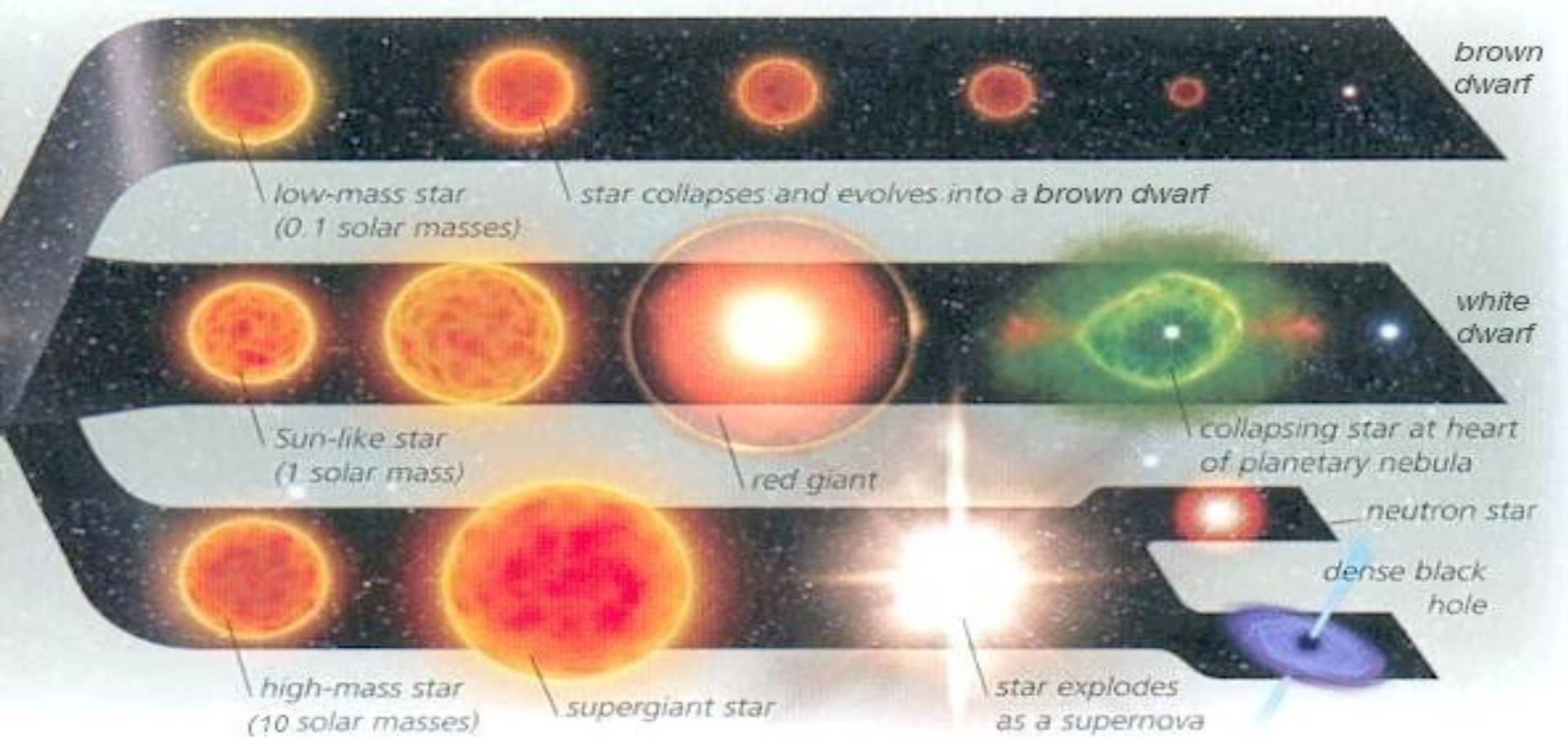
