AGB Stars in Globular Clusters

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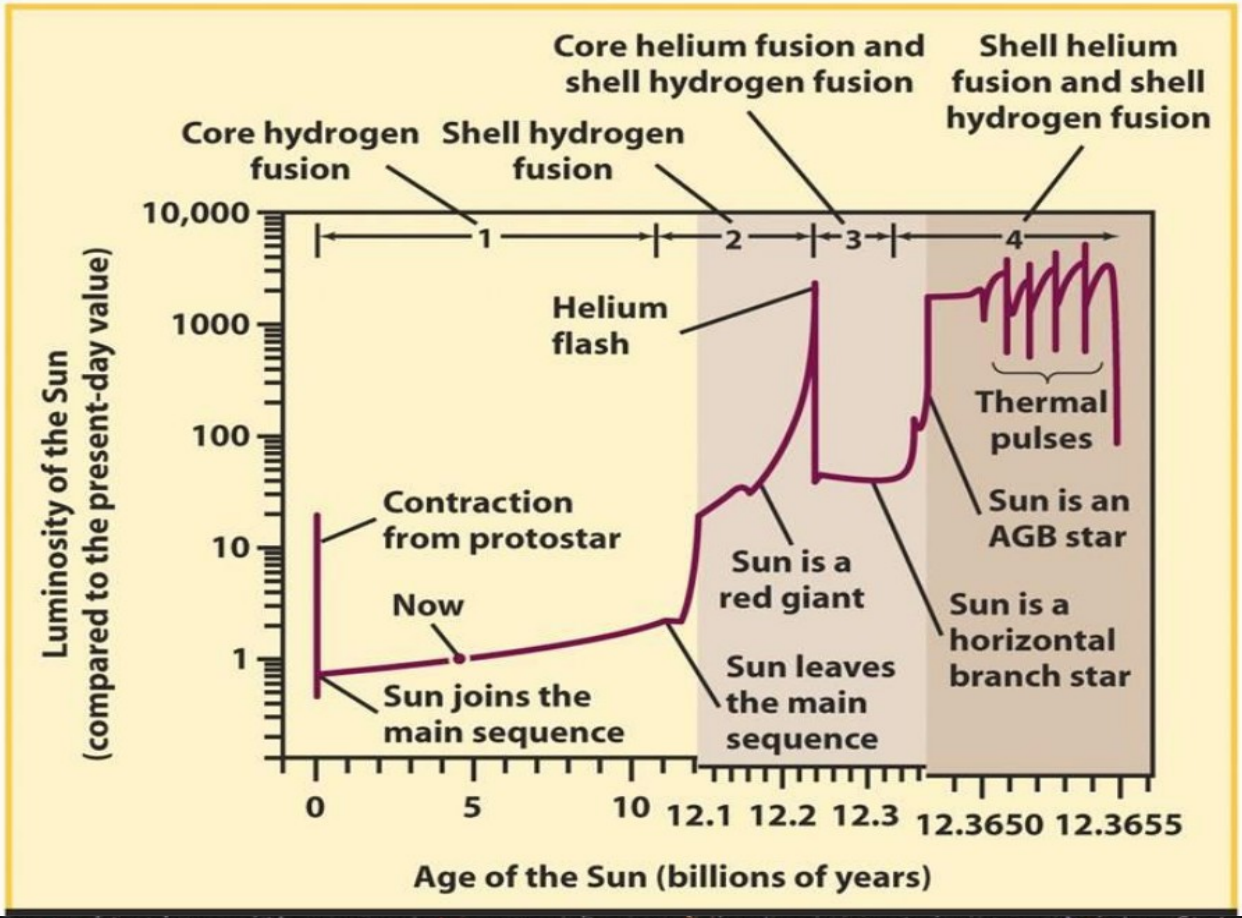
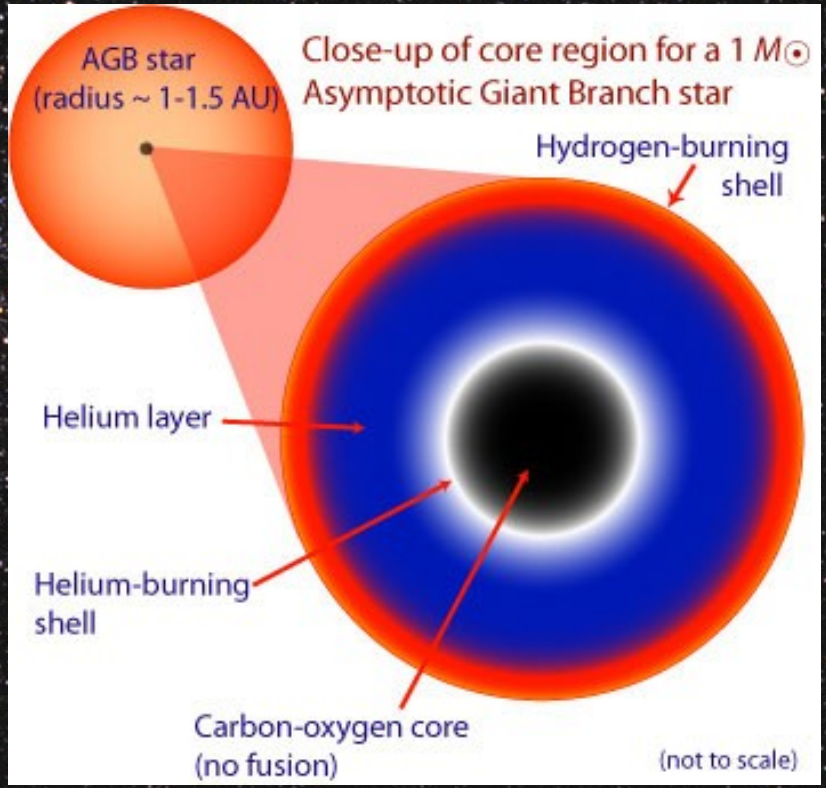
Star Evolution



