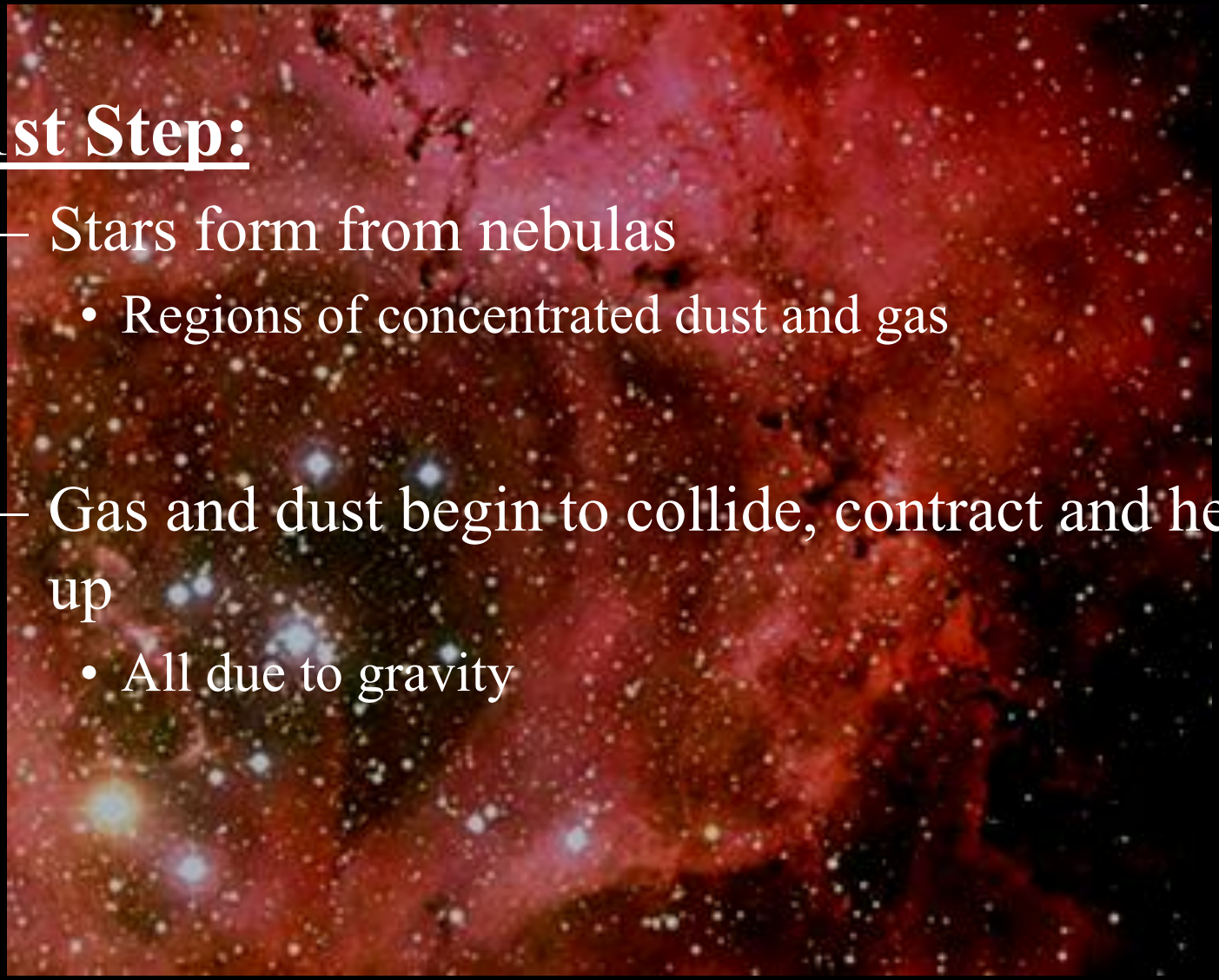
Life Cycle of Stars



- **<u>1st Step:</u>**
  - Stars form from nebulas
    - Regions of concentrated dust and gas
  - Gas and dust begin to collide, contract and heat up
    - All due to gravity

