

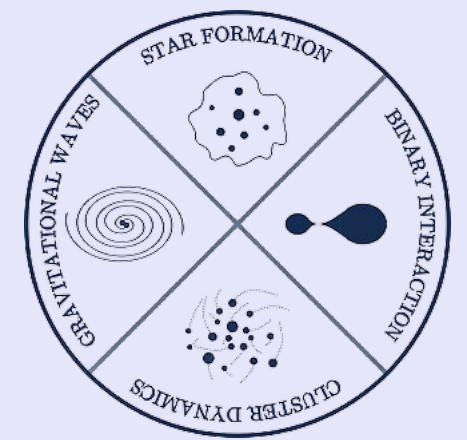
UV Study of the open cluster NGC 2818: Exploring the origins of the exotic stellar populations

SCAN ME



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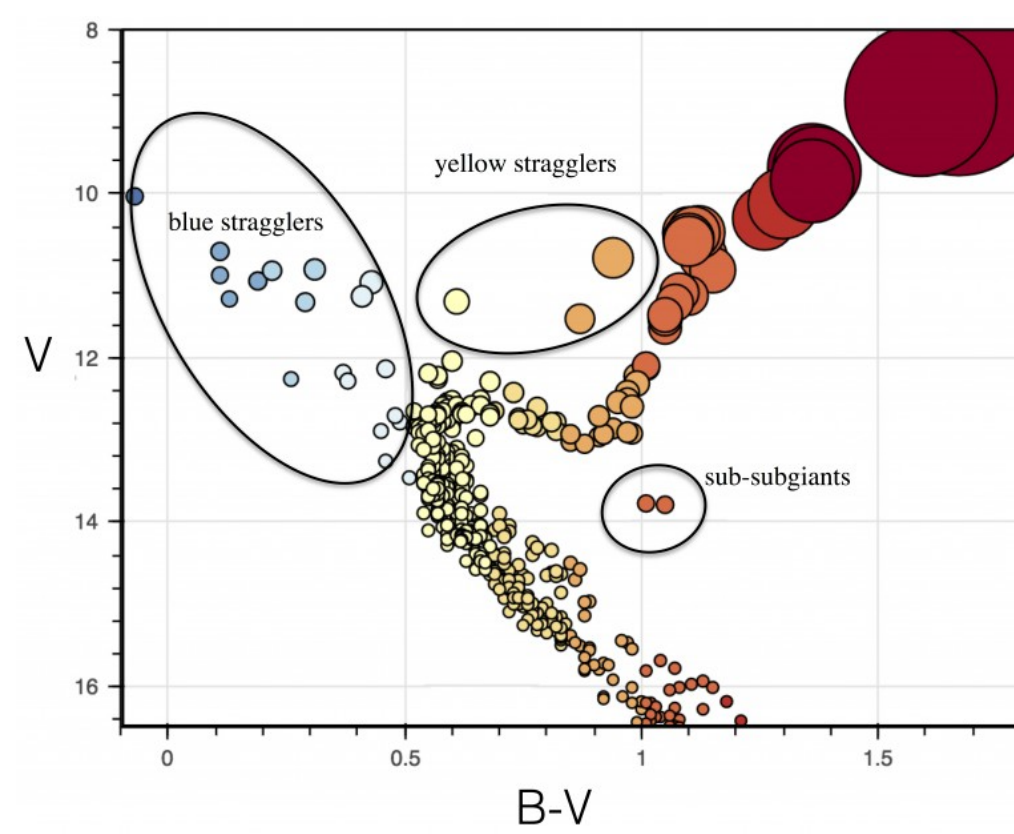
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Exotic Stars in Clusters

Blue Stragglers (BSs) appear brighter and bluer than the stars lying on the main sequence turn-off (MSTO), where no stars are expected on the basis of canonical stellar evolution theory.

Yellow Stragglers (YSs) occupy the region in between BSs and RGB. They are brighter than the stars in SGB, and bluer than the RGB, also described as evolved BSs.