Phase	yrs
Main Sequence	9×10^9
Subgiant	3×10^9
RGB	1×10^9
HB	1×10^8
AGB	5×10^6
PNe	1×10^5

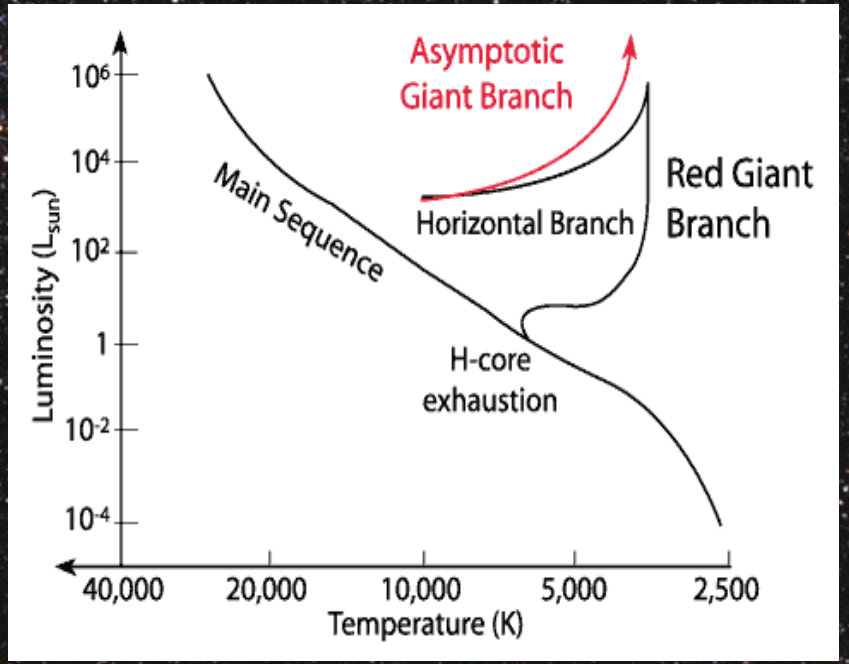
Asymptotic Giant Branch

Asymptotic Giant Branch (AGB) is one stage of the star evolution with $1.8M_{\odot}$ to $3M_{\odot}$ which takes $5x10^{6}$ years



Characteristics of Asymptotic Giant Branch

- Convection in large portion of envelope
- Heavier elements formed in the star's interior mixed
- Strong stellar wind
- Large radiation pressure drives stellar wind
- Particles absorb photons from radiation field
- Interstellar medium enriched with mostly carbon



Globular Clusters

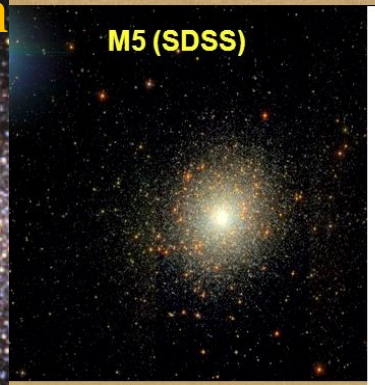
Globular clusters (GCs) are compact, gravitationally bound systems of up to ~1 million stars.

