

AGN driven outflows in dwarf galaxies



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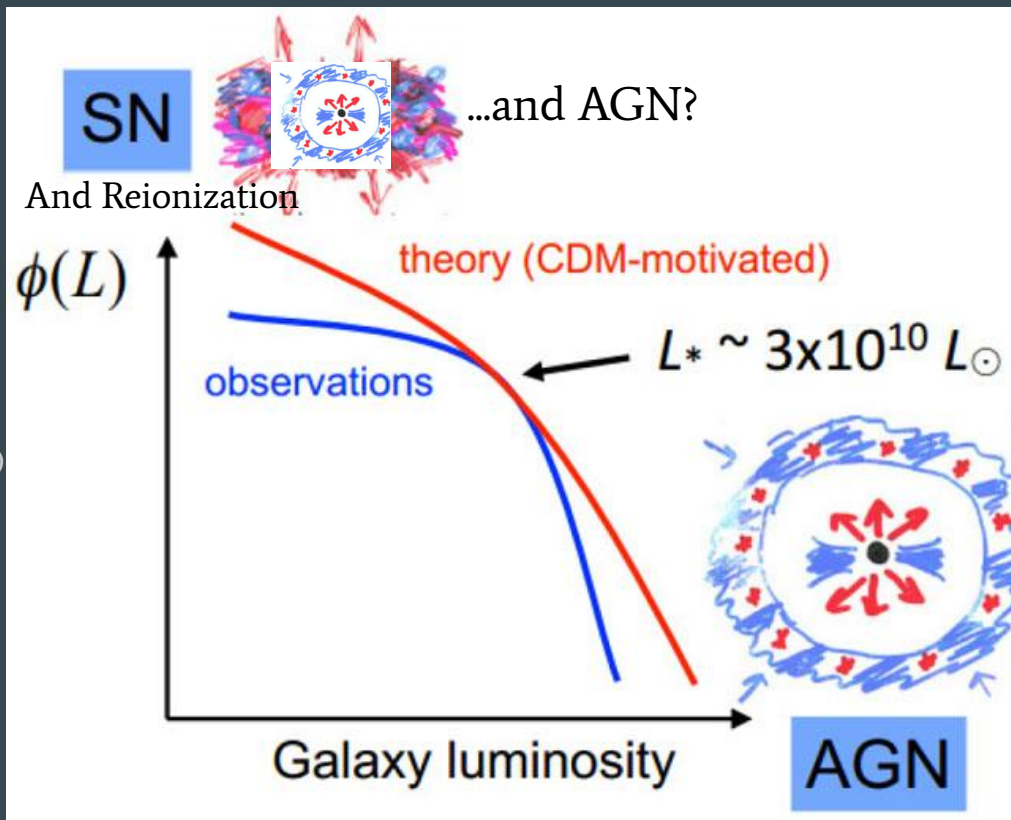
UC Riverside