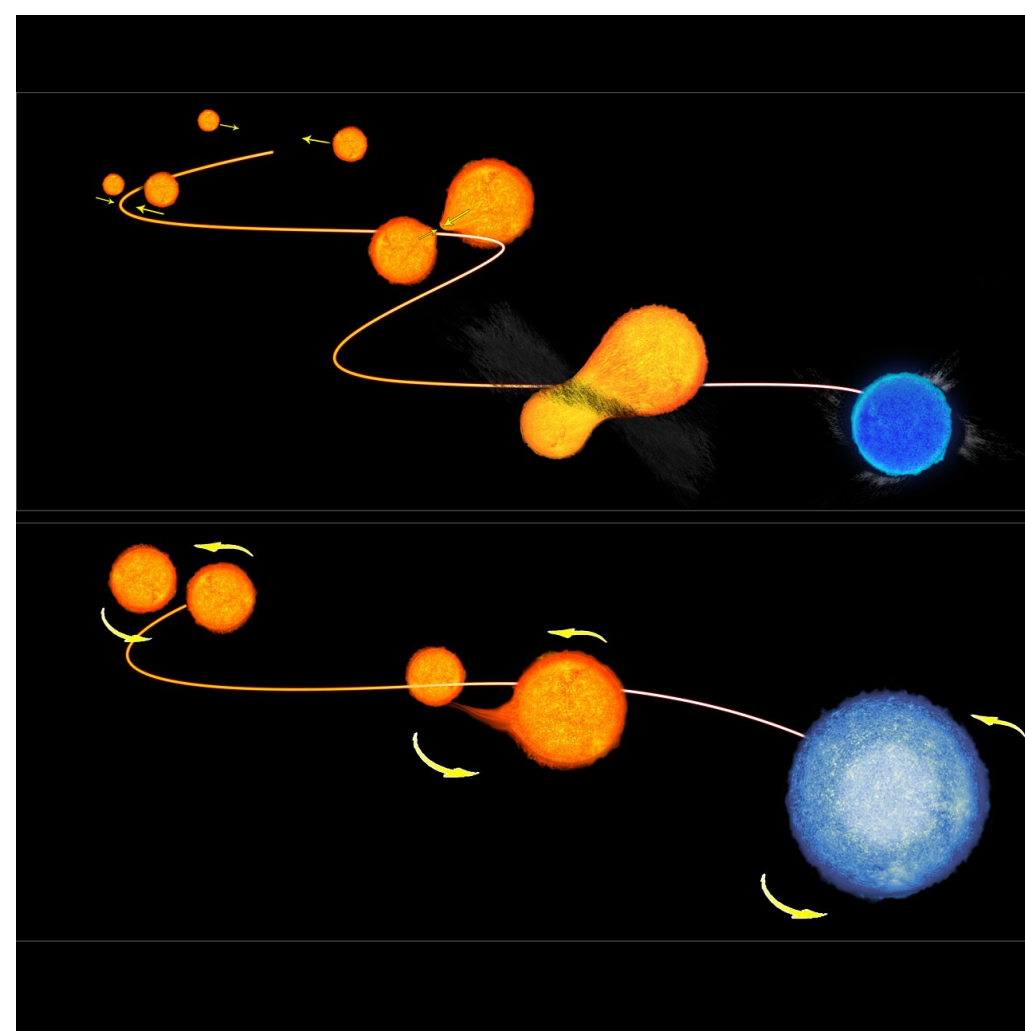


Credit: Emily M. Leiner

Why to Study?

The origin of BSs is still under debate. As they are massive than MSTO stars, they have gained mass somehow. Two main formation scenarios proposed to explain their origin in clusters are:

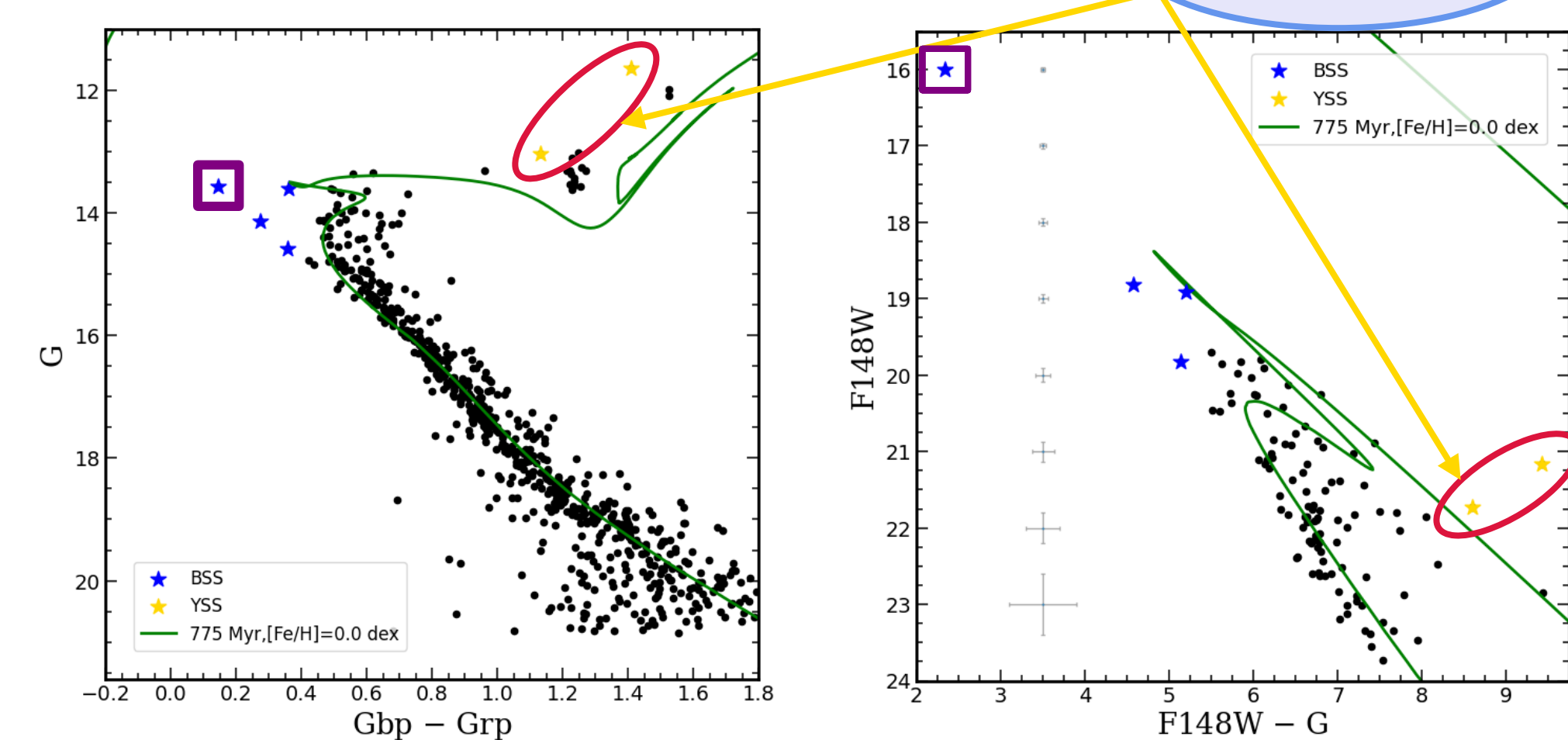
- 1) **Stellar mergers** resulting from direct stellar collisions (Hills & Day +1976)
- 2) **Mass transfer** in close binary systems (McCrea+1964)



