

The diffuse fraction of PAH emission in spirals

Alison Crocker¹, Daniela Calzetti¹, David Thilker², and KINGFISH team

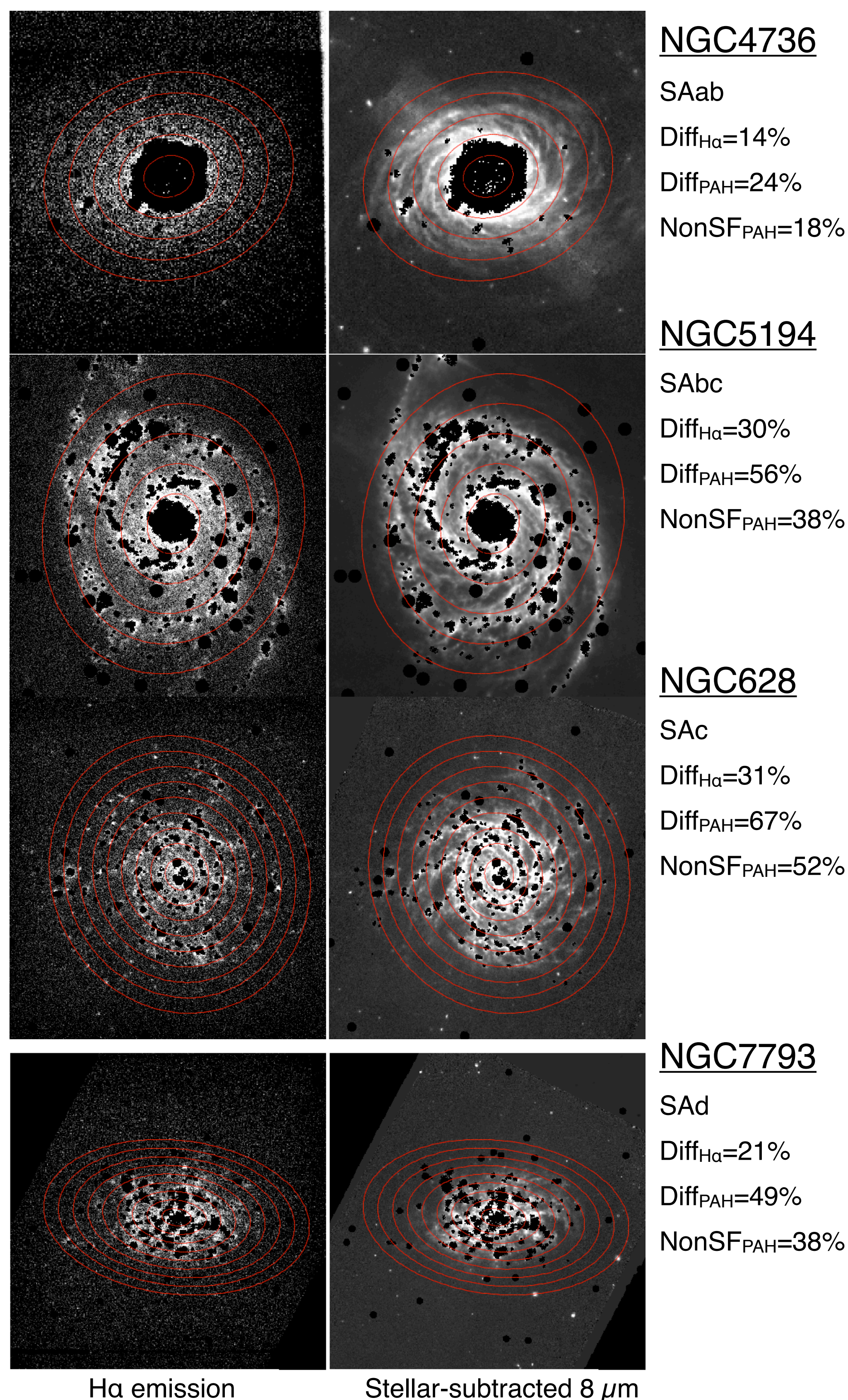
1- University of Massachusetts, Amherst, 2- The Johns Hopkins University

Questions

- Does excitation by star formation dominate the PAH emission in spiral galaxies? How much PAH emission is directly associated to HII regions versus more quiescent regions in the disk?
- What effect does the diffuse PAH emission have on using PAH emission as a SFR indicator?

Approach

Mask HII regions using an H α image and HIIphot, determine diffuse H α and PAH fractions:



However, many ionizing photons escape HII regions (see maps above). If a similar fraction of softer UV photons also escape HII regions, then much of the diffuse PAH emission may be excited by these photons.