Small Galaxies, Cosmic Questions

30 July 2019

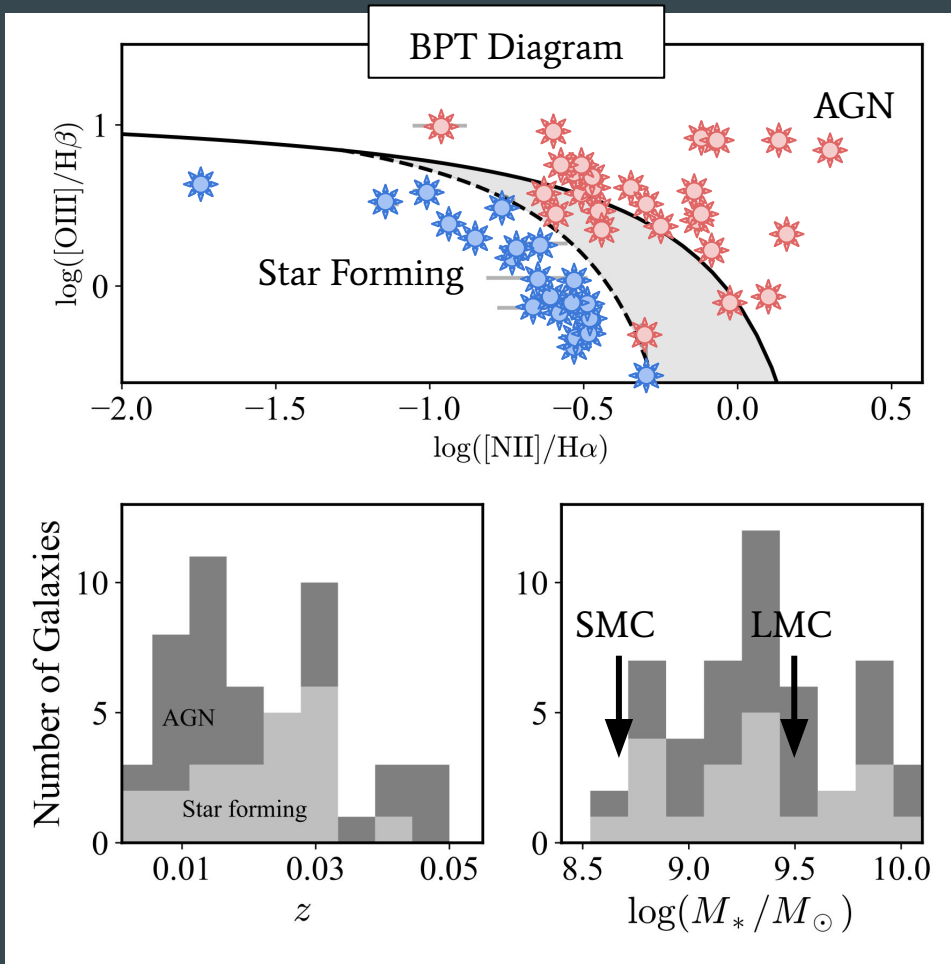
The background

- AGN are present and possibly common in dwarf galaxies (Reines+2013, Moran+2014, Sartori+2015)
- Theory work suggests AGN feedback could be important (Silk 2017, Dashyan+2017, Barai+2018, Koudmani+2019)
- Recent evidence that quiescence and AGN coexist (Penny+2018, Bradford+2018, Dickey+2019)

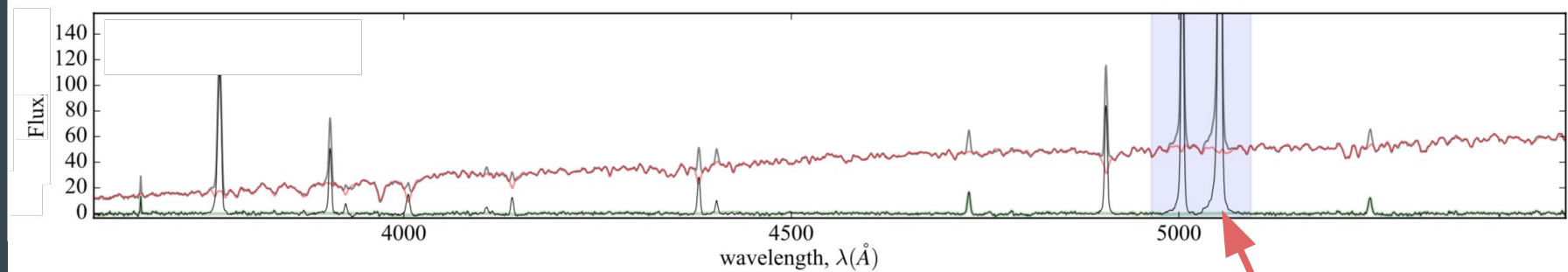
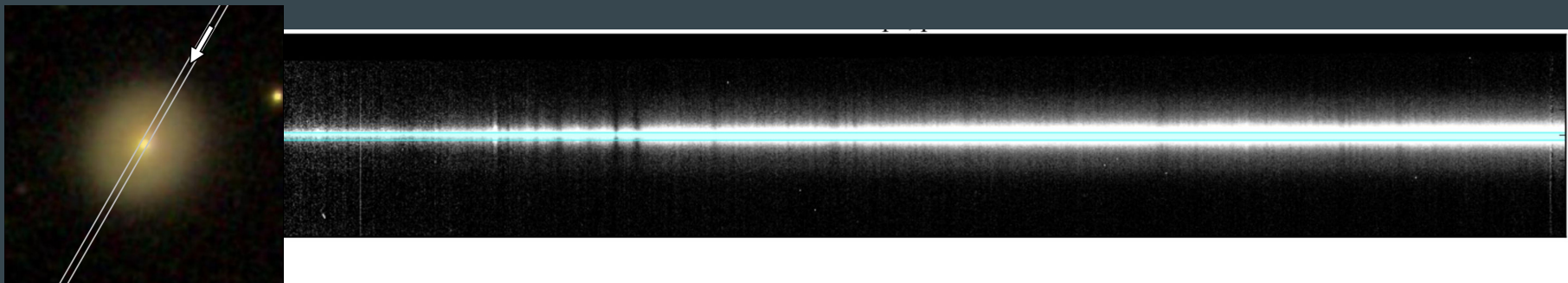


Our work

- 50 dwarf galaxies
 - 29 AGN (Reines+2013, Moran+2014, Sartori+2015)
 - 21 SF (control sample from SDSS)
- LRIS longslit on Keck I