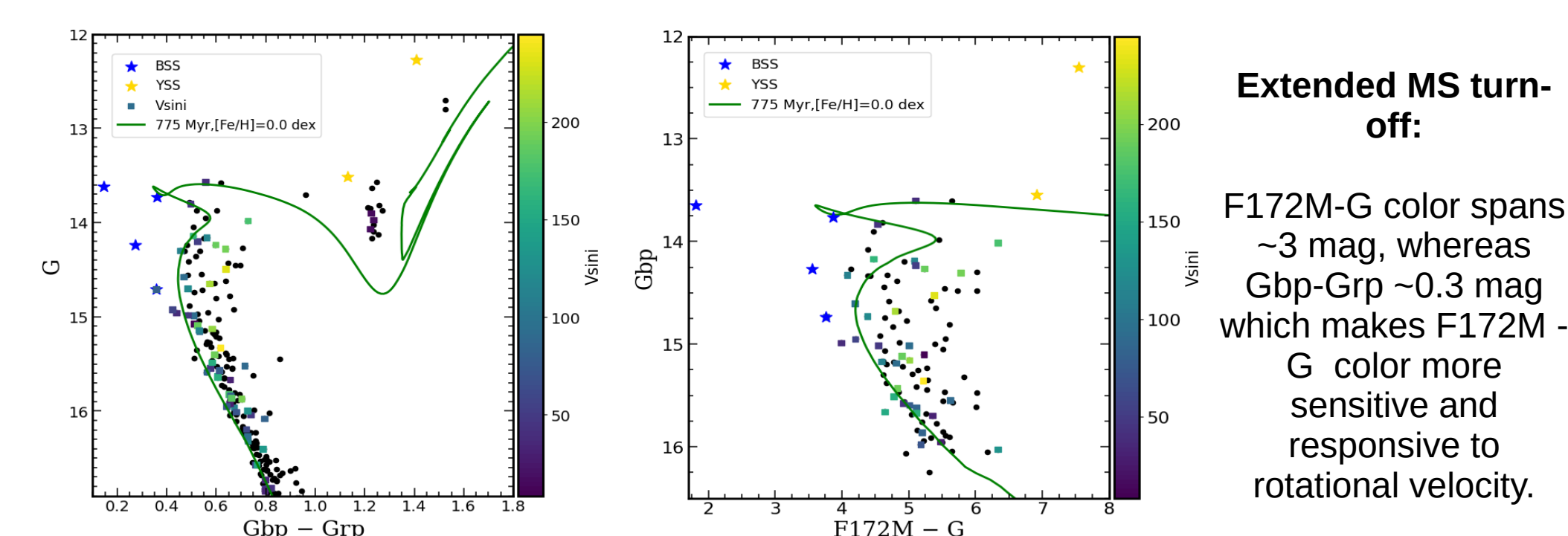
Credit: NASA/ESA

Color-magnitude diagrams (CMDs)

2 YSs Bright in FUV CMDs, Binarity