GCs link a range of scales, from the physics of star formation in turbulent gas clouds, to the large-scale properties of galaxies and their dark matter.

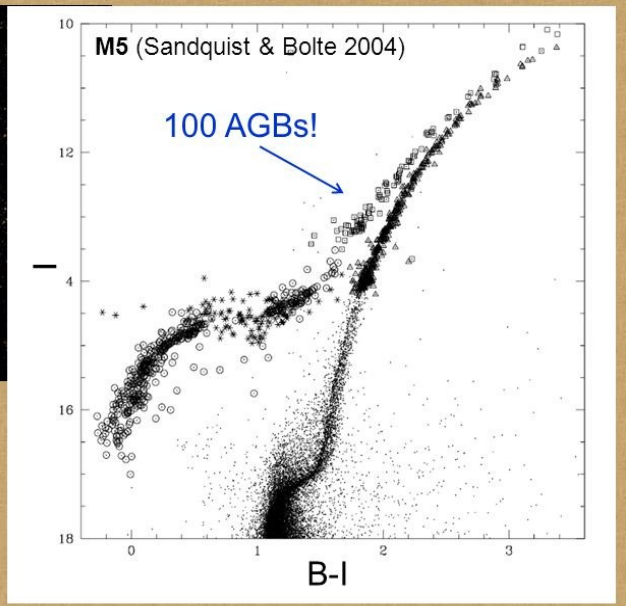
Different AGB stars in Globular Clusters

- Variations of light elements and helium
- Lower metal-enhanced stars in AGB than in RGB
- AGB/HB frequency correlates with the average mass of the most helium-enriched population

AGBs in Globular Clusters



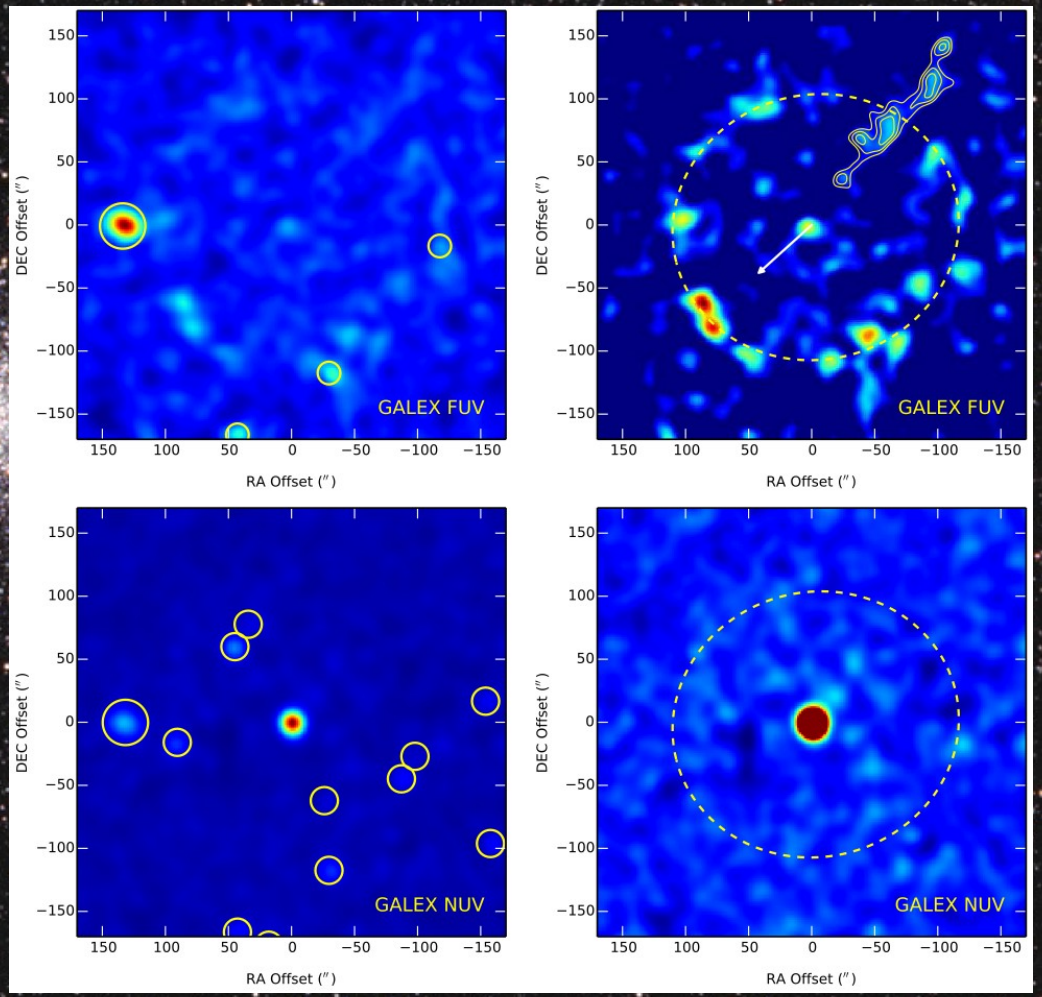
- High quality photometry is now making the AGB accessible in GCs, we can now get good numbers of AGBs.