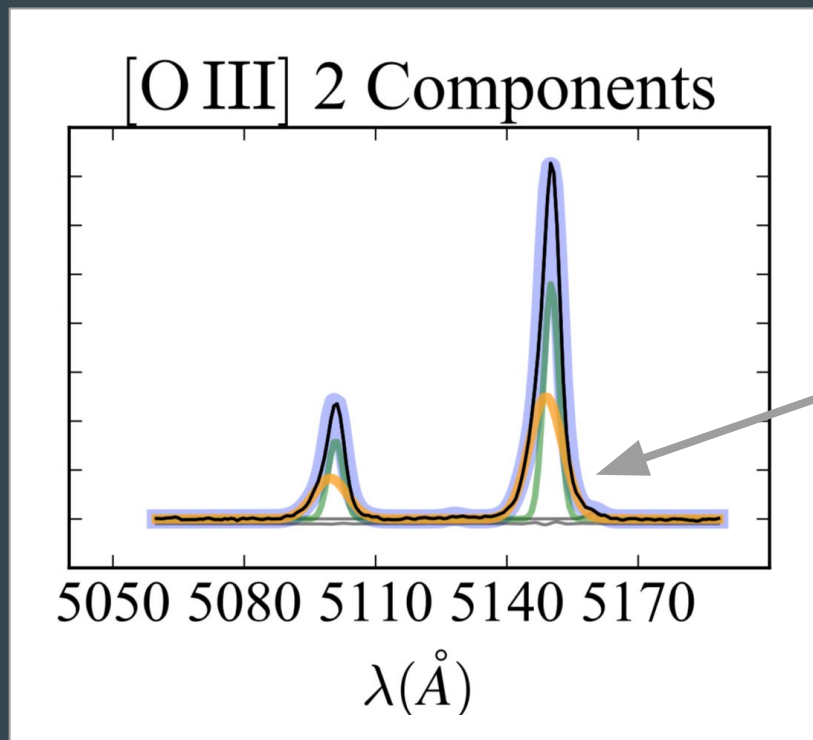


The data

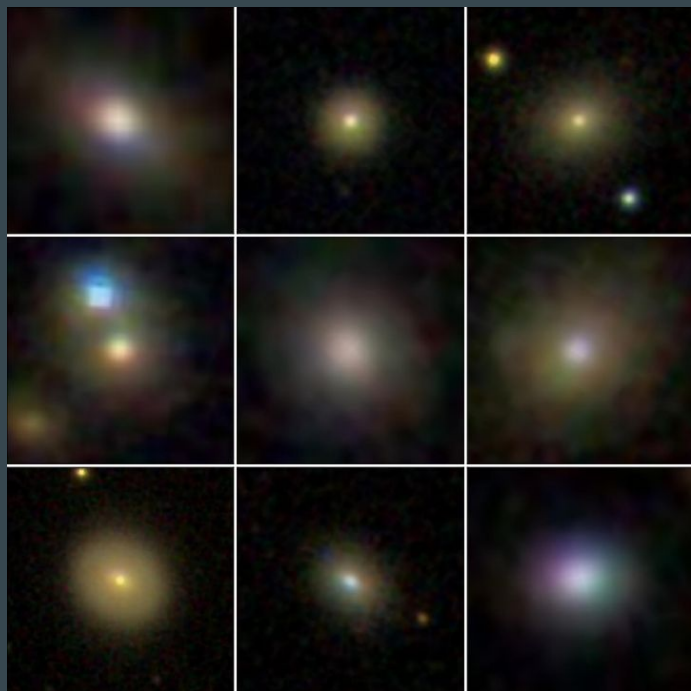


outflow?