We have attempted to subtract off this contribution by computing a nonSF-related PAH fraction:

$$\text{NonSF}_{\text{PAH}} = \text{Diff}_{\text{PAH}} - \text{Diff}_{\text{H}\alpha} * (\text{HII}_{\text{PAH}} / \text{HII}_{\text{H}\alpha})$$

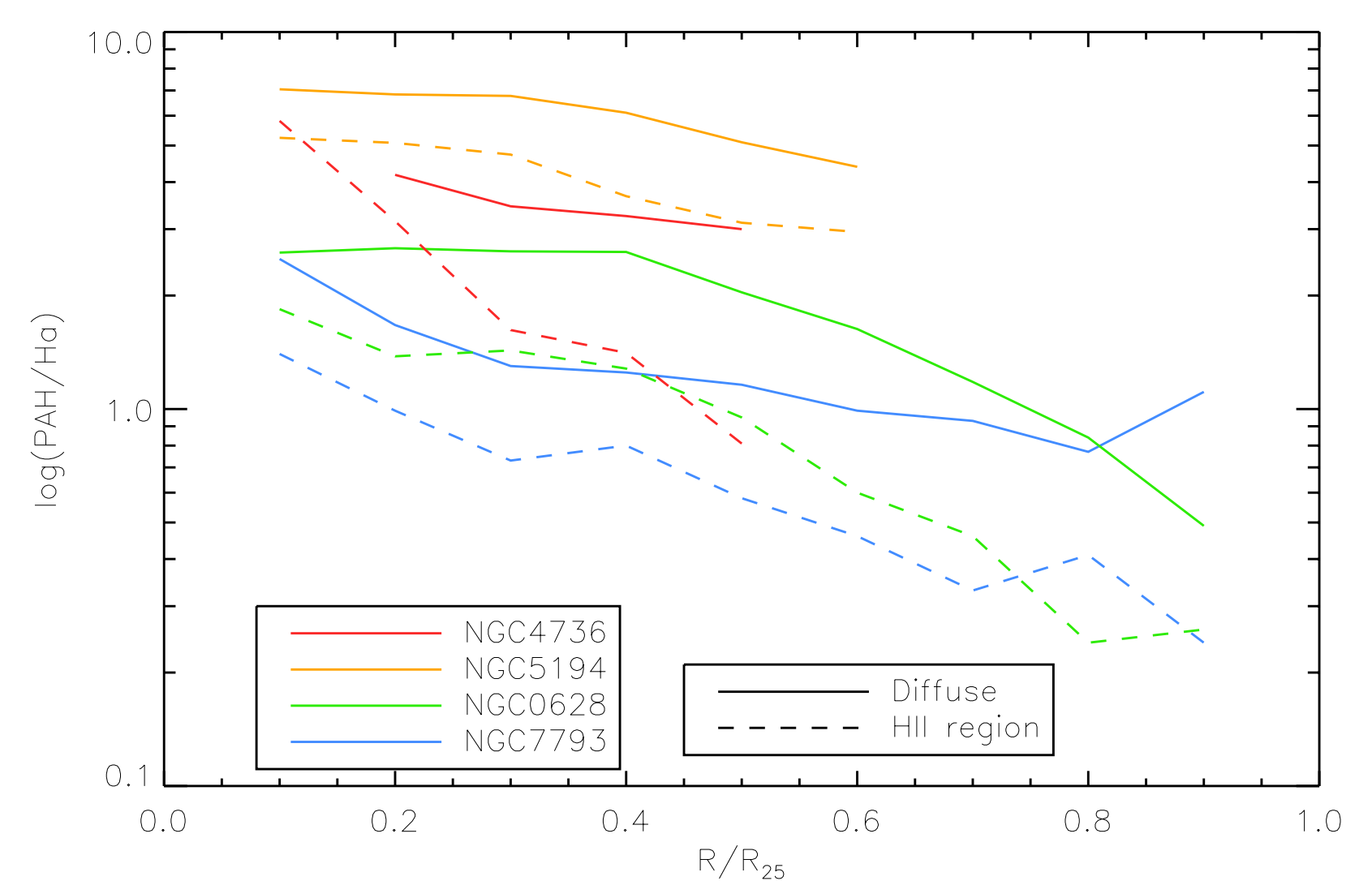
This is computed in radial annuli, as the HII_{PAH}/HII_{H α} ratios exhibit radial gradients (see next column).