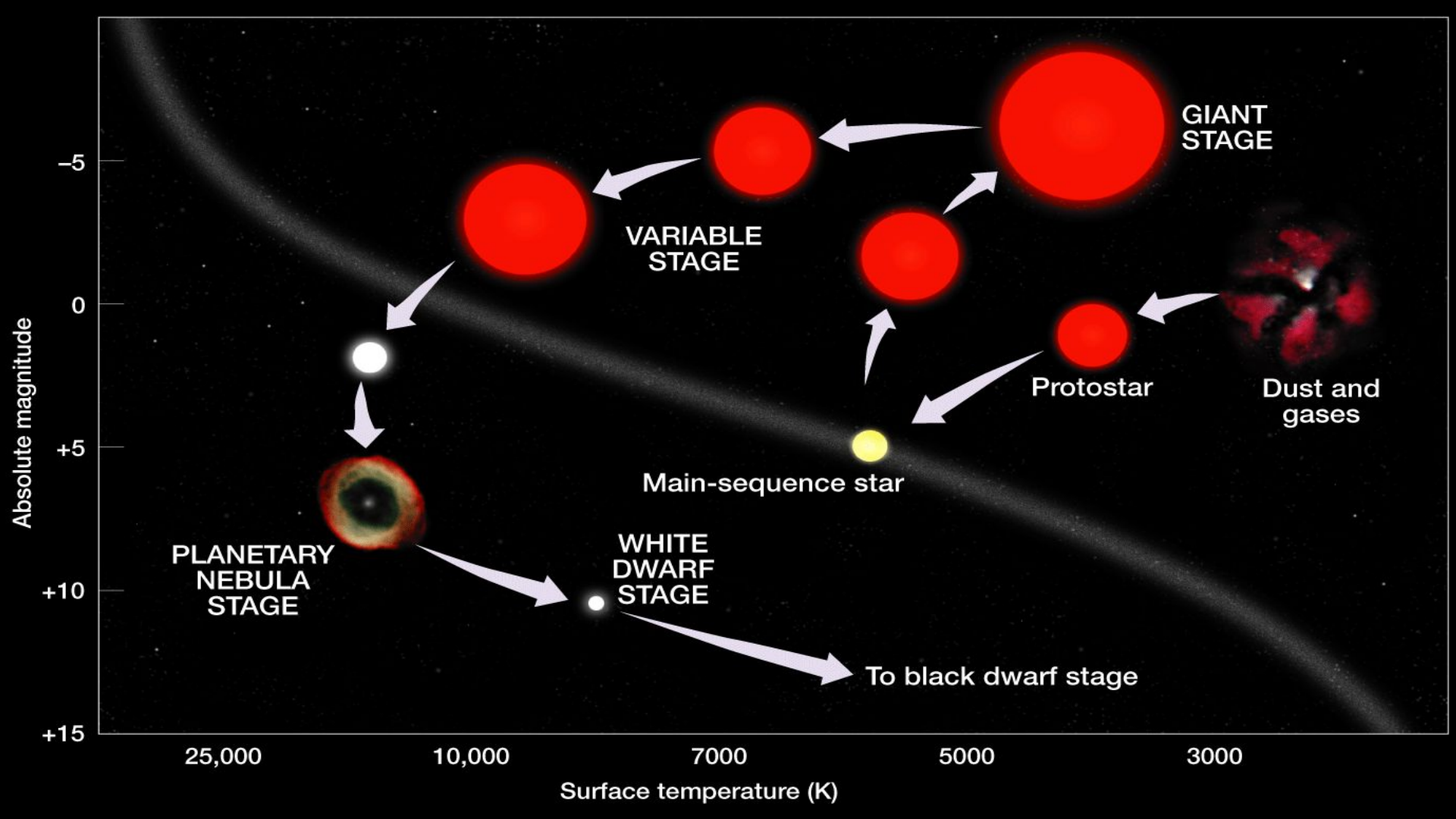
25.2: Stellar Evolution