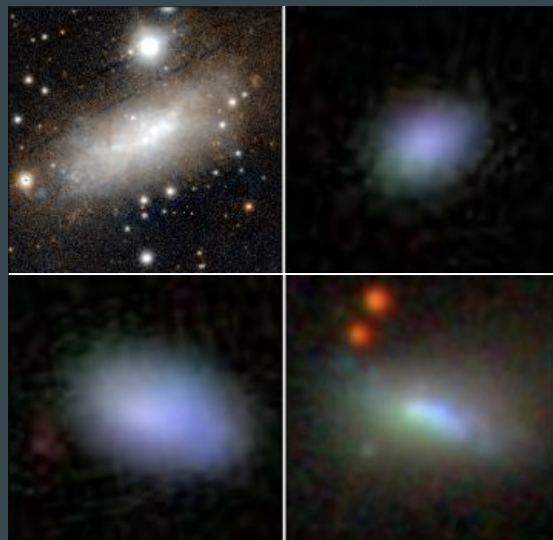
Identifying outflows



13 Dwarfs with Galaxy-Wide Outflows



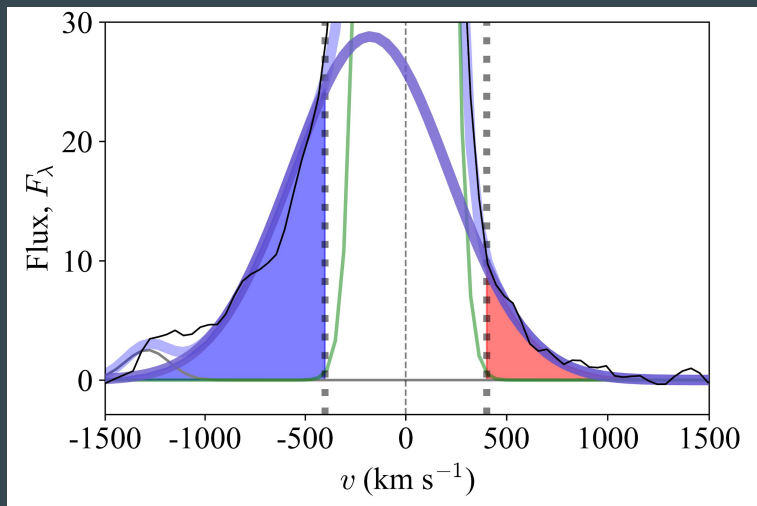
9 AGN



4 star forming

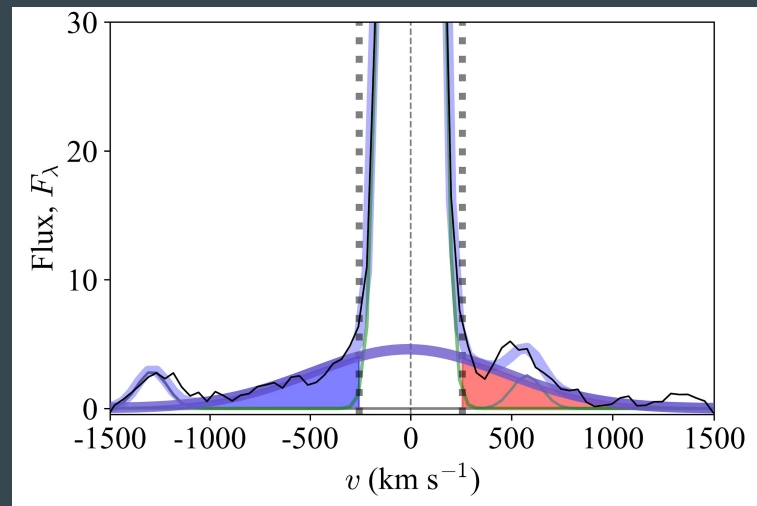
