Spatially Resolving the Quenching Time in F8D1 with Luminous AGB Stars

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What are Ultra-Diffuse Galaxies (UDGs) and why are they important?

NGC 1052-DF2

Ultra Diffuse Galaxy:

- Low mass, large radius
- Recent classification
- Little to no active star formation

Importance:

- Very common
- Understanding UDGs is important for understanding evolution of galaxies/universe as a whole

Why F8D1? Why do we want to know the quenching time?

- Average UDG
- Close enough to resolve stars
  - Study stellar population, not galaxy as a whole
- Use evolution of stellar population to determine evolution of the galaxy and its effect on the group

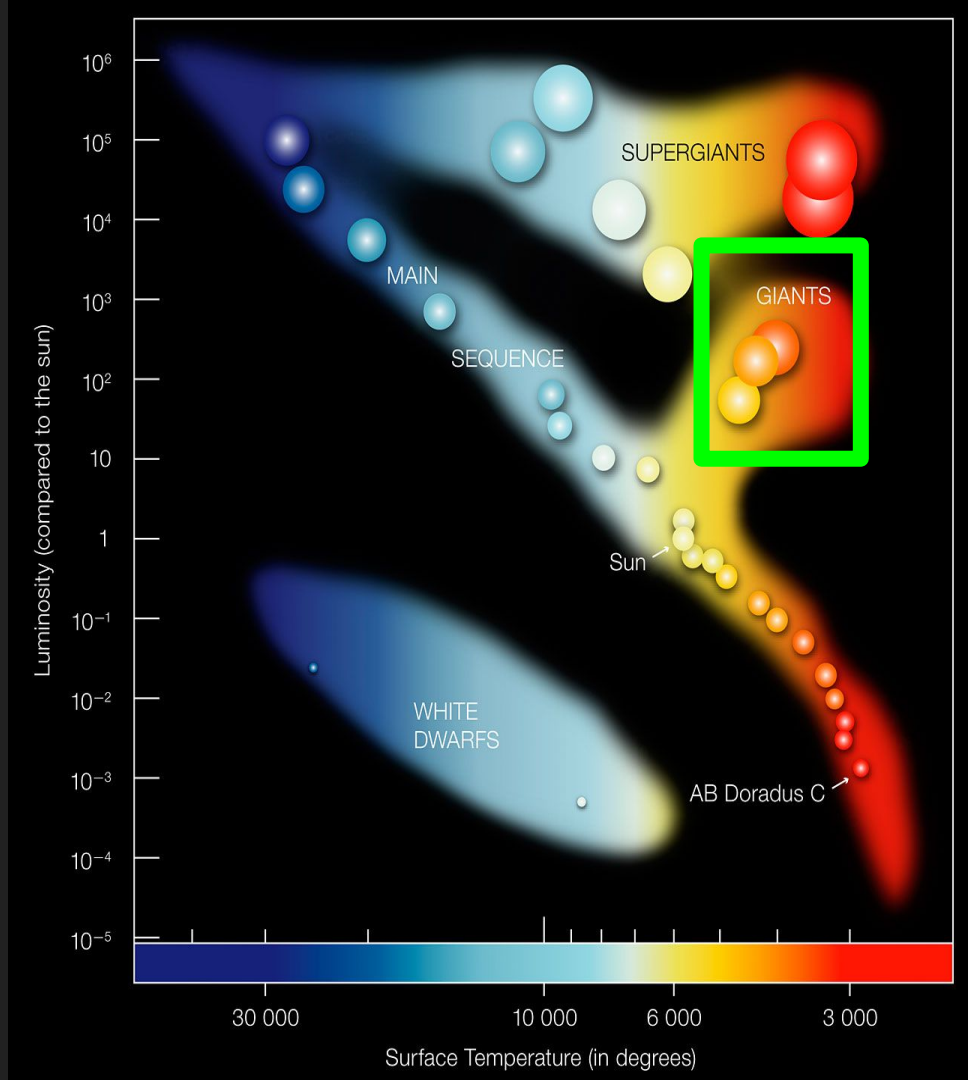
- Finding the quenching time gives us an estimate of how long ago the galaxy closely interacted with its host

What is quenching time and what do we use to we find it?