Life Cycle of Stars

- **<u>2nd Step:</u>**
  - As nebula contracts, a small star is formed
    - Called a protostar
  - Eventually, the protostar will **begin nuclear fusion**
    - Hydrogen protons attract to each other
      - Strong nuclear force
      - Fusion begins
    - Necessary for stars to survive

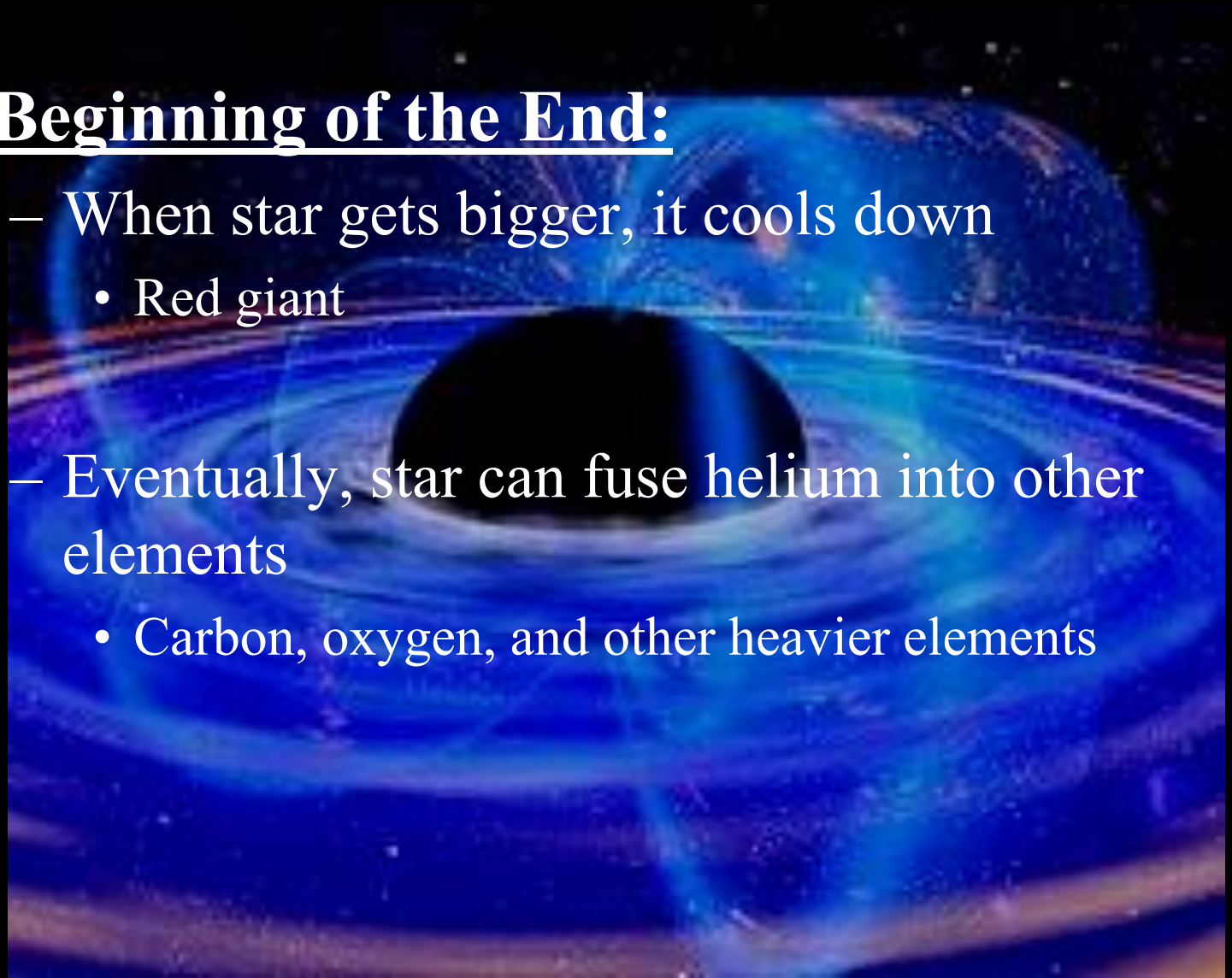
Life Cycle of Stars

- **3rd Step:**
  - Star joins the main sequence
    - 90% of stars spend life here
    - Nuclear fusion = Hydrogen into Helium
    - Mass of star determines location on main sequence