Different Line Profiles

AGN



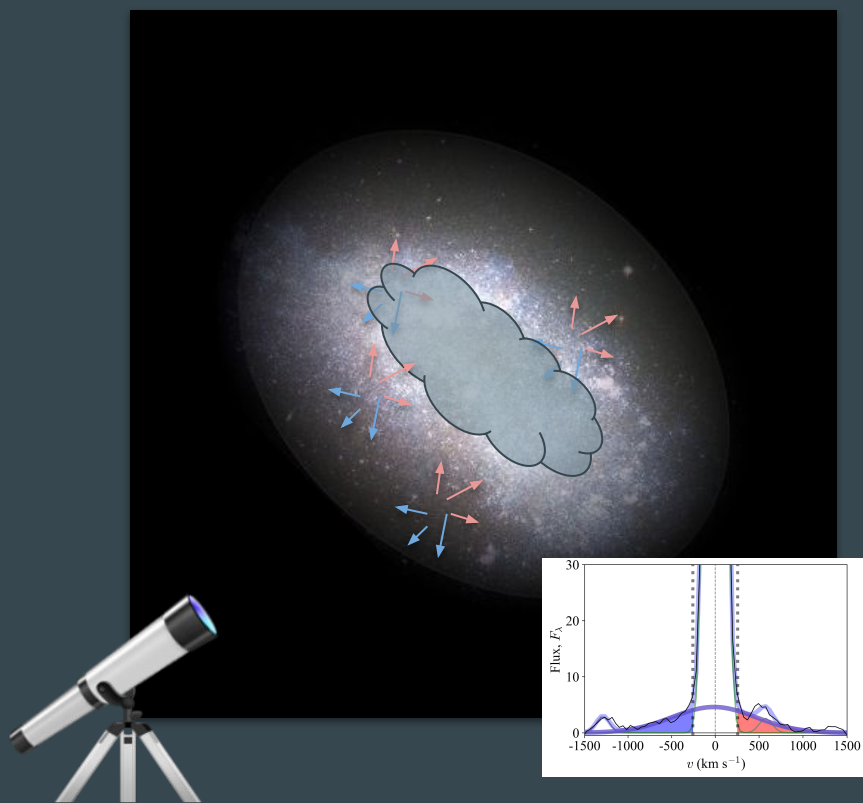
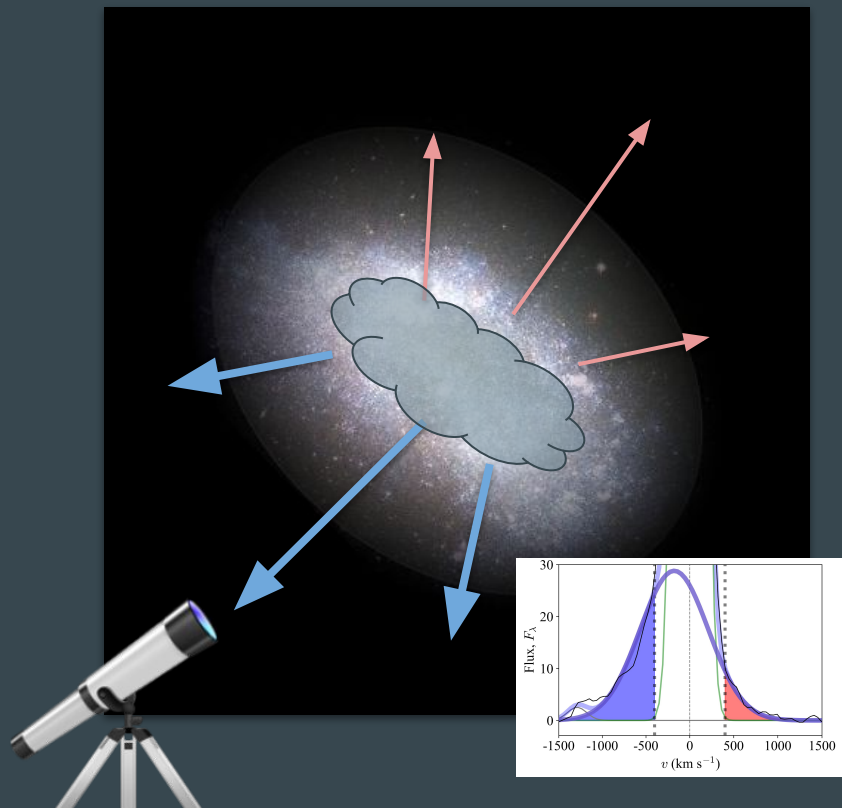
- Blueshifted
- Larger fraction (up to 50%) of [O III] flux