Observing AGB stars in Ultraviolet

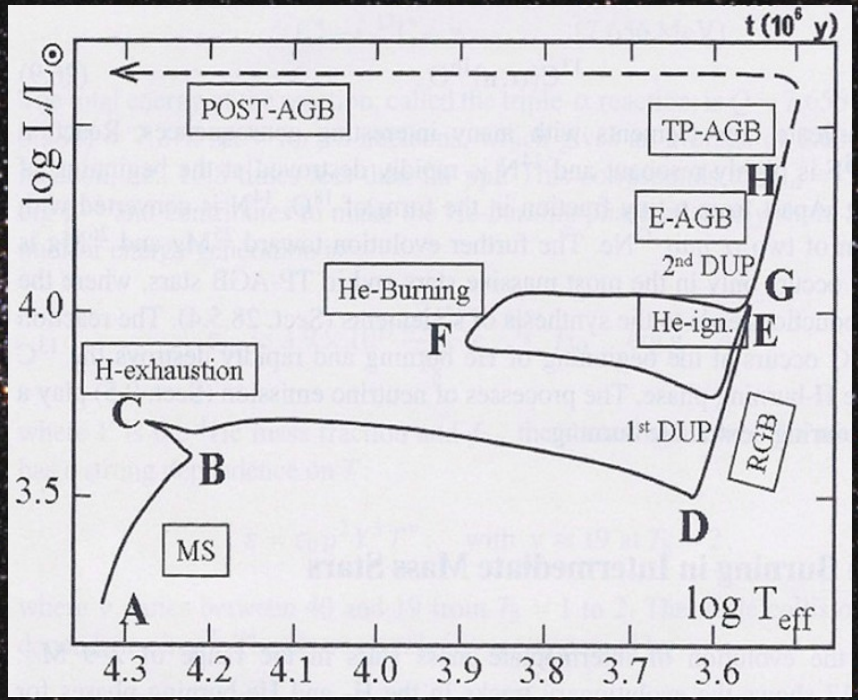
Extended FUV and NUV emission is spatially coincident with the detached dust shell.

FUV (top panels) and NUV (bottom panels) images of U Hya as observed in the GALEX AIS images. The left panels show field source regions selected for removal. In the right panels, field sources have been removed and the best-fit ellipse to the bright FUV emission is depicted by the dashed line



Variable AGB Stars

Asymptotic Giant Branch variables are the brightest and most distinctive individual stars to be found in the resolved, old and intermediate age, stellar populations of galaxies in the Local Group and beyond.