Life Cycle of Stars

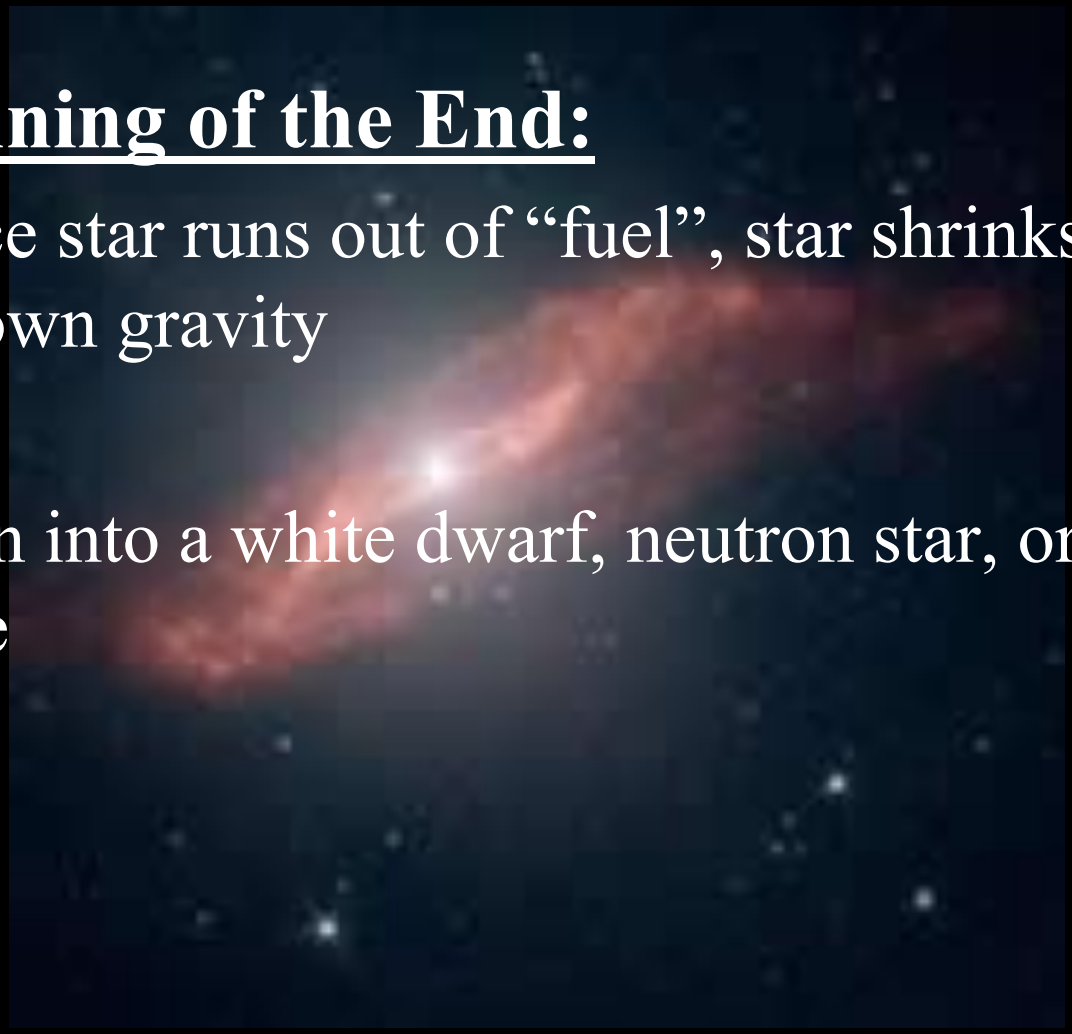
- **<u>Beginning of the End:</u>**
  - Stars begin to die when they run out of hydrogen
    - Gravity begins to take over
  - Star begins to shrink; outer core of hydrogen begins to fuse
    - Star gets bigger