or Chromospheric activity



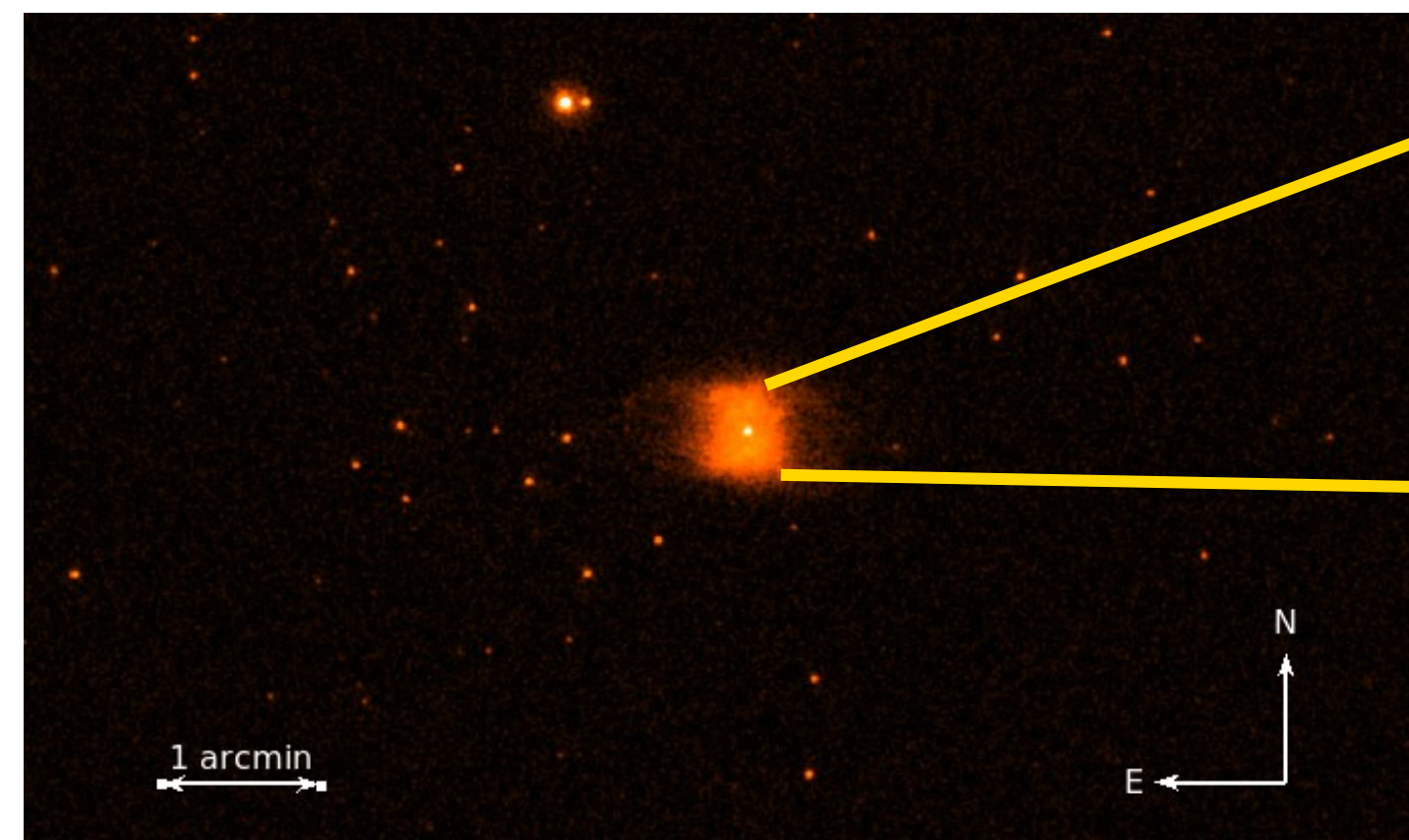
Optical and FUV-optical CMDs of NGC 2818