GIANT STAGE
VARIABLE STAGE
Protostar
Dust and gases
Main-sequence star
PLANETARY NEBULA STAGE
WHITE DWARF STAGE
To black dwarf stage
Absolute magnitude
−5
0
+5
+10
+15
25,000
10,000
7000
5000
3000
Surface temperature (K)

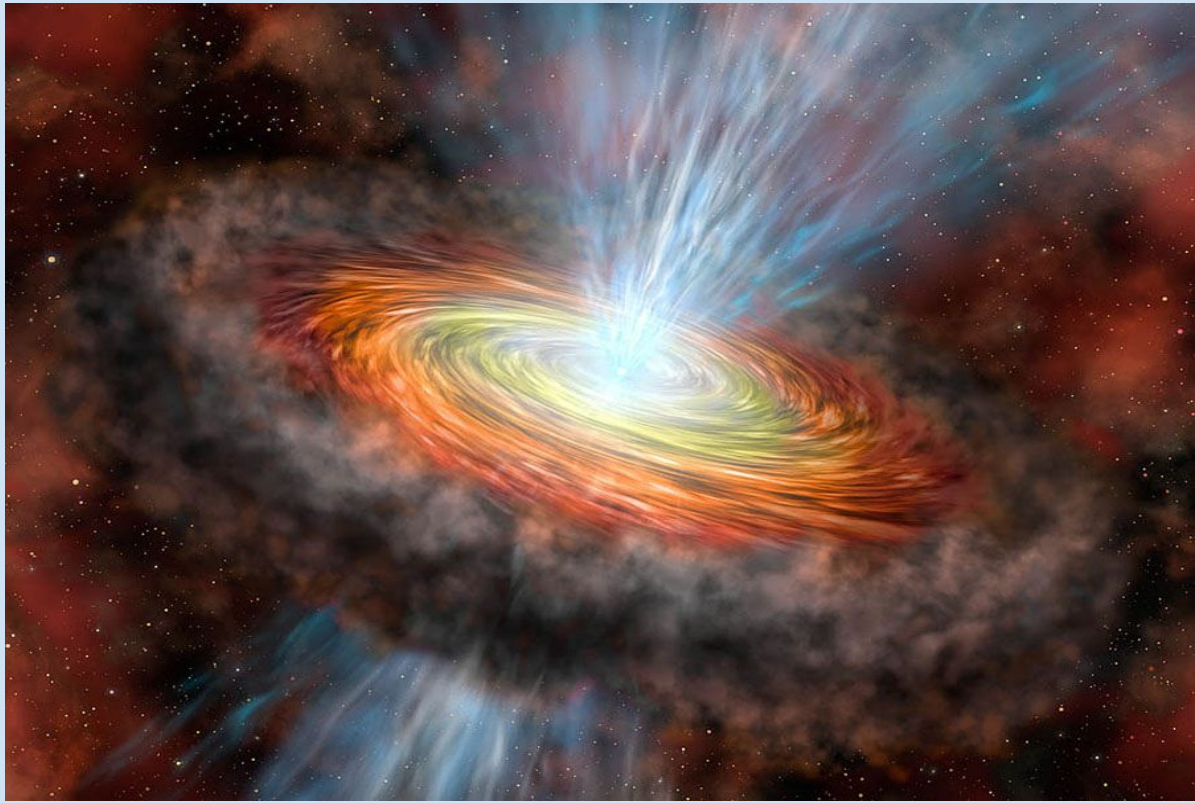
Star Birth

Stars are born in a nebula

Nebula: a dark interstellar cloud which gravitationally contract and begin to create heat- the beginning of a star's core

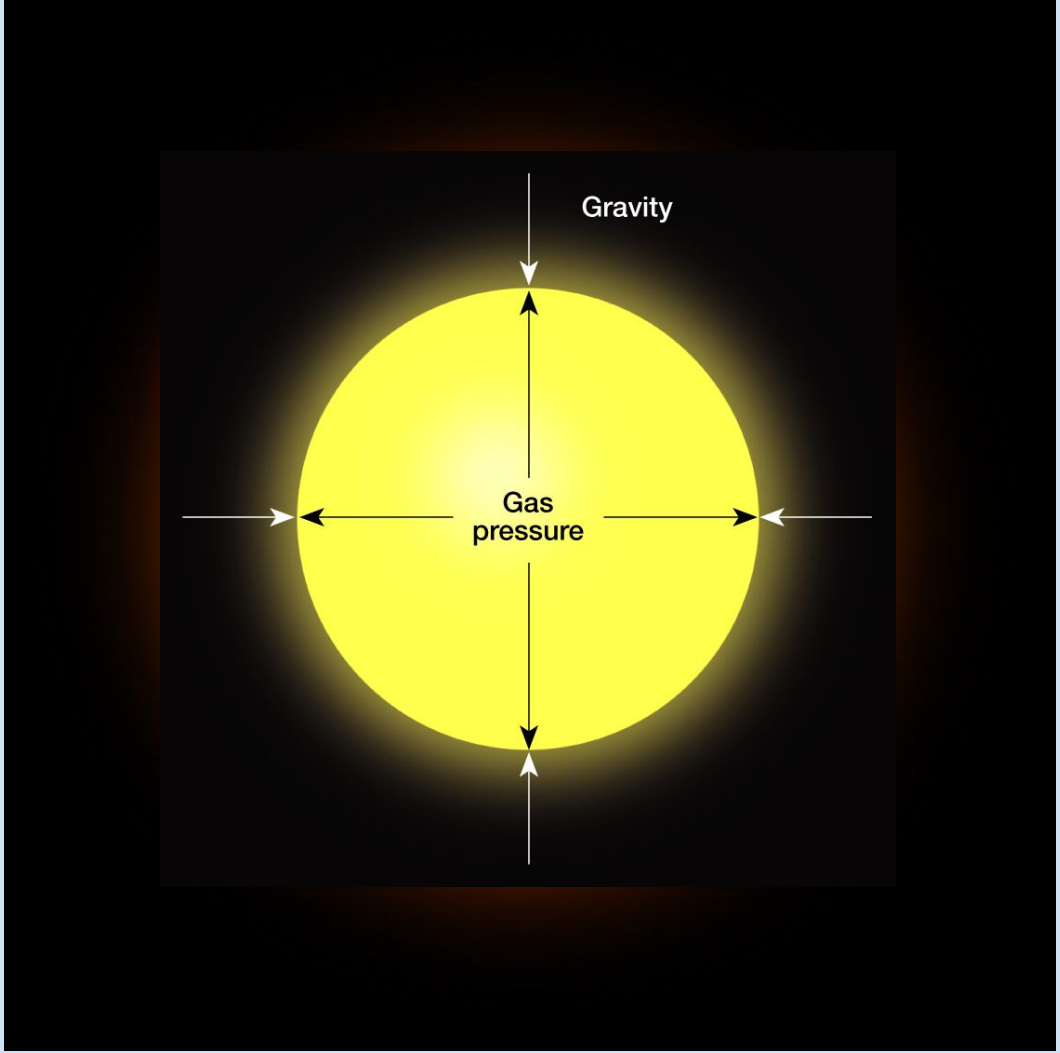
Protostar: is a developing star not yet hot enough to start nuclear fusion

A star is said to be “born” when the core reaches a temperature of about
10 million K and fusion of hydrogen begins



Main-Sequence Stage:
nuclear fusion has begun
An average star will spend 90% of its life in this stage

Stability is created by two forces:
Gravity and gas pressure



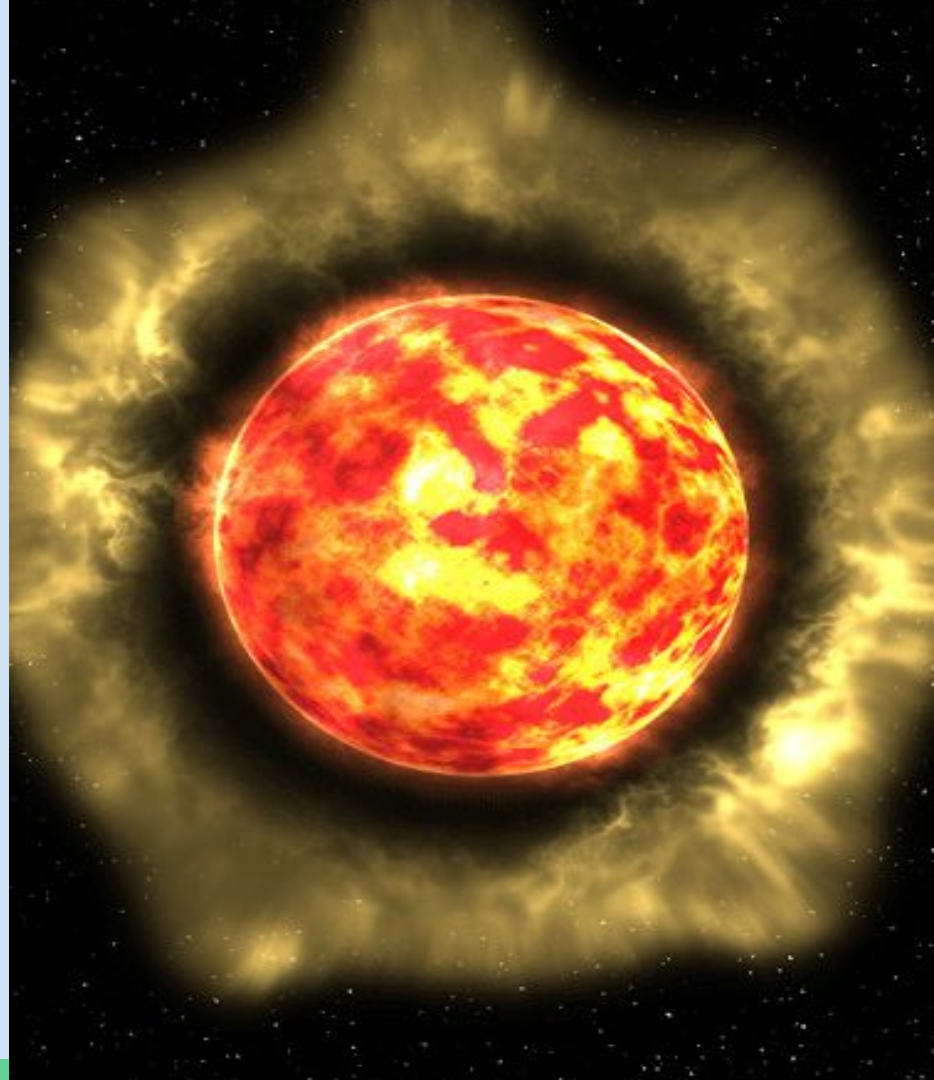
Red Giant Stage:

Eventually, all the Hydrogen in the star's core is used up

The core loses energy and begins to contract, growing hotter

This causes the outer layers to expand

As the outer layers expand, they cool down, explaining the reddish appearance



Burnout and Death:

All stars will eventually run out of fuel and collapse due to gravity

Low mass stars - collapse into a white dwarf

Medium mass stars - bloat off their outer layer forming a planetary nebula as the core collapses into a white dwarf

Massive stars - create a supernova then turn into a neutron star or black hole