Results

- 18-58% of PAH emission in spiral galaxies is excited by the general interstellar radiation field (dominated by A stars) as opposed to the very youngest OB stars
- Differences in fraction seen with dust/HII region morphology or perhaps metallicity \rightarrow more galaxies required to separate effects

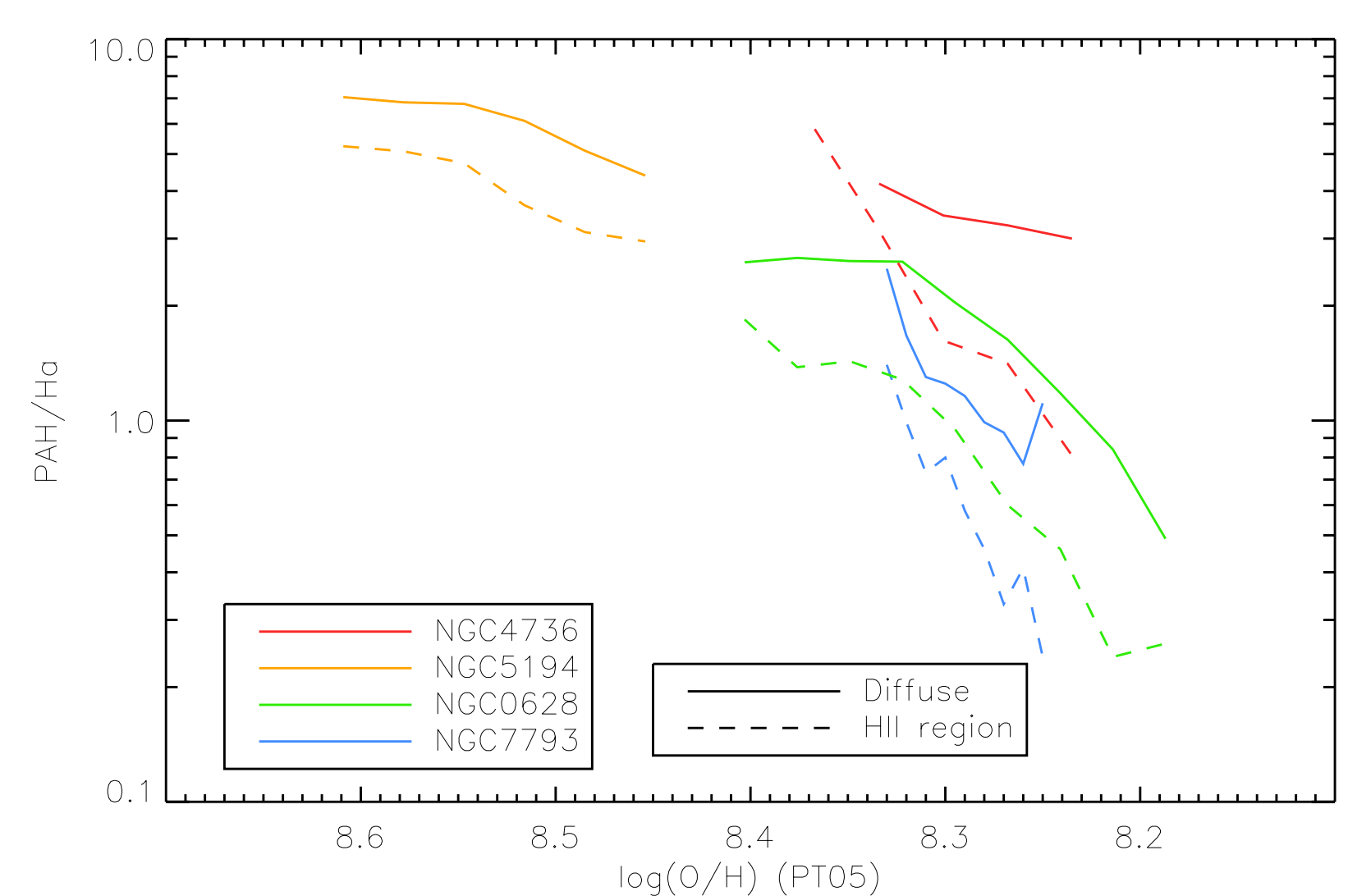
H α /PAH Ratios

With radius:



- PAH/H α ratios are always higher (\sim 2) in diffuse regions than HII regions. (PAH emission not as strongly linked to ongoing SF as H α .)
- PAH/H α ratios decline with radius both in diffuse and HII regions.

With metallicity:



- PAH/H α declines more steeply as lower O/H approached (other studies show drop off of PAHs near this abundance)
- Not in NGC4736: outside of central star forming region, lots of PAH emission, little H α

Conclusions

- Fractions of PAH emission directly due to star formation vary from galaxy to galaxy, care must be taken when using PAH emission as a SFR indicator
- PAH/H α ratios within and without HII regions track each other as they decline with radius and metallicity; a steeper drop off is seen towards low metallicities