

Resolved Spectroscopy of Galaxies in GASS:

The GALEX-Arecibo-SDSS Survey

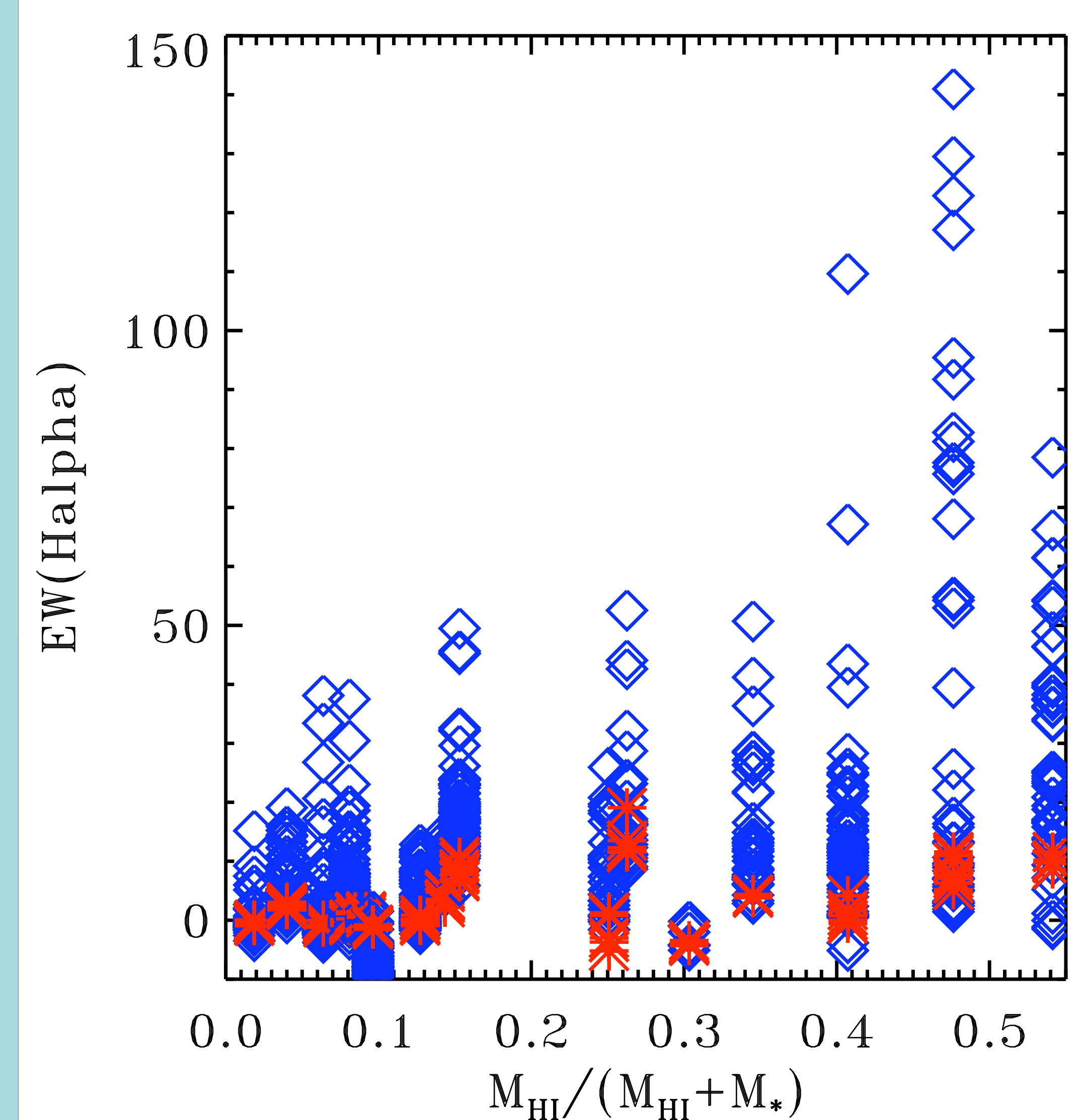
Sean Moran¹, Tim Heckman¹, Barbara Catinella², David Schiminovich³,
Guinevere Kauffmann² & The GASS Team

¹Johns Hopkins University, ²MPA Garching, ³Columbia University

Abstract: We present initial results from our longslit spectroscopy of galaxies in GASS, an Arecibo HI program to measure the gas content of a volume-limited sample of galaxies at $0.025 < z < 0.05$. The GASS sample spans the critical “transition” mass separating star forming galaxies from passive red sequence galaxies. Earlier SDSS spectra cover only the central few kpc of GASS galaxies, and so provide no information on the galaxies’ outer reaches, where much of the star formation and gas may be located. We have therefore been pursuing longslit spectroscopy to better relate these galaxies’ resolved recent star formation histories and internal dynamics to their total HI content. We trace these quantities to beyond one scale length in each galaxy, and our initial results uncover a number of peculiar cases of both HI deficient galaxies with extended ongoing star formation and seemingly quiescent red-sequence galaxies with copious HI. These findings suggest that a significant number of galaxies in the “green valley” fall into one of these peculiar categories, as might be expected for galaxies in such a transitional phase.