Life Cycle of Stars



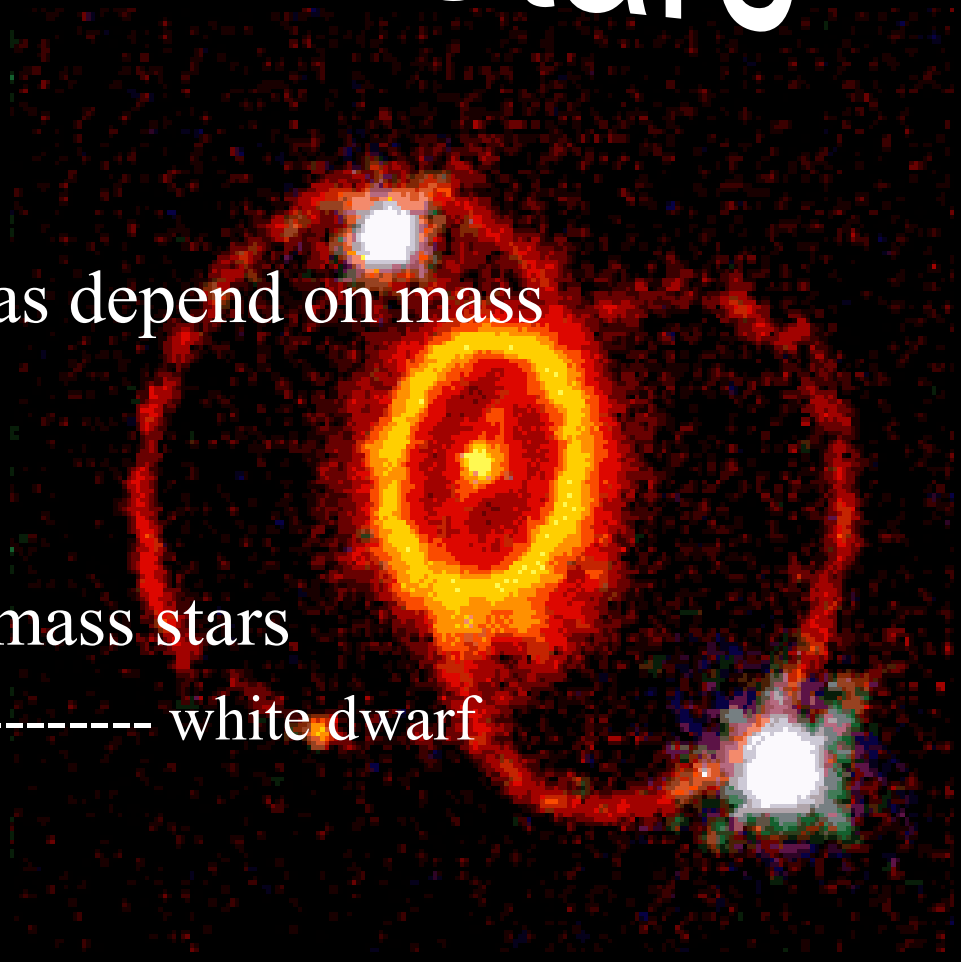
- **<u>Beginning of the End:</u>**
  - When star gets bigger, it cools down
    - Red giant
  - Eventually, star can fuse helium into other elements
    - Carbon, oxygen, and other heavier elements

Life Cycle of Stars



- **<u>Beginning of the End:</u>**
  - Once star runs out of "fuel", star shrinks under its own gravity
  - Turn into a white dwarf, neutron star, or black hole

Life Cycle of Stars



- **<u>Death of Stars:</u>**
  - What stars end up as depend on mass
  - Low and Medium mass stars
    - Planetary nebula --------- white dwarf
  - High mass stars
    - Supernova --------- neutron star or black hole