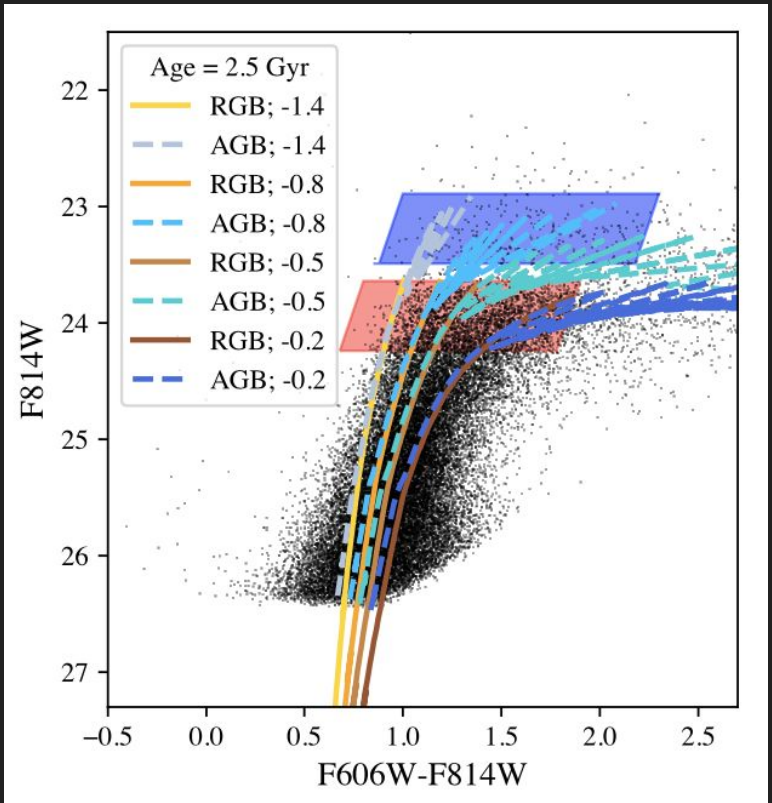
Quenching time: time since star formation ended

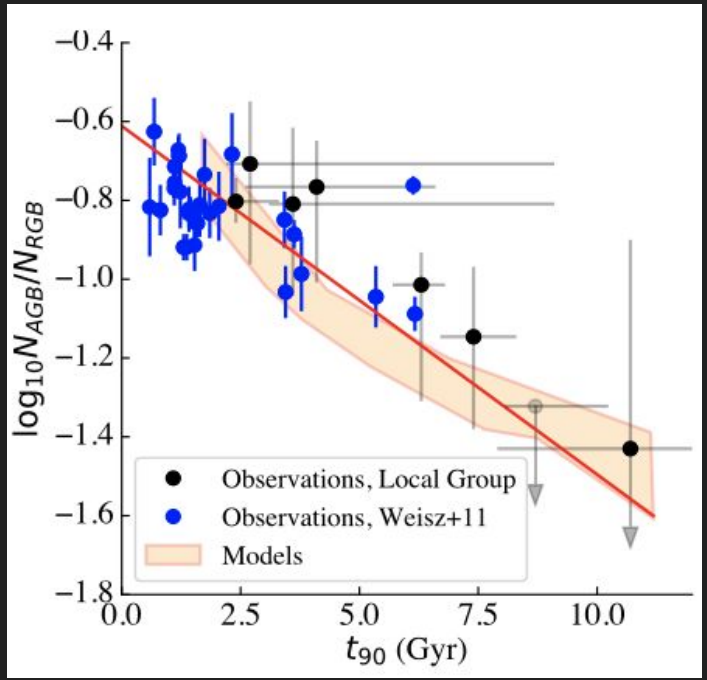
AGB:	TRGB:
Bright	Slightly less bright
Younger	**Older**

The presence of both of these types of stars implies at least two periods of star formation



How do I determine the quenching time using stars?