Extended MS turn-off:

F172M-G color spans ~3 mag, whereas Gbp-Grp ~0.3 mag which makes F172M - G color more sensitive and responsive to rotational velocity.

Why NGC 2818?



UVIT FUV (F148W) image of NGC 2818

- OC NGC 2818 is known to harbour PN also designated as NGC 2818. As the evolutionary lifetime of PNe are short compared to other phases, it is crucial to detect and study them to understand the late stages of evolution. But, the membership status of this PN is still unclear.

HST image of PN NGC 2818

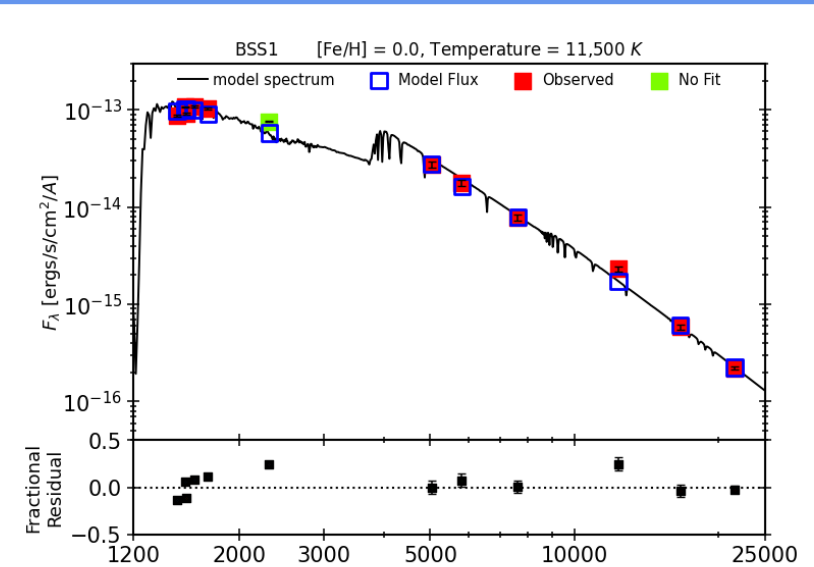
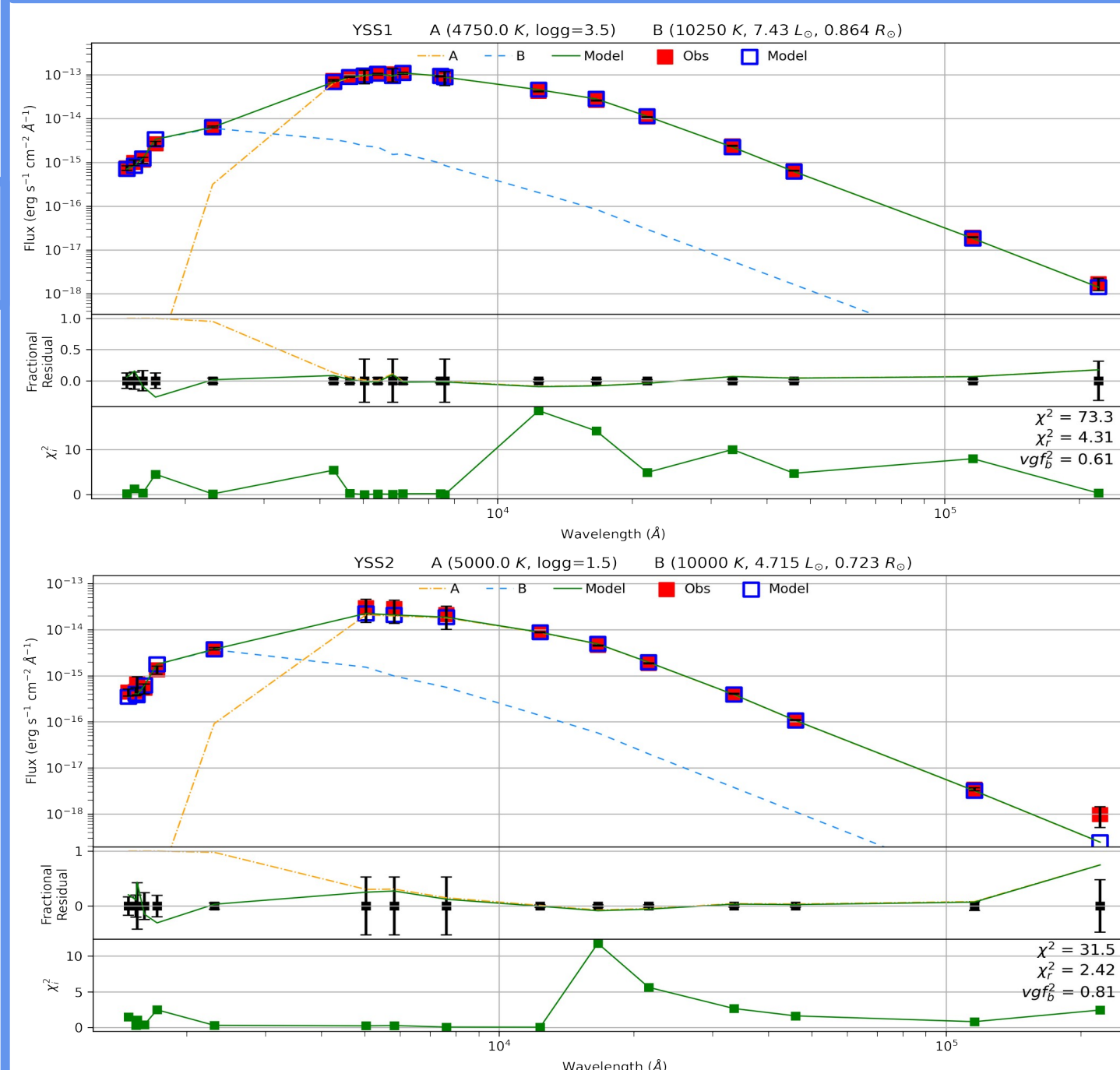


Image Credit: Z. Levay, STScI

In the optical HST image, Planetary nebula (PN) features are seen, whereas central star of PN is detected in FUV image as it is very hot.

This work aims to identify and throw light on the properties of exotic stars in NGC 2818 and find their formation mechanisms in comparison with theory. We also aim to characterize the central star of the PN to examine its association with the cluster.

