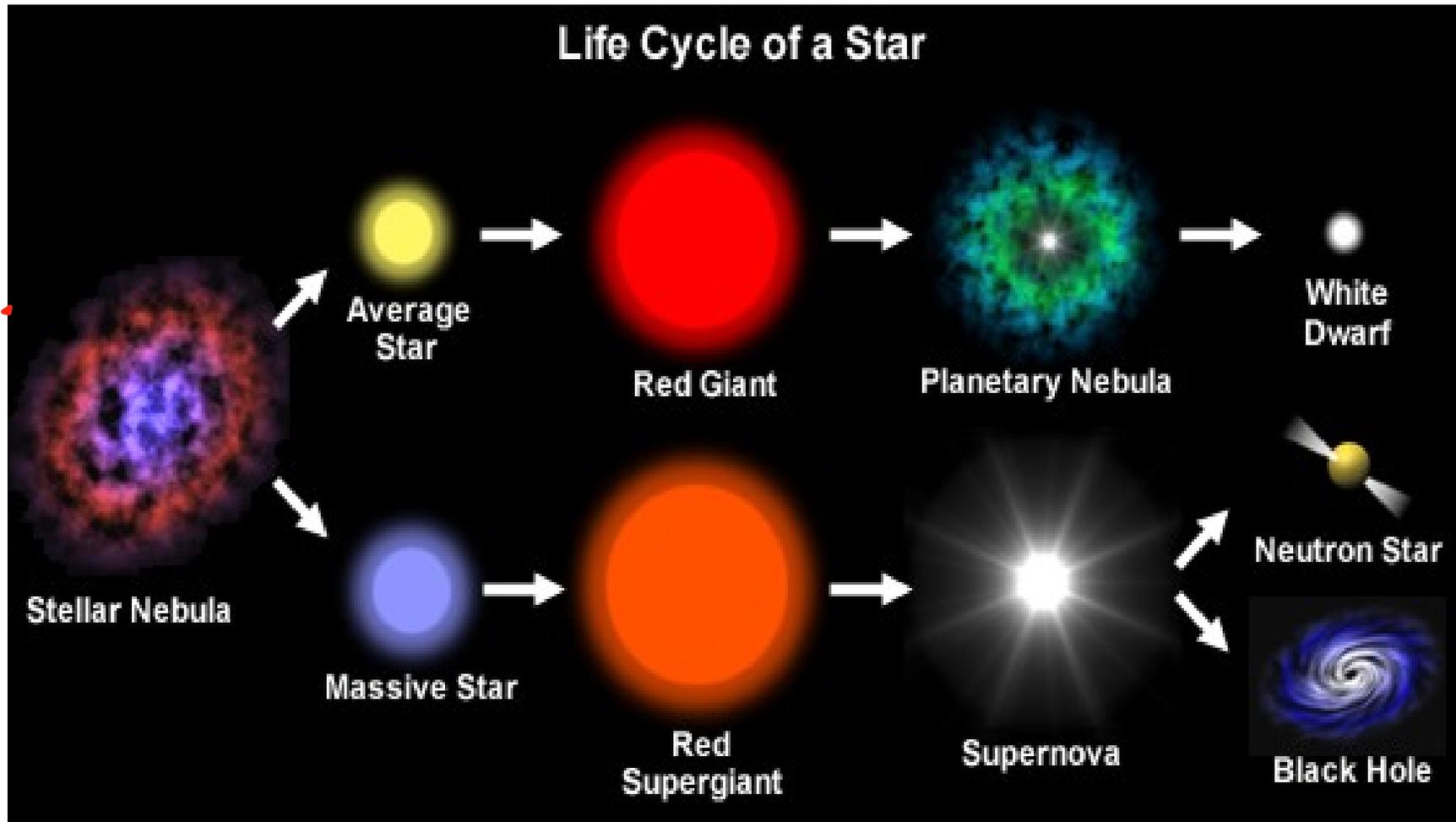
- This “cooking” of elements is called **nuclear fusion**
- During nuclear fusion, two or more atoms of one element combine to form one atom of a different element
- During most of their lives, stars make energy by turning hydrogen into helium
 - 4 hydrogen atoms → 1 helium



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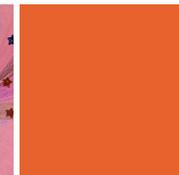
Life Cycles of Massive Stars



© Sea & Sky



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Life Cycles of Massive Stars

