



The Life Cycle of Stars

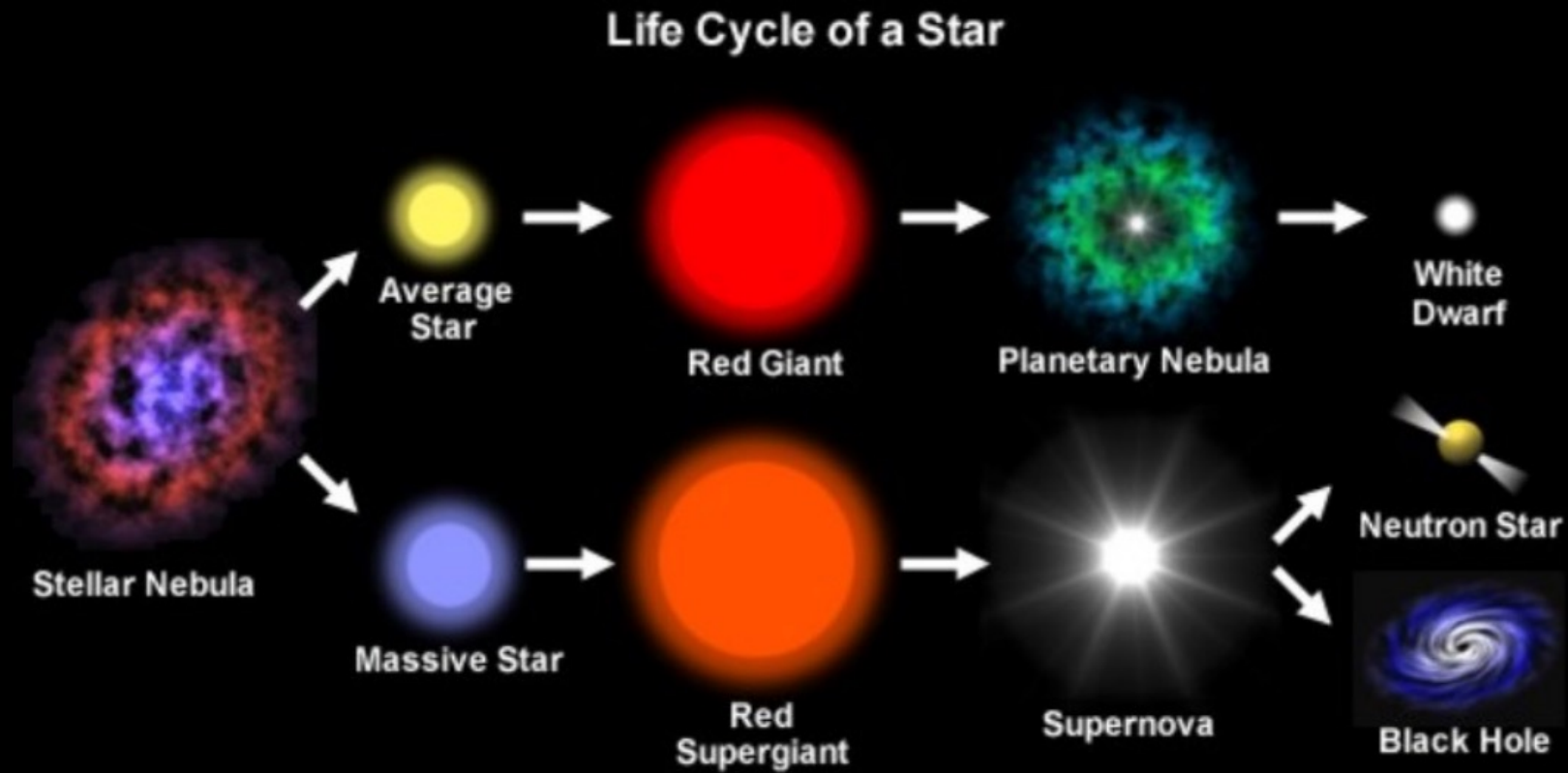
Grade 9 Science

What is a star?