Life Cycle of Stars

- **Death of Stars: Low and Medium Mass**

Main Sequence Star

↓

Red Giant

↓

Planetary Nebula

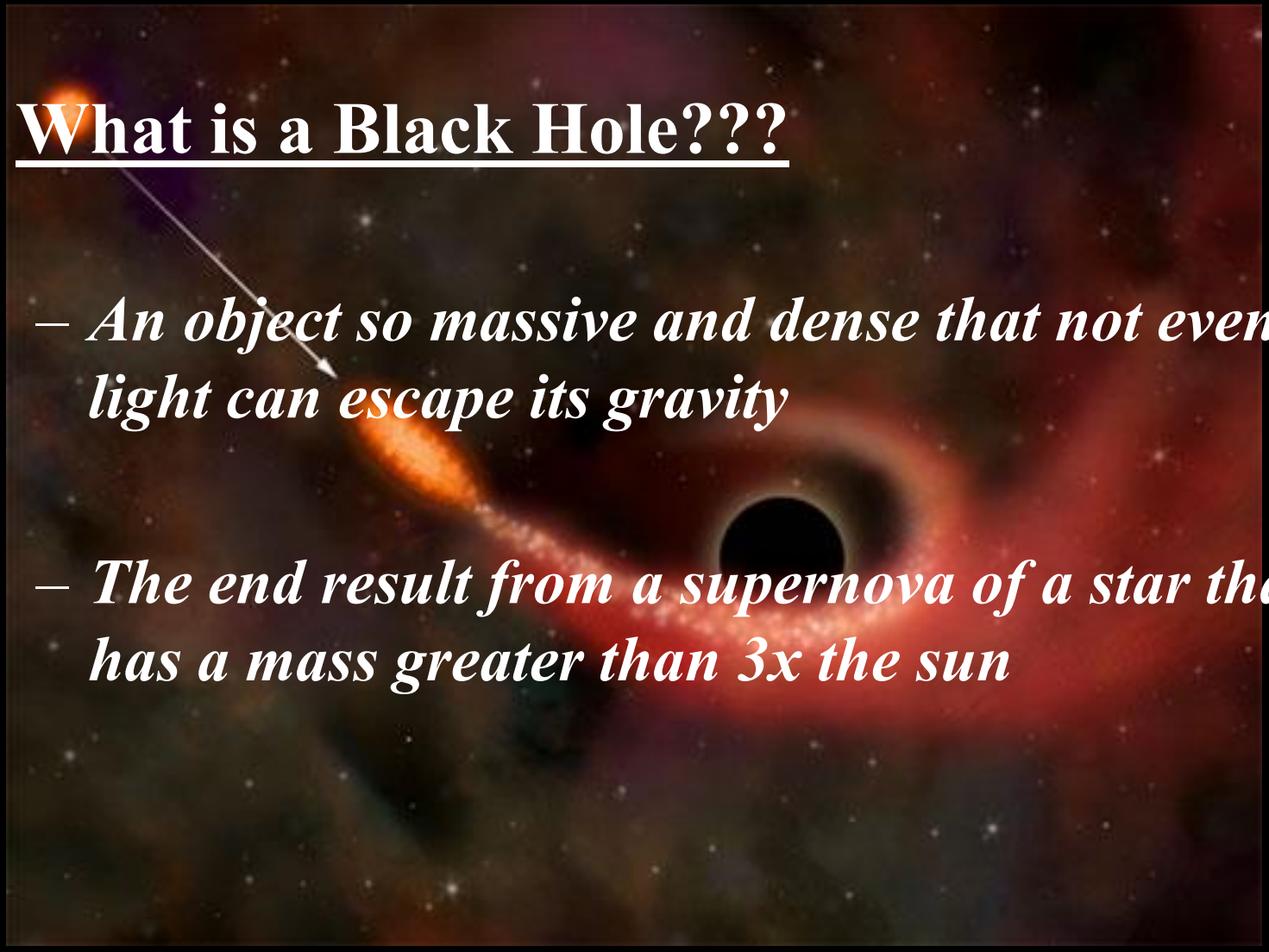
↓

White Dwarf

Life Cycle of Stars

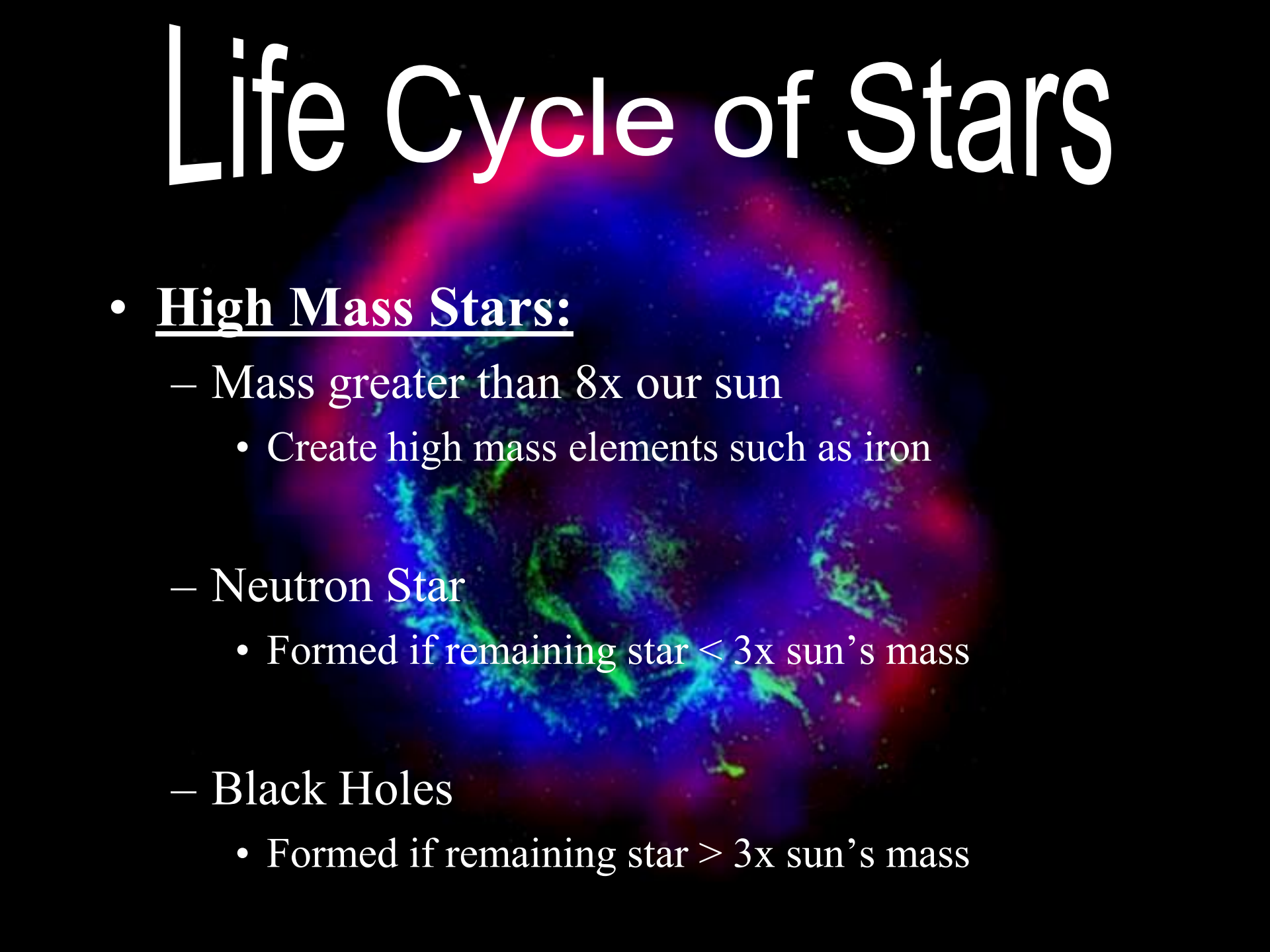
- **Death of Stars: High Mass**

Black Holes



- **What is a Black Hole???**
  - *An object so massive and dense that not even light can escape its gravity*
  - *The end result from a supernova of a star that has a mass greater than 3x the sun*