Star Forming

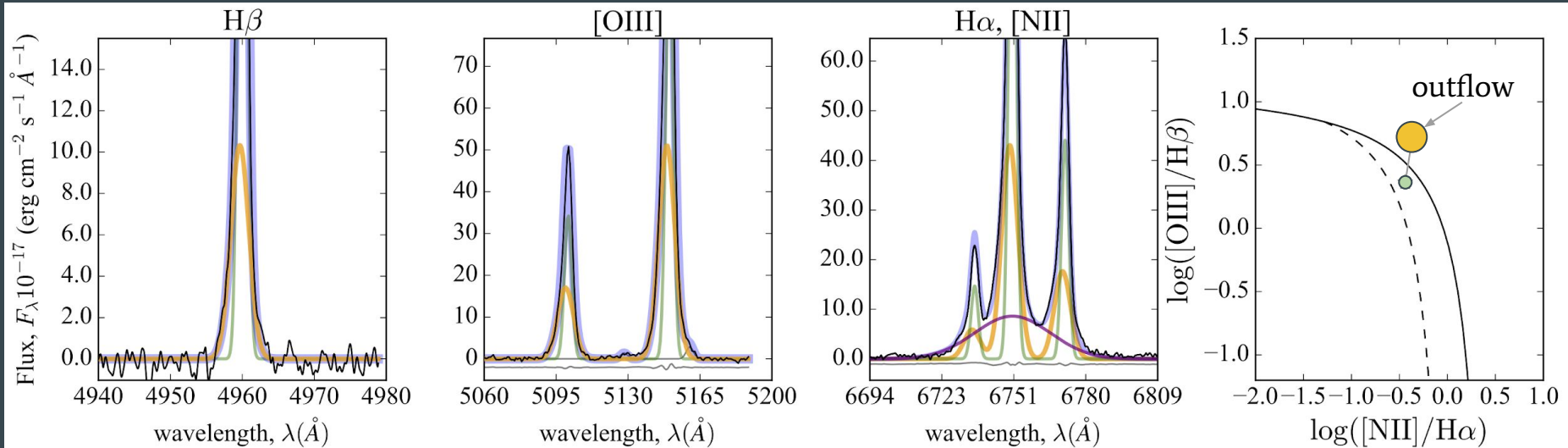


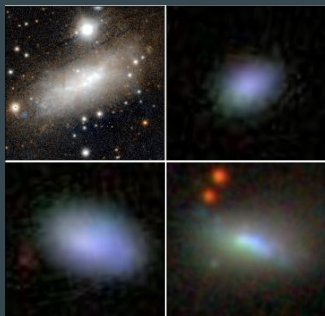
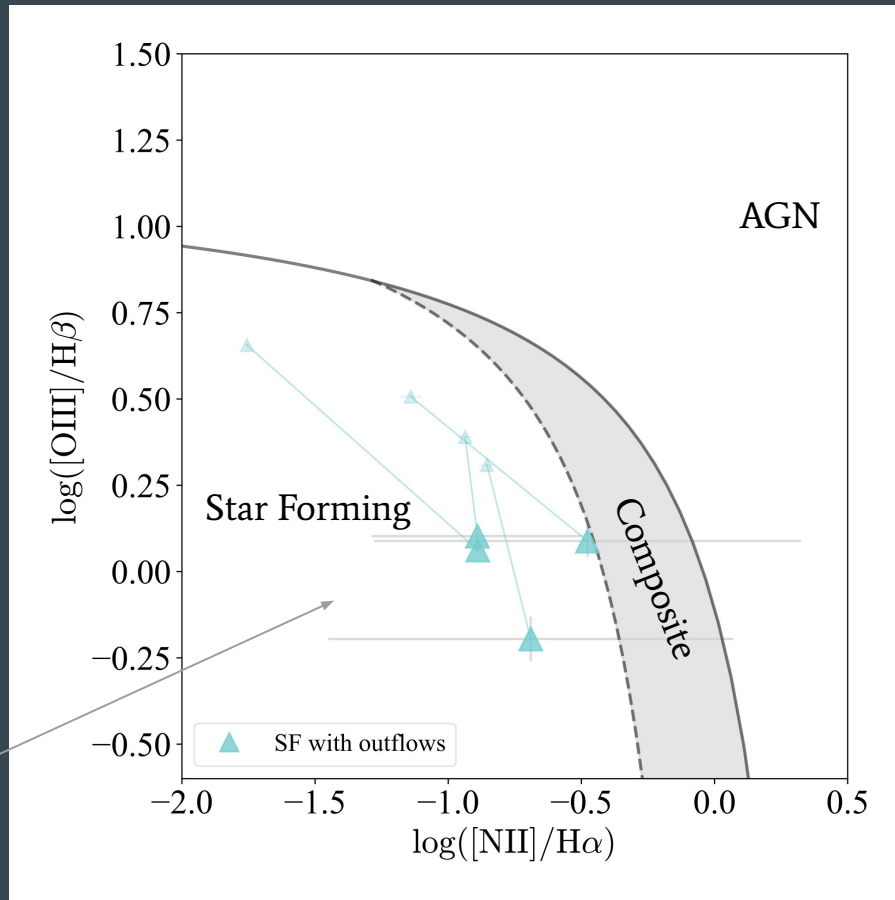
- Symmetrical
- Smaller fraction (4-8%) of [O III] flux