- The objects that heat and light the planets in a system
- A star is a ball of plasma held together by its own gravity
 - Nuclear reactions occur in stars (H \rightarrow He)
 - Energy from the nuclear reactions is released as electromagnetic radiation

[Link to Video](#)

Life Cycle of Stars



<http://www.seasky.org/cosmic/sky7a01.html>

Stellar Nebula

- Is made of Hydrogen gas and dust
- This is the first phase of the life cycle of a star





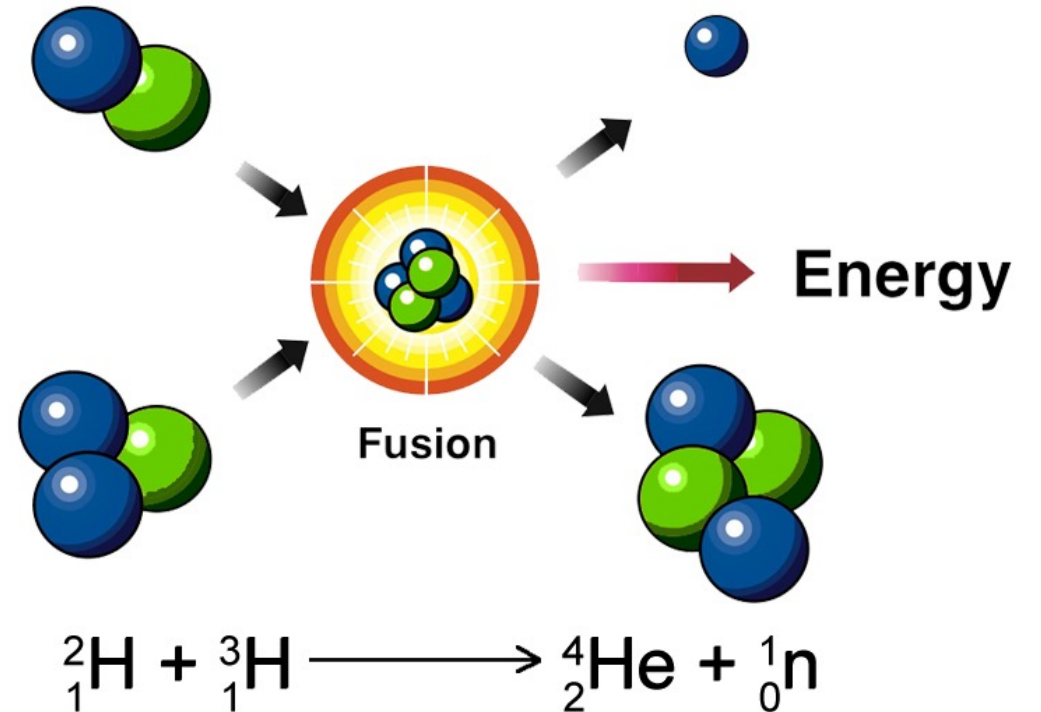
ProtoStar

- Created from the condensing of a stellar nebula
- This condensing is caused by the gravity and electrostatic forces between the dust and hydrogen gas of the stellar nebula
- Mass and temperature of this young star is increasing



