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THE UNIVERSITY OF MELBOURNE

(stellar driven) Galactic winds in EAGLE simulations and SAMI observations

Edoardo Tescari

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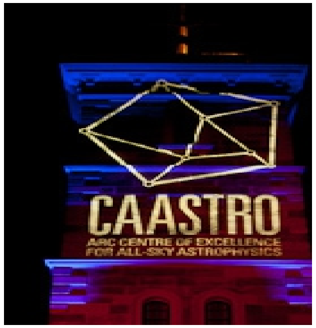
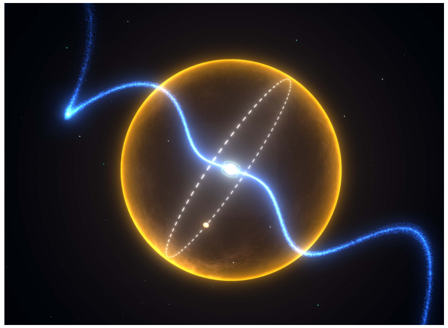


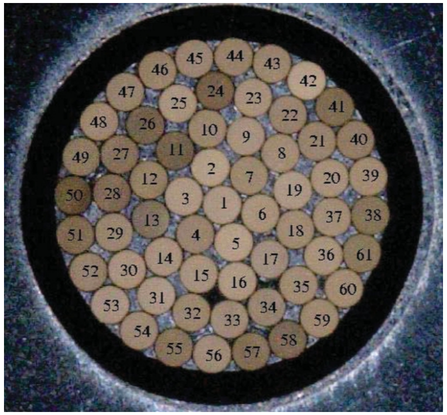




PEOPLE INVOLVED

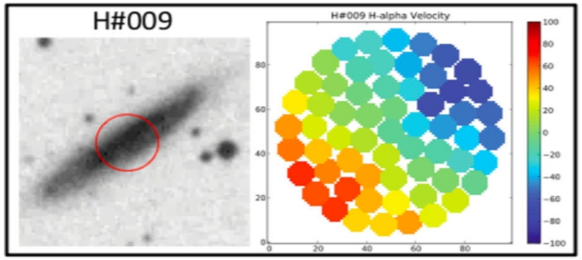
- **Luca Cortese (UWA)**
- **Chris Power (UWA)**
- **Stuart Wyithe (UoM)**
- **I-Ting Ho (ANU)**
- **Rob Crain (LJMU)**

+ SAMI & EAGLE teams

→ Tescari et al. (in prep)



The Sydney-AAO Multi-object Integral field spectrograph



Croom et al. (2012)

EAGLE SIMULATIONS

- **Fully hydrodynamical cosmological simulations** calibrated to reproduce (simultaneously) the stellar mass function at $z = 0.1$ and the observed size distribution of (disc) galaxies.

- We use the highest resolution run with box size **L = 25 cMpc** and **2×752^3** DM+gas **particles**.

- Mass resolution: **$M_{gas} = 2.26 \times 10^5\ M_{sun}$**.

- Spatial resolution: **0.35 pkpc** → **comparable to** the pixel size of **SAMI** (0.5 arcsec = 0.5 kpc at $z = 0.05$).

Schaye et al. (2015)

EAGLE STELLAR FEEDBACK

EAGLE simulations develop wind mass loading by heating relatively few ISM particles and allowing outflows to form via pressure gradients

↓

no extra parameters are needed to specify direction, velocity or mass loading factor of wind particles

Crain et al. (2015)

EAGLE STELLAR FEEDBACK

EAGLE simulations develop wind mass loading by heating relatively few ISM particles and allowing outflows to form via pressure gradients

no extra parameters are needed to specify direction, velocity or mass loading factor of wind particles

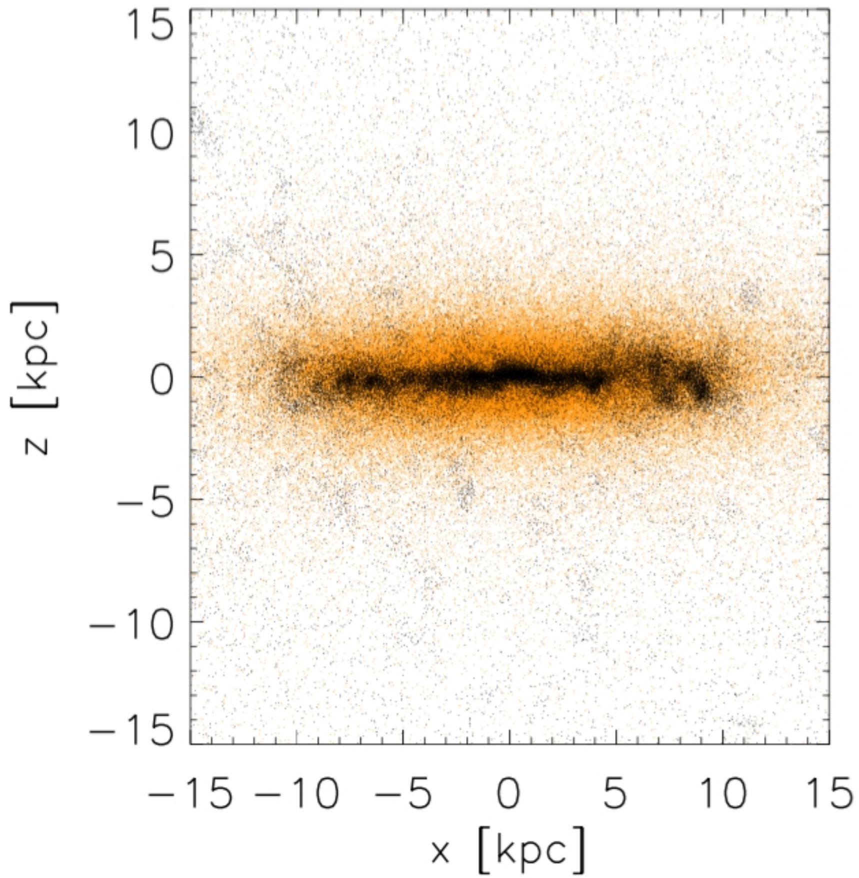
(still a subresolution model)