Life Cycle of Stars



- **<u>High Mass Stars:</u>**
  - Mass greater than 8x our sun
    - Create high mass elements such as iron
  - Neutron Star
    - Formed if remaining star < 3x sun's mass
  - Black Holes
    - Formed if remaining star > 3x sun's mass

Life Cycle of the Sun

- As fusion begins to slow down, the core of the sun will contract
  - Temperature in the core will rise
- The outer layers of the sun will expand, consuming in the inner planets
  - Sun will become a Red Giant

Life Cycle of the Sun

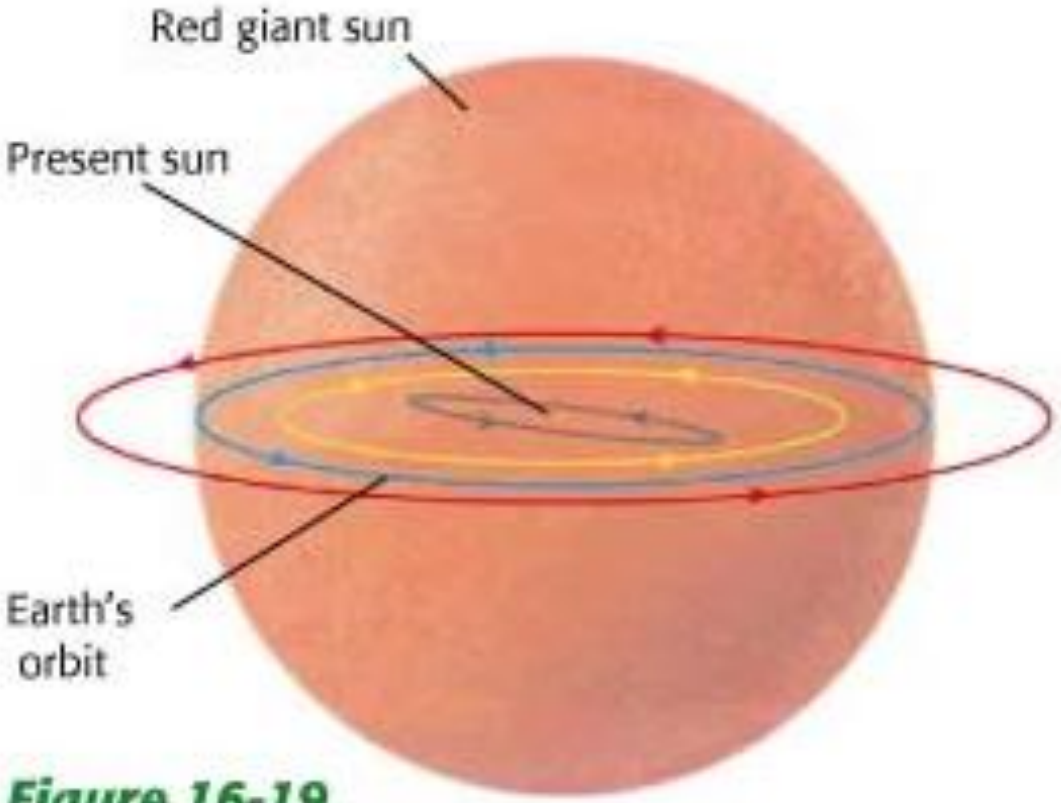


Figure 16-19
When the sun becomes a red giant, it will expand out past Earth's orbit.

Life Cycle of the Sun

- Core of the sun will begin to fuse helium into larger elements such as carbon and oxygen

- **<u>Continuing over the next 100 million years…</u>**
  - ***Core will become entirely carbon and oxygen***
  - ***Core will contract***
  - ***Outer layers will expand***

- Outer layers will form a planetary nebula
  - Core of sun will become a **<u>white dwarf</u>**