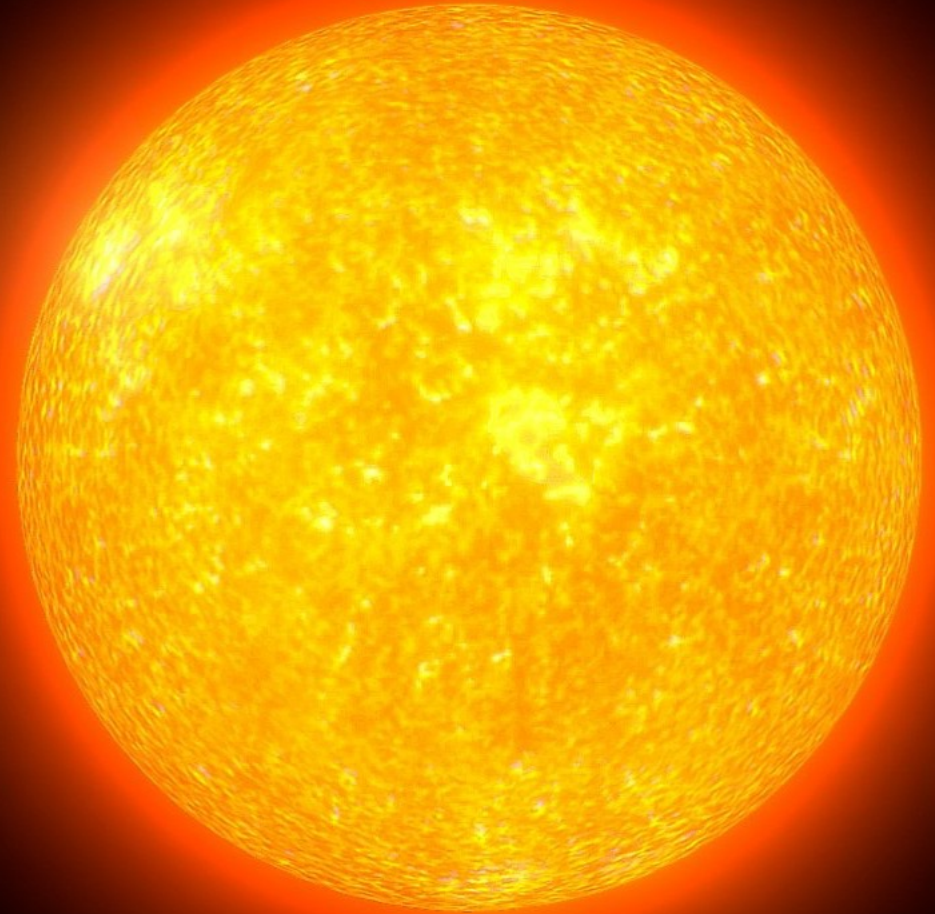
Nuclear Fusion

- When a protostar condenses enough to enable nuclear fusion in its core (high temperature and gravity) it is **now** considered either a Main Sequence Star or a Massive Star depending on its size
- Nuclear fusion is simply when two hydrogen atoms fuse to form a helium atom
- This reaction is what produces the star's heat and light
- The fusion produces an energy which counter acts the massive gravity of the star