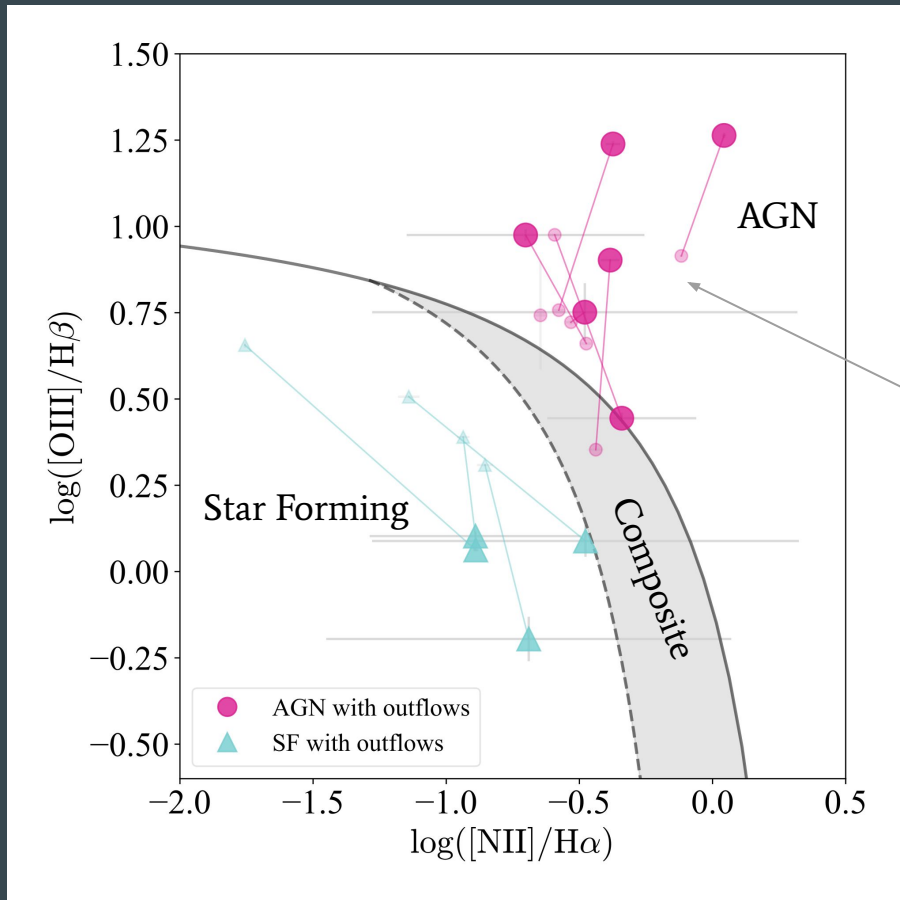
Different Outflow Origins?