Spectral Energy Distributions (SEDs)



• SEDs of all BSs detected with UVIT are well fitted with single model, implying that either they are single stars or might have a undetectable WD companions.

• Teff range for BSs: 8,500 – 11,500 K

• Both YSs show significant UV excess, well-fitted with double component SED, indicating the presence of a hot companion.

• They are also found to be spectroscopic binaries.

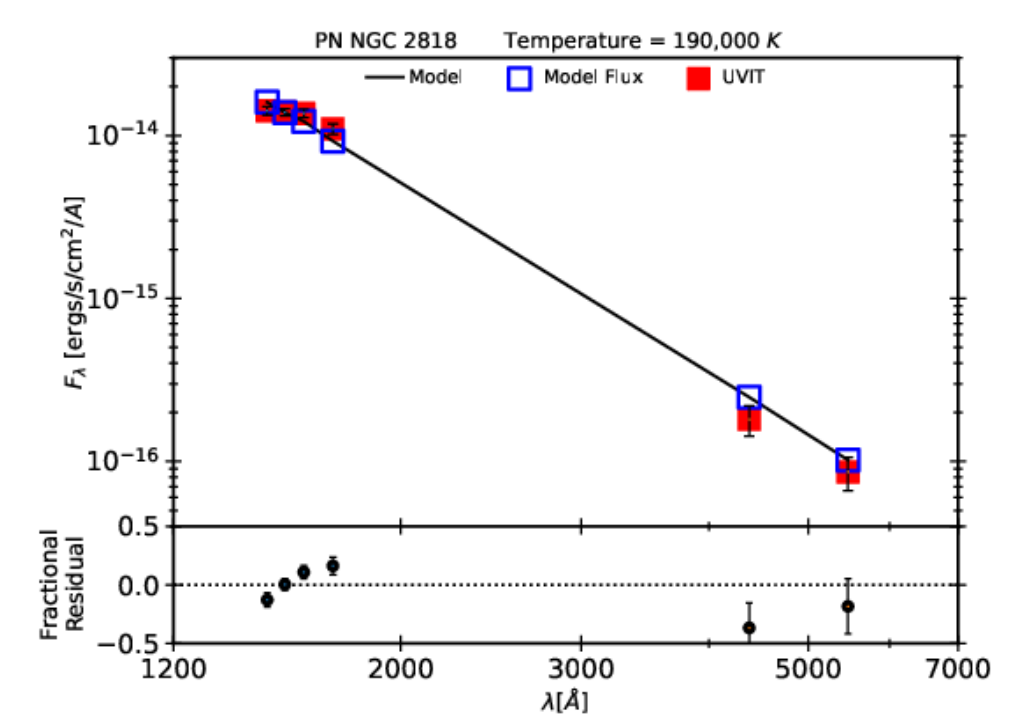
• Teff of hot companions to YSs: ~10,000 K, Radii: ~0.7 – 0.8 R_o

• From their radii, we infer that they are not WDs.