Main Sequence Star

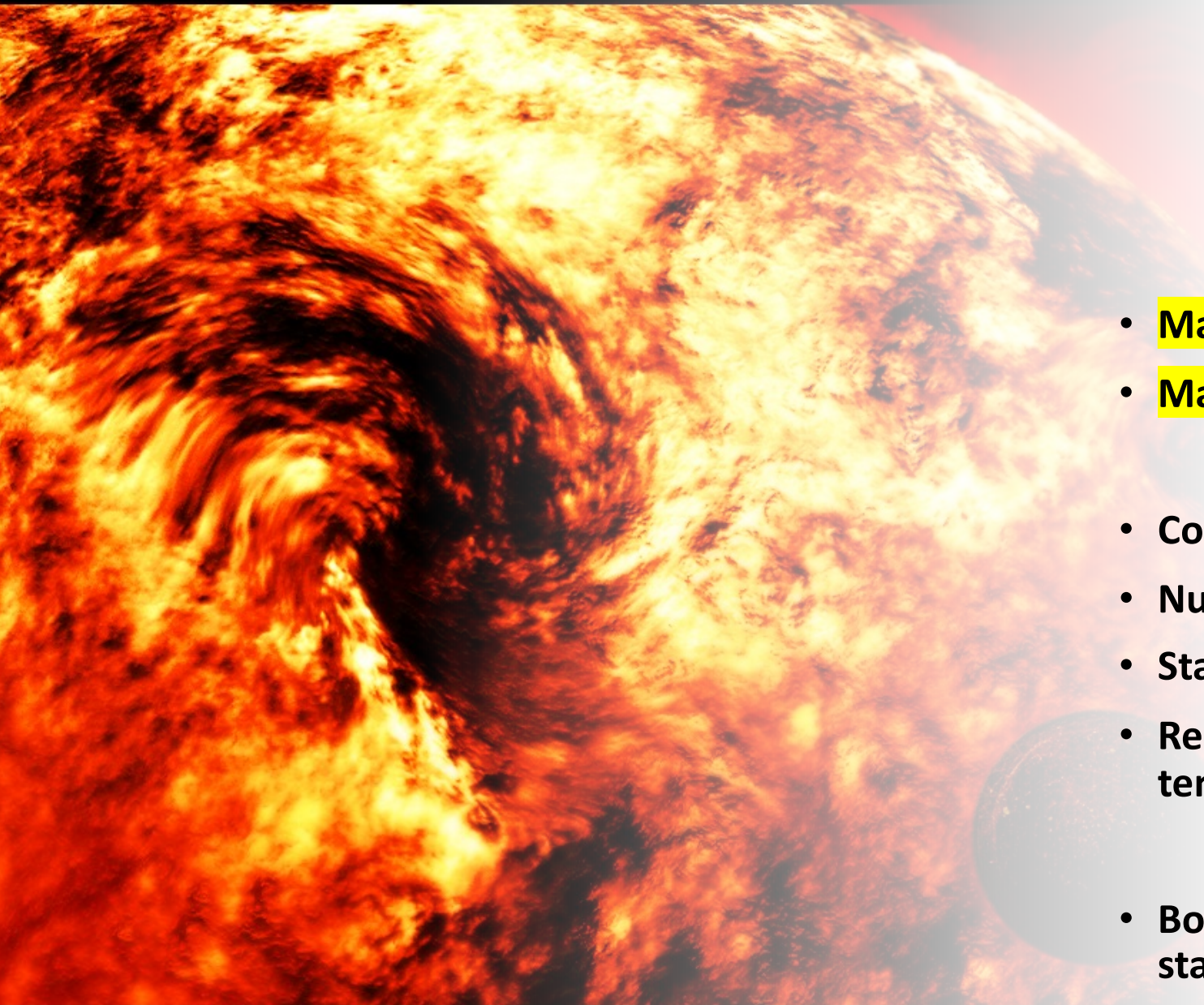
- Stable nuclear reactions are occurring
- Stars will spend most of their life in this stage (several billions of years)
- Our sun is currently a Main Sequence Star



Massive Stars

- If the star produced from the condensing of the protostar is over 8 times larger than our sun then it is considered a Massive Star
- It will produce more heat and light
- Stronger gravity
- Shorter life span (can be as low as a few million years)





Red Giant Star/ Red Super Giant Star

- **Main sequence stars form Red Giants**
- **Massive Stars form Red Super Giants**

- **Core of star gets hotter and collapses**
- **Nuclear fusion of Hydrogen decreases**
- **Star expands as fusion of Helium occurs**
- **Red Super Giants have a larger size and greater temperature and gravity**

- **Both are at the end of the stars life cycle (dying star)**

White Dwarf

- White Dwarfs are considered dead Main Sequence stars
- Red Giants collapse quite abruptly into white dwarfs once the Star's helium is used up
- Will slowly produce lower and lower amounts of heat and light until they become black dwarfs
- White dwarfs are usually around the size of the earth but are 200,000 times more massive



Supernova

- Instead of turning into White Dwarfs, Red Super Giant Stars turn into Super Novas
- When helium fusion stops in a Red Super Giant, the star condenses very quickly
- Because of the size of the Super Red Giant, this massive condensing of the star produced the explosion of a Super Nova

Due to the extreme energy of a Super Nova, all elements on the periodic table are produced in this explosion



Neutron Star

- After a Supernova, either a neutron star or black hole will be produced from this original massive star
- A Neutron Star is made of densely packed Neutrons
- Formed when pressure is so high that protons merge with electrons to form Neutrons
- What was once a vast star is now the most dense object in universe, a Neutron Star