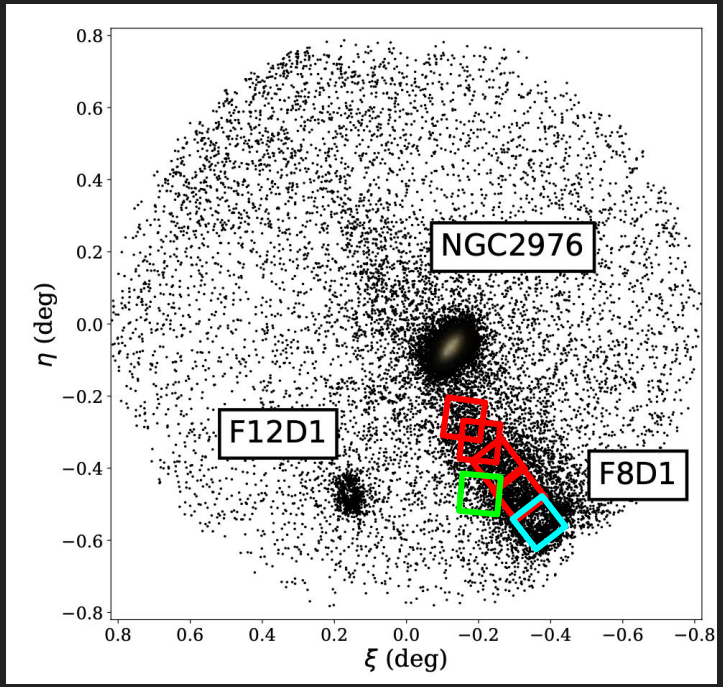


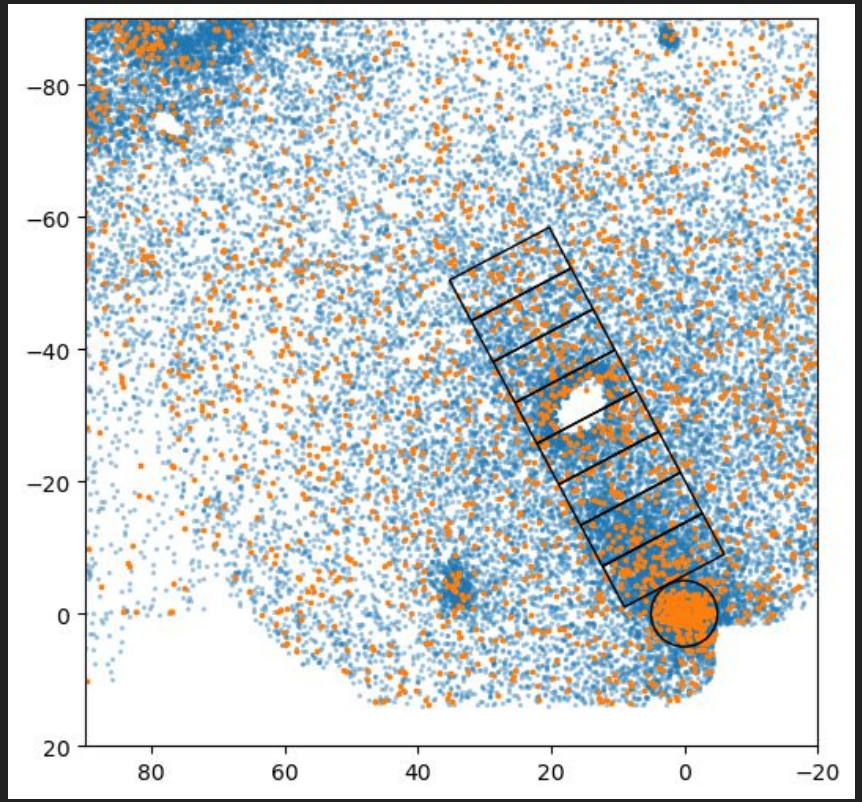


Left: Example CMD with isochrones and AGB/TRGB selection boxes

Above: Data and model to fit t90 with AGB/TRGB ratio

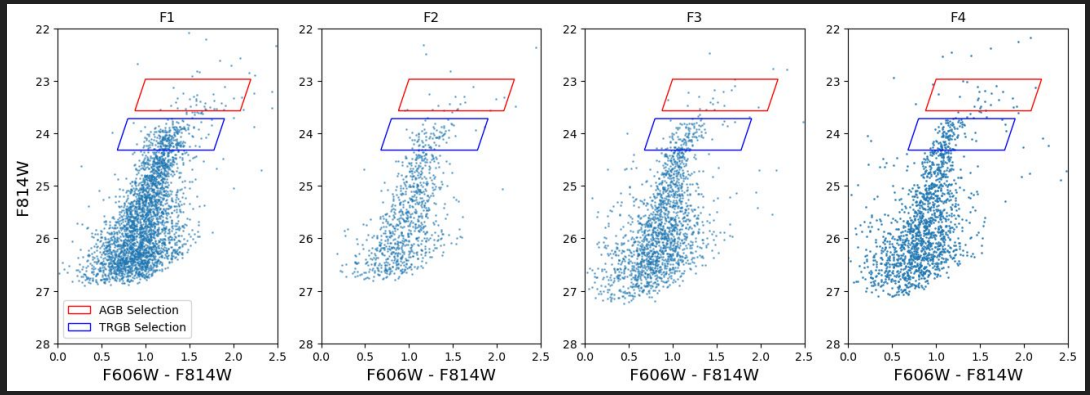
Data

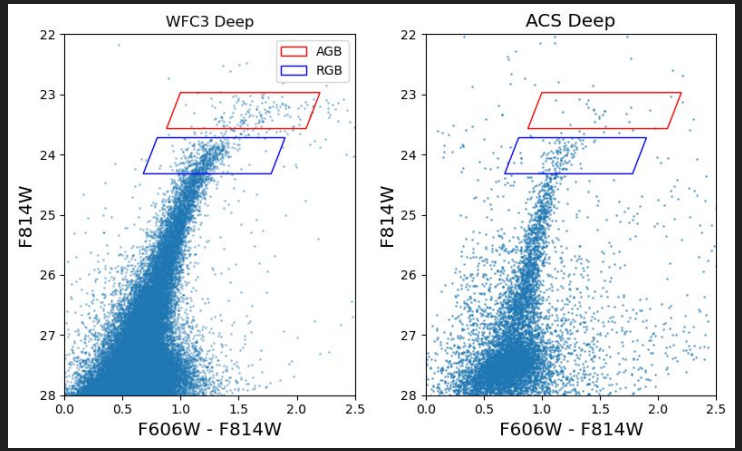




- Using both HST (left) and Subaru (right)
- Tidal stream is present
- Last burst of star formation corresponds to last pericentric orbit of F8D1