Ongoing Star Formation: For each galaxy, we plot H α for all independent positions along the slit, versus the parent galaxy’s gas fraction ($M_{\text{HI}}/(M_{\text{HI}}+M_*)$). Blue points represent H α from a region beyond that covered by the SDSS spectra, while red points indicate positions that were within the SDSS fiber. Each vertical strip therefore indicates the range of star formation intensities observed across that galaxy. Key features to note:

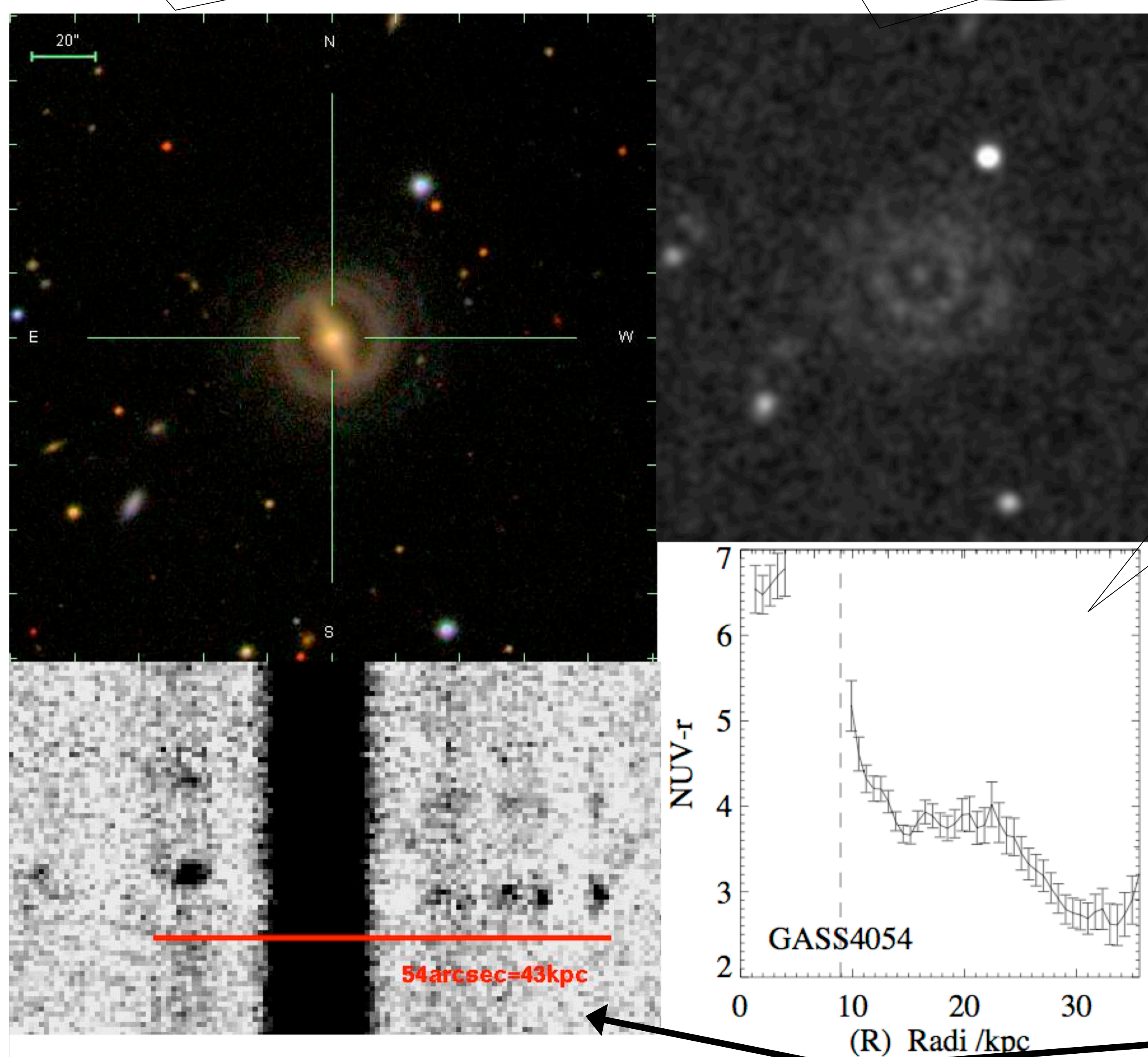
- Large amounts of star formation completely missed by the SDSS spectra
- The expected trend of overall greater EW(H α) with increasing f_{HI} is only apparent in the new spectra covering a wider portion of the disk.
- Some galaxies with low HI exhibit significant star formation in their outskirts
- At least one peculiar galaxy with high f_{gas} exhibits no star formation at all.