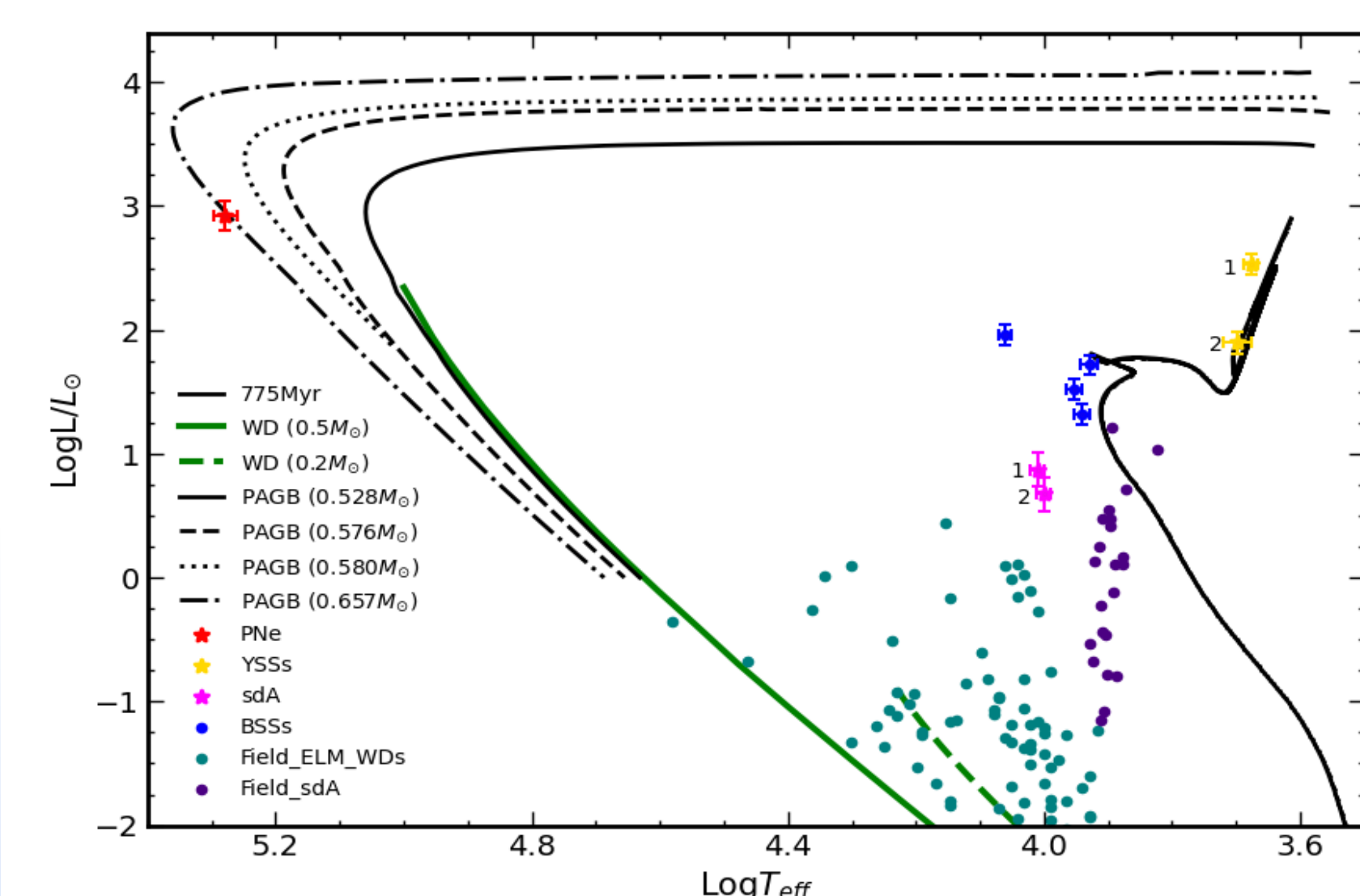
SED of PN NGC 2818

Previous studies estimated Teff Range: 160,000 – 215,000 K
Lum. = 851 L_o
Rad. = 0.038 R_o

In this study, Teff = 190,000 ± 9,000
Lum. = 827 ± 225 L_o
Rad. = 0.027 ± 0.002 R_o, consistent with previous studies.



Evolutionary Status



- Hot companion of YSs:
 - Might be A type subdwarfs (sdA)
- CSPN mass
 - 0.6M_o
 - Progenitor's mass ~2.1M_o
- Turn-off Mass of the cluster:
 - 2 - 2.2M_o

Summary and Conclusions

- We reported the first FUV photometric results of the unique OC NGC 2818
- Detected four BSs:
 - Single SED fits
 - Either collisional products or they might have a faint WD companion.
- Detected two YSs:
 - Excess flux in UV
 - Confirmed photometric and spectroscopic binaries
 - hot companions are compact objects, likely to be sdA stars
 - products of the binary mass transfer
- Central star of the PN (CSPN) NGC 2818:
 - In the WD cooling phase
 - Mass found to be ~ 0.6M_o
 - Mass of the progenitor corresponding to the WD of mass 0.6M_o would be ~2.1M_o
 - Turn-off mass of the cluster ~2 - 2.2M_o
 - Radial velocity, proper motion from Gaia DR3, and reddening towards the cluster and PN are found to be similar.
 - Likely member of the cluster