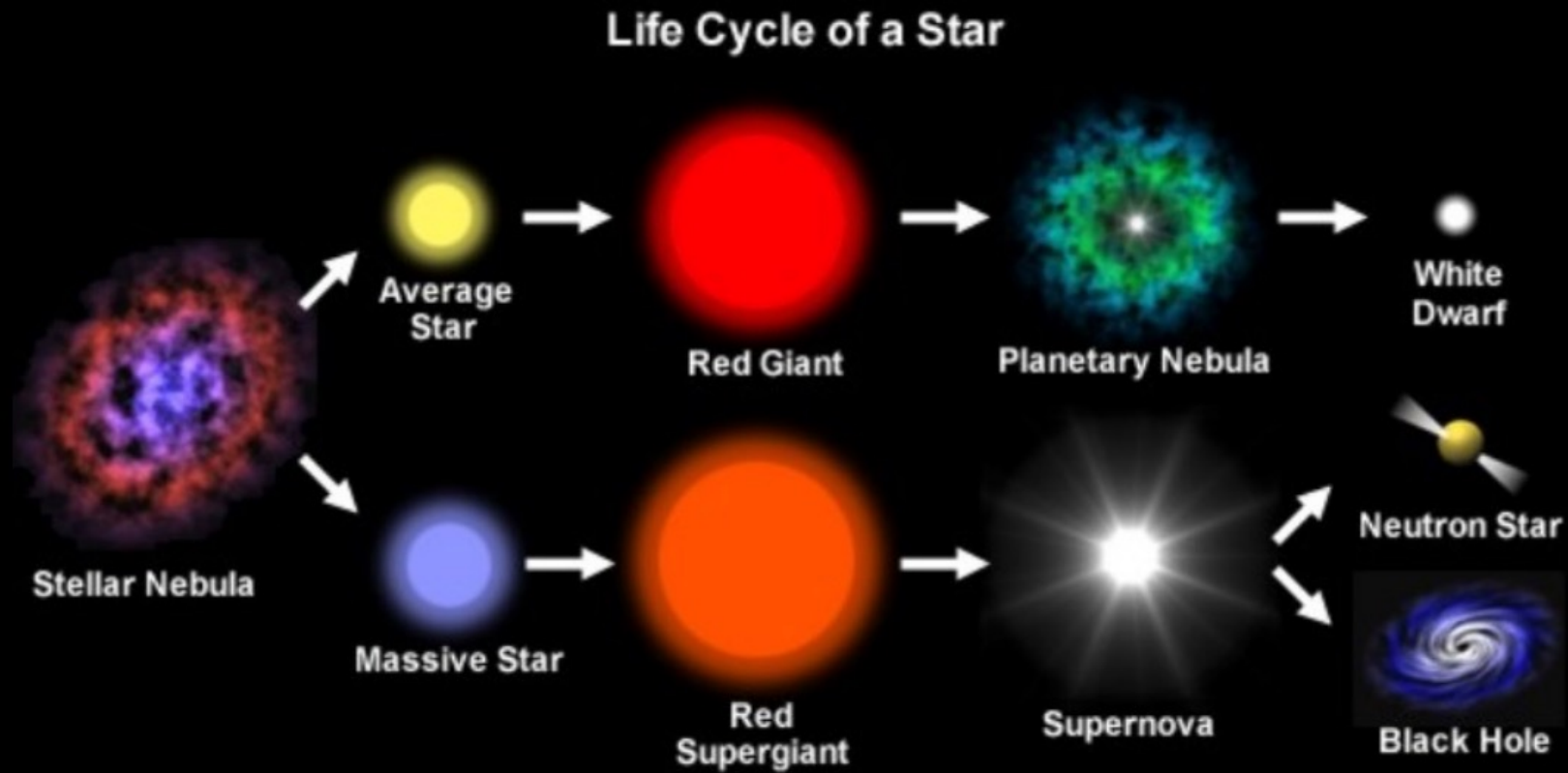
Black Hole

- A Black hole is the other potential fate of massive stars
- After the super nova, if the star (or what is left of it) is still large enough, a black hole will be produced
- A black hole is a phenomena where gravity is so large that not even light can escape it!
- So how do we know they exist?
 - We can observe how things around them act thus confirming their existence



- Black Holes
- [Link 1](#)
- [Link 2](#)

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