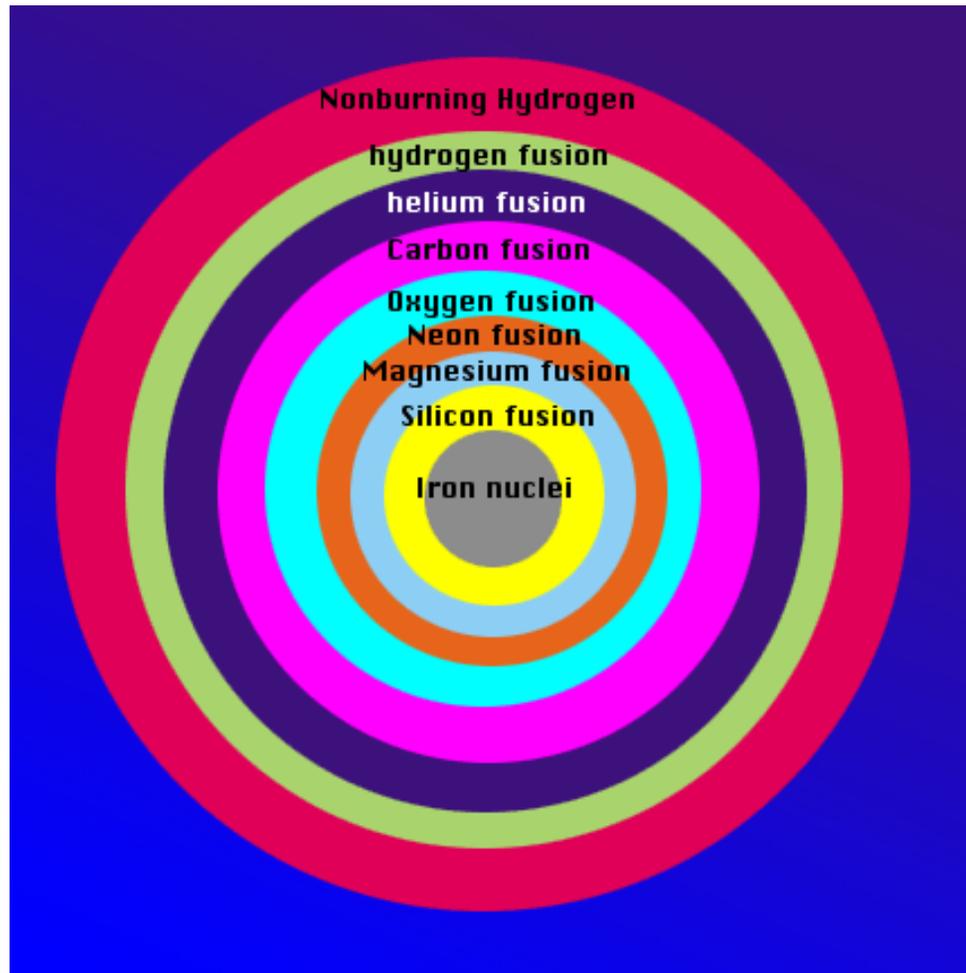
- **A massive star will...**
 - Run out of hydrogen after a few million years
 - Will carry on cooking elements...
 - Helium→Carbon→Oxygen→Neon→Magnesium→Silicon→Iron
 - Nuclear fusion process stops at iron. The star cannot release anymore energy once iron has been made.
 - Without energy generation, gravity causes core of star to rapidly collapse (in a few seconds).
 - Energy released from collapse causes rest of star to explode in a **SUPERNOVA!**
 - After the supernova, we are left with a superdense object, either a **neutron star** or a **black hole**.



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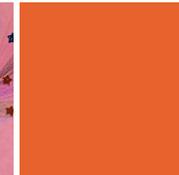
Interior of a Massive Star



Just before a supernova, the inside of the star has shells of various elements.



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Elements in the Universe

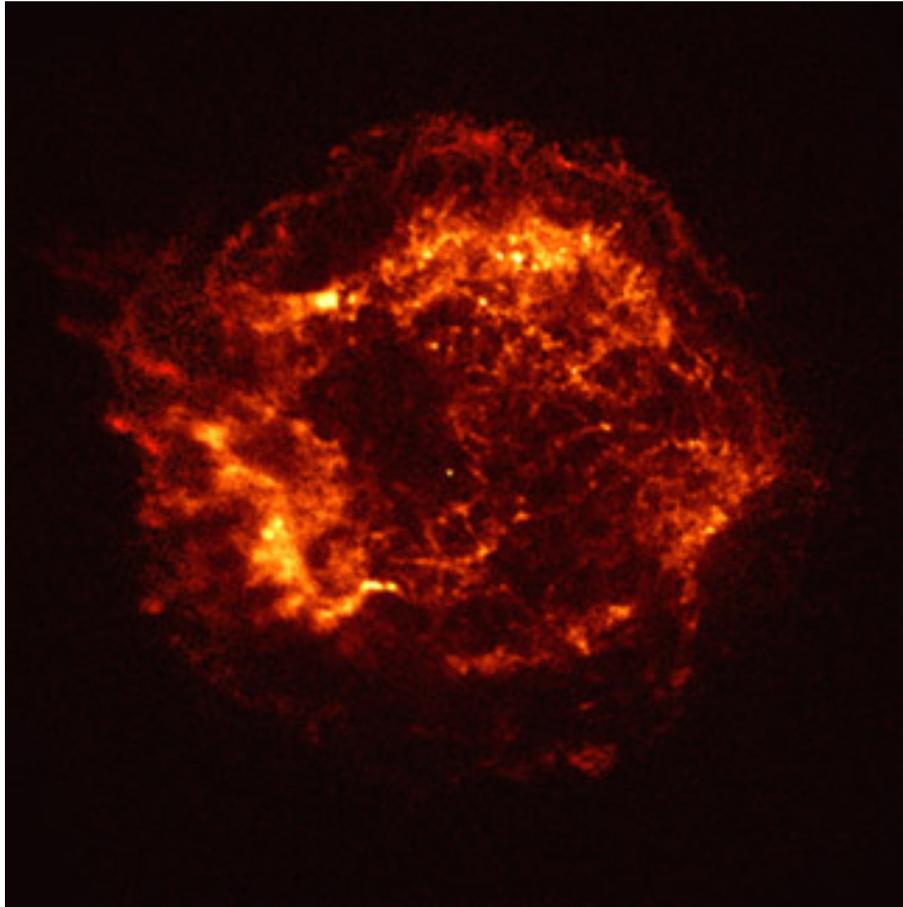
- Hydrogen and some helium was made at the beginning of the Universe (Big Bang).
- All other elements were made inside of stars, and then spewed out into space by the supernova explosions!
- What about elements with atoms heavier than iron? Such as Uranium, Gold, and so on?
 - The heavy atoms are made during the supernova explosion itself!
 - There is so much energy during the explosion that iron atoms can be forced together to form larger atoms.



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Supernova Remnants



X-ray picture of the “Cas-A” supernova remnant. The elements in this gas will eventually be dispersed into space, maybe to form new stars, planets and people!



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