Where, When and Why Stars Form in Galaxies



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with PhD students:

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Disk Formation



THINGS survey: Leroy et al, 2008; Walter et al, 2008

COLD GAS

Disk Formation



COLD GAS STAR FORMATION

THINGS survey: Leroy et al, 2008; Walter et al, 2008

Disk Formation

COLD GAS STAR FORMATION

STARS



THINGS survey: Leroy et al, 2008; Walter et al, 2008

z~0: Star Formation tracks stellar disk



ALFALFA, Ha3 sample: HI-normal galaxies only

At z~0 stars dominate local potential

Resolved star formation at 0.7<z<2.6



KMOS^{3D}

Co-leads: N.M. Förster Schreiber, D. Wilman

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KMOS^{3D}



$H\alpha$ Detections

Detections:

- •76% TOTAL
- •88% On or Above SF Main Sequence
- •19% Below SF Main Sequence









Credit: Emily Wisnioski



Wisnioski et al. 2015: $z \sim 1:93\%$ of the galaxies have clear disk-like kinematics



Wisnioski et al. 2015: $z\sim2:74\%$ of the galaxies have clear disk-like kinematics

Image Fitting: continuum (stars) and $H\alpha$ (star formation)

HST F160W (H)

KMOS Ha



Galaxy Growth in Disks



Wilman et al. in prep







Continues to form stars for t_{quench}

Satellite Quenching

- Does not depend strongly on halo mass (massive clusters not considered)
- Consistent with quenching of SF by lack of external accretion
- Gas continues to fuel SF for many Gyr (longer than molecular gas supply), especially in low mass galaxies

Spatially Resolved Satellite Quenching

Spatially Resolved Satellite Quenching

Spatially Resolved Satellite Quenching

Where do stars form?

Kulkarni et al., in prep

Where do stars form?

Kulkarni et al., in prep

Where do stars form?

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Signature of Gravitational Interactions

• Type II (truncated) profiles for normally star forming, typically late type spirals and irregulars

• Type III (anti-truncated) profiles for passive galaxies

Conclusions

- Growth via Star Formation:
 - In normally evolving galaxies, star formation is ubiquitous throughout the disk.
 - The half-light size of this disk is only slightly larger than that of the existing stellar disk at z>1.
- Quenching of Star Formation in Satellite Galaxies:
 - Star formation can be quenched when the gas supply dries up in satellite galaxies.
 - This typically takes a long time, suggesting satellite galaxies in most groups retain most of their gas after infall.
 - At low redshift, many galaxies with globally low SFR form stars only in their cores many of these are satellites of groups, suggesting outside-in environmental quenching.
 - This is unlikely to be just ram-pressure as stellar profiles are also different in quenched galaxies. Gravitational interactions (tidal interactions / mergers) are likely to be important.