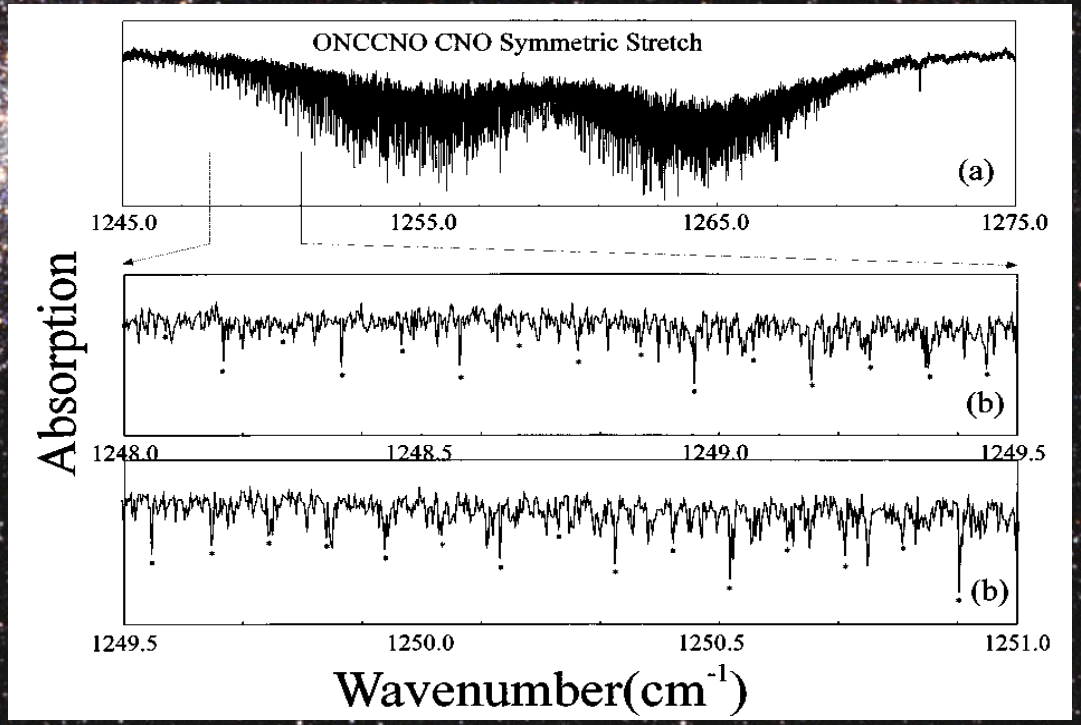


Cyanogen chemical populations

Two distinct chemical populations of stars in most of GCs:

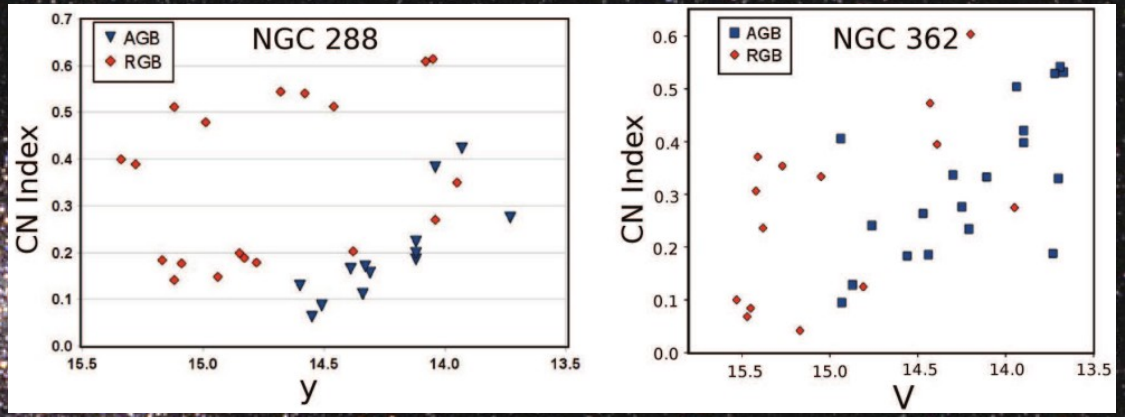
- Cyanogen-Strong
- Cyanogen-Weak

Based on the observed strength of the cyanogen molecular bands



Effects of Cyanogen in AGB Stars in Globular Clusters

- Cyanogen (CN)-strong stars seem to disappear between the RGB and AGB
- There is a variation in the number of CN-strong stars that disappear



Left panel: Preliminary results for NGC 288, showing the S3839 CN index versus y magnitude. Diamonds (red) are RGB stars, filled triangles (blue) are AGB stars. A very clear CN bimodality can be seen on the RGB, whilst the AGB is 100% CN-weak. The trend with magnitude is due to stellar temperature effects. Right panel: Results for NGC 362 showing the S3839 CN index versus V magnitude. Diamonds (red) are RGB stars, filled squares (blue) are AGB stars. On the RGB a CN bimodality can be seen. The AGB is less well defined but the majority of stars appear to be CN-weak.

References

- 1) Michael A. Beasley. (2020, AJ, 245)
- 2) Lebzelter et al. (2007, AJ, 378, 105)
- 3) Campbell et al. (2011, AJ, 445, 63)
- 4) Sanchez et al. (2015, AJ, 798, 39)
- 5) P.A. Whitelock. (2001, OAP, 14, 180)
- 6) P.A. Whitelock et al. (2003, RAS, 342, 86)


Thank
you!