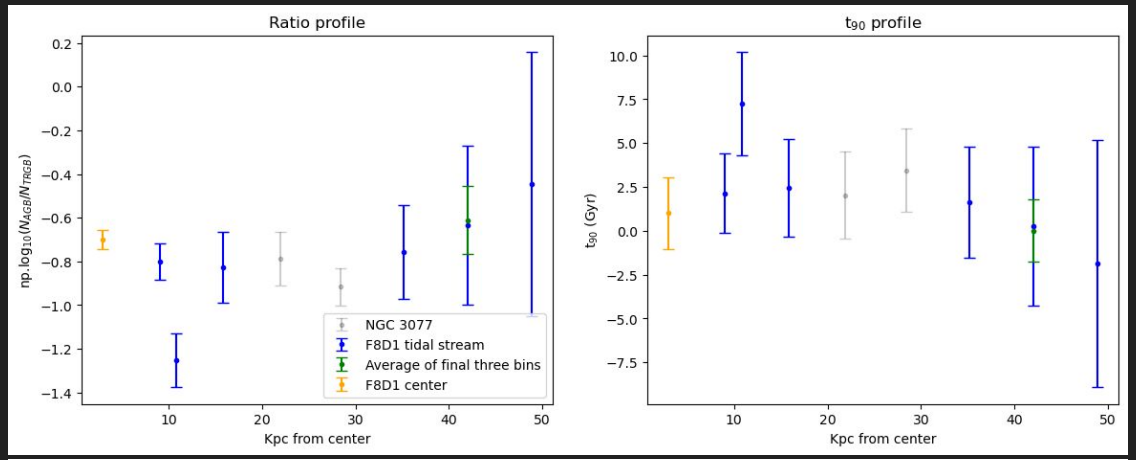
AGB/TRGB ratios

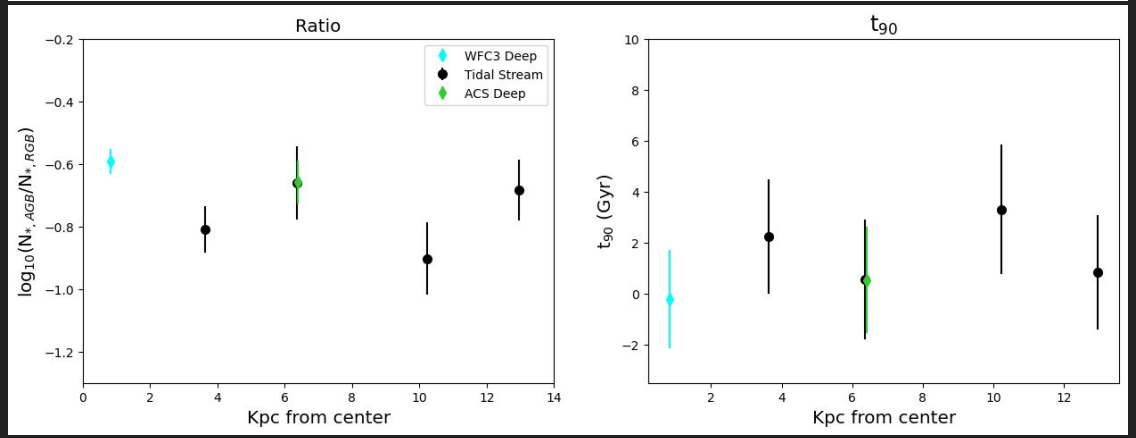




- These are the CMDs from the HST fields
- The same process was used for the Subaru data, but there wasn't room to include them

Fitting observed ratio to calibration





t_{90}: 2 +/- 1.2 Gyr

t_{90} profile of the center and tail using Subaru data

t_{90}: 1.7 +/- 2 Gyr

Same as above, but using HST

Why does this matter?

For this galaxy and the group as a whole:

- Gives clues into the evolutionary history of the galaxy
- Good measurement of ratio can constraint SFH model for a better understanding/fit
- Adding knowledge to our understanding of the M81 group and UDGs

For our broader understanding of galactic evolutionary history:

- Introduces the dimension of *time* to our understanding of merger history
  - Mass of merger event and time since merger event are the most important factors affecting how galaxies appear to us when we observe them
- This is the first time this method has been used!

References

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