Outflow Ionization

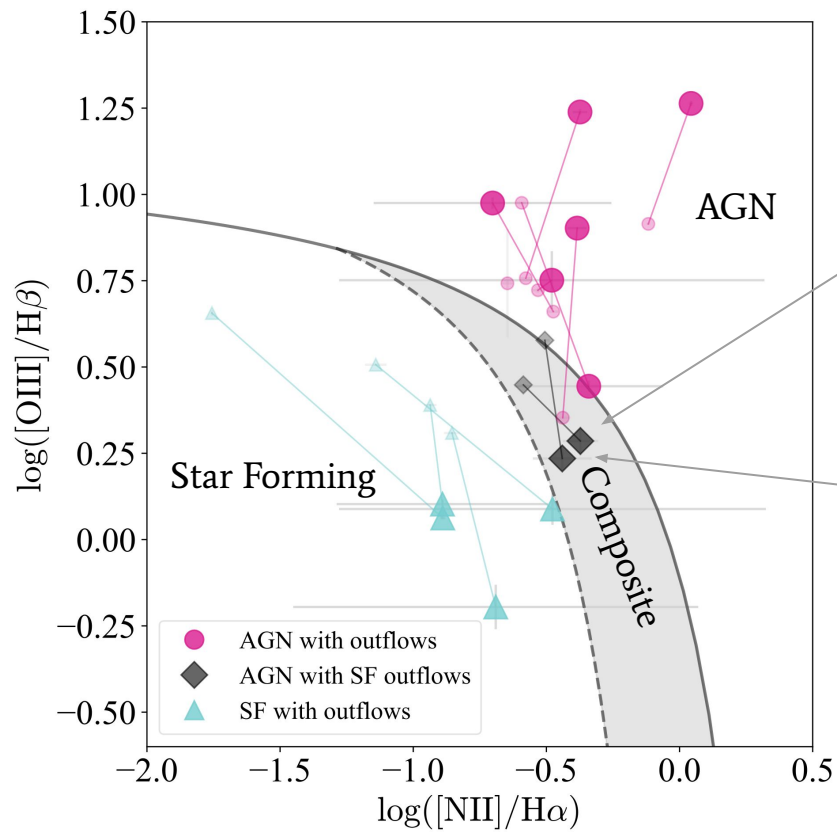






Plus, their line profiles tend to be blueshifted



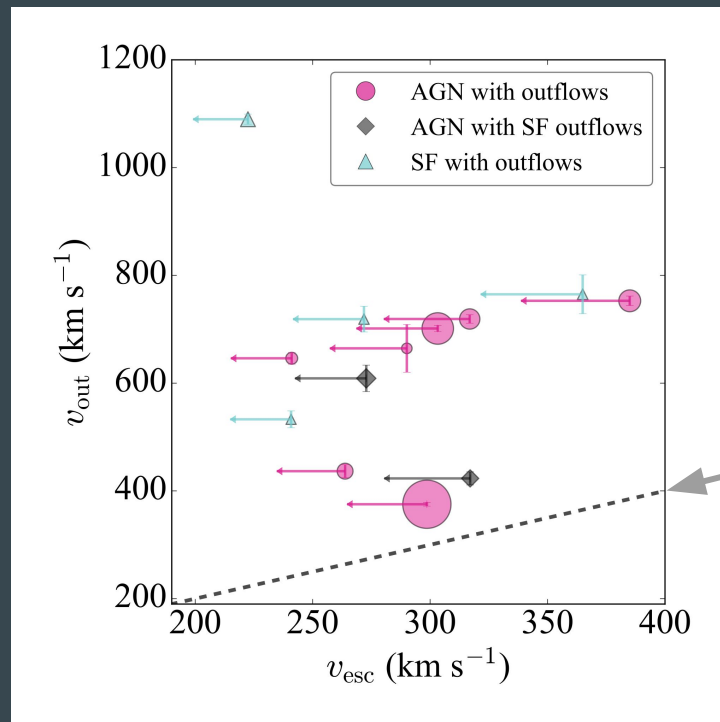
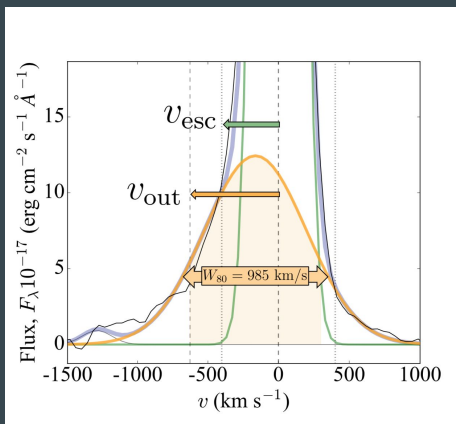


Plus, both of their line profiles are symmetric



Fate of the gas?

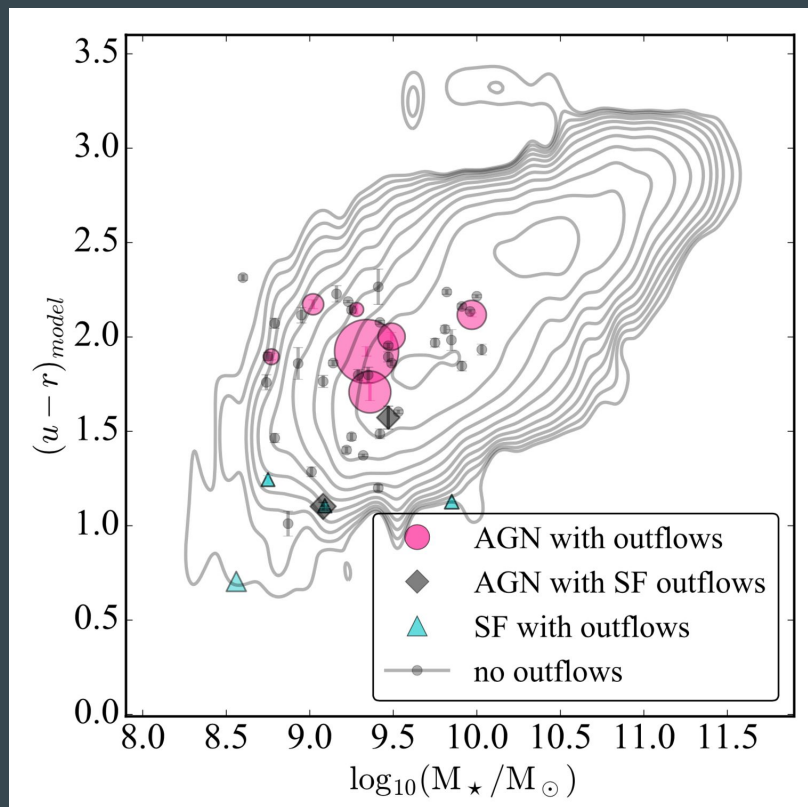
- Points are scaled by % of [O III] flux in outflow component
- v_{esc} is an upper limit



Tying outflows to the AGN -- IR

- Most outflow galaxies hosting AGN have Si[IV]
- Line ratios strongly exclude shocks as ionizing mechanism for gas in IR

Possible star formation suppression?



In Summary,

- Outflows detected in 9/29 AGN and 4/21 SF dwarfs
- Differences in line profiles suggest origin
 - Blueshifted outflow implies central source with obscuration
 - Symmetrical outflow implies unobscured sources
- Emission line diagnostics indicate AGN-like ionization in at least 6 galaxies
- Outflow velocities exceed escape velocities in all cases
- Evidence suggestive of feedback:
 - AGN-driven outflows tend to carry a higher fraction of emission line flux than SF (5-50%) vs. (4-8%)
 - Outflows carrying a larger fraction of [OIII] flux tend to populate redder galaxies
 - Placement on color-mass diagram is suggestive of ongoing star formation suppression