A Case Study: GASS4054

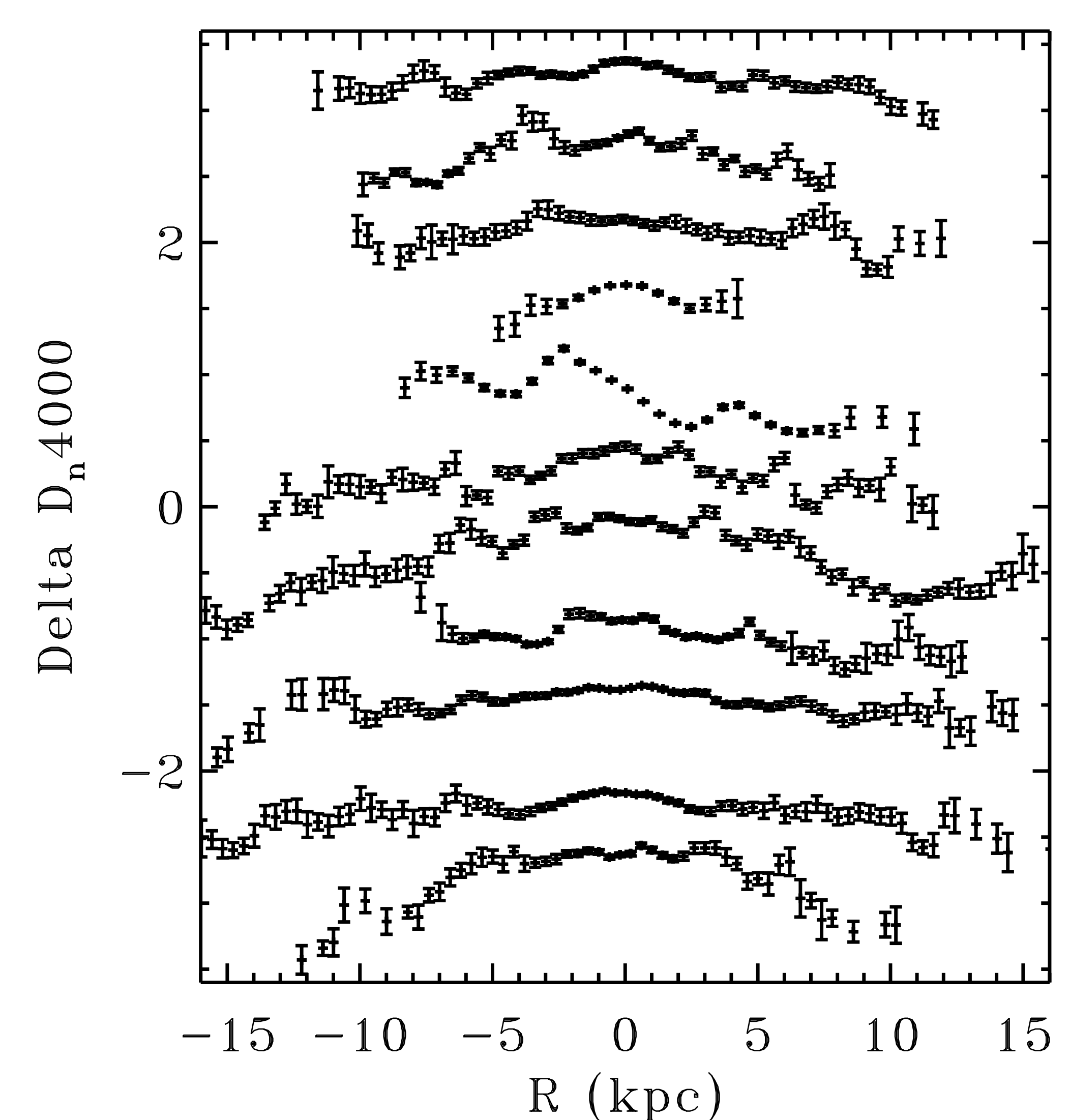
Despite red optical color
Arecibo indicates $f_{\text{gas}} \sim 10\%$

GALEX NUV image
reveals significant UV in main optical
ring AND another ring barely
visible in optical



NUV-r radial profile
shows a strong
gradient from very old
& red core to
surprisingly blue &
young outskirts

New longslit spectrum
reveals **many** star-
forming knots spread
over more than 40kpc.
Each black dot is
emission from H α ,
each having spatial
(horizontal) separation
from the next.



Recent Star Formation Histories Selected radial profiles of $D_n 4000$, sensitive to 1–2 Gyr old stellar populations. Profiles are arranged from bottom to top in order of increasing HI gas fraction ($1\% < f_{\text{gas}} < 50\%$), with profiles given an arbitrary offset on the Y-axis. Some features to note:

- Some gas-poor galaxies exhibit younger stellar populations in their outskirts (low $D_n 4000$ at large radius), along with some H α (above). A hint that that their gas has been depleted from the inside out, with star-forming gas persisting only at large radius?
- Several gas-rich galaxies exhibit both a wide spread in H α strengths and distinctly “bumpy” $D_n 4000$ profiles. Together, these reveal a mix of stellar populations of varying (young) ages, which may reflect an underlying ‘clumpy’ HI distribution.