



# STARS

## Stellar Populations I, II, III





## STARS - Stellar Populations I, II, III

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### **Overview**

Stars are sometimes referred to as Pop I, II, or III stars.

The “Pop” means Population.

The three classifications of Populations are intended to categorize stars based on how much metal is within them.

This lesson will just provide an overview of the concept so that you have a better foundation should you encounter these terms when performing your research.



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### Division by Metallicity

The populations of stars are divided into three categories based on their metallicity.

#### Metallicity:

- Astronomers define metals differently than any other group.
- To astronomers, this means any element heavier than helium.
- The level of metallicity in a star is denoted by a “Z” and will be reported as  $Z=.03$ , for example. This is also noted as  $[Fe/H] = .03$  meaning that Iron to Hydrogen as the ratio
- Metals, elements heavier than Helium, are formed through the fusion process at the cores of stars
- Metallicity is used as a statement of age.



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### Populations

Population classifications are by star's heavy element abundance (metallicity), which correlates with their age, and the types of galaxies they are found in.

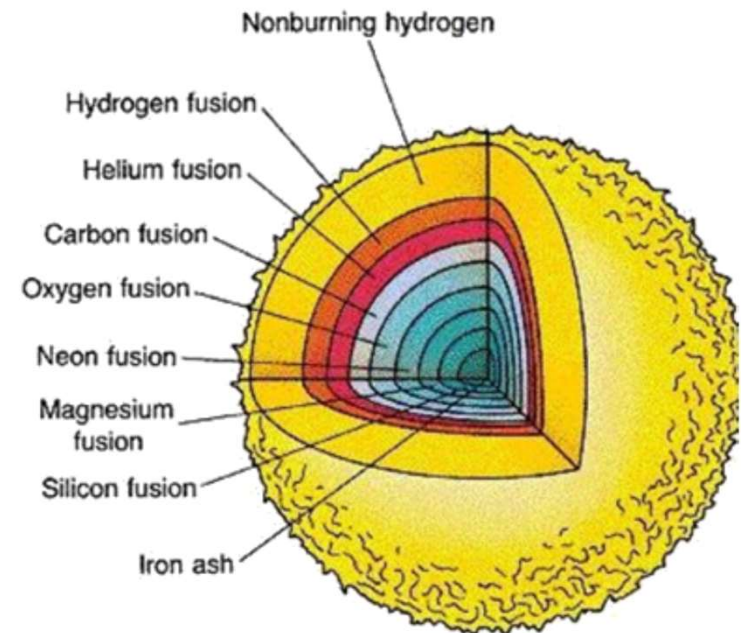
The first stars were formed of only Hydrogen.

The fusion process developed heavier elements.

When the star died, these heavier elements were distributed into space and into the interstellar gas clouds that were to become the birth place of new stars.

These new stars collected some of these heavier elements.

They started fusion, and eventually died spreading their even heavier elements into the Universe for the next new stars.





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### Populations

Population classifications, therefore, are based on stars and the heavy elements within them as a result of the stellar evolution processes before them.

#### Population I: New Stars

- Luminous, hot and young, concentrated in the disks of spiral galaxies. Our Sun is an example.
- Typically found in galactic spiral arms.
- It is estimated that about 2% of the stellar population are Pop I

#### Population II: Older, not as New

- These are typically found in globular clusters and the nucleus of a galaxy.
- Older, less luminous, and cooler than Pop I stars.
- Fewer heavy elements due to either being older or possibly being from regions free of previous heavy element producing stars
- Deems “metal poor”



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### Populations

#### Population III: Hypothetical Population

- Very massive and hot
- Contain no metals. Thus, were not derived from the supernova remnants of other stars, but are thought to be the “first” stars
- Hypothetical cause their existence is inferred from theory.
- Pop III stars have never been found but have been inferred through the studies of distant, old galaxies.
- Theories predict these stars were far more massive than any stars observed today



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### **Summary**

Pop I, II, and III stars are groups of stars based on the heavier elements within.

While Pop I and II stars are observed, Pop III remains theorized whose existence is, currently, only inferred.

Keep these terms in mind, as the concept of Pop stars arises on occasion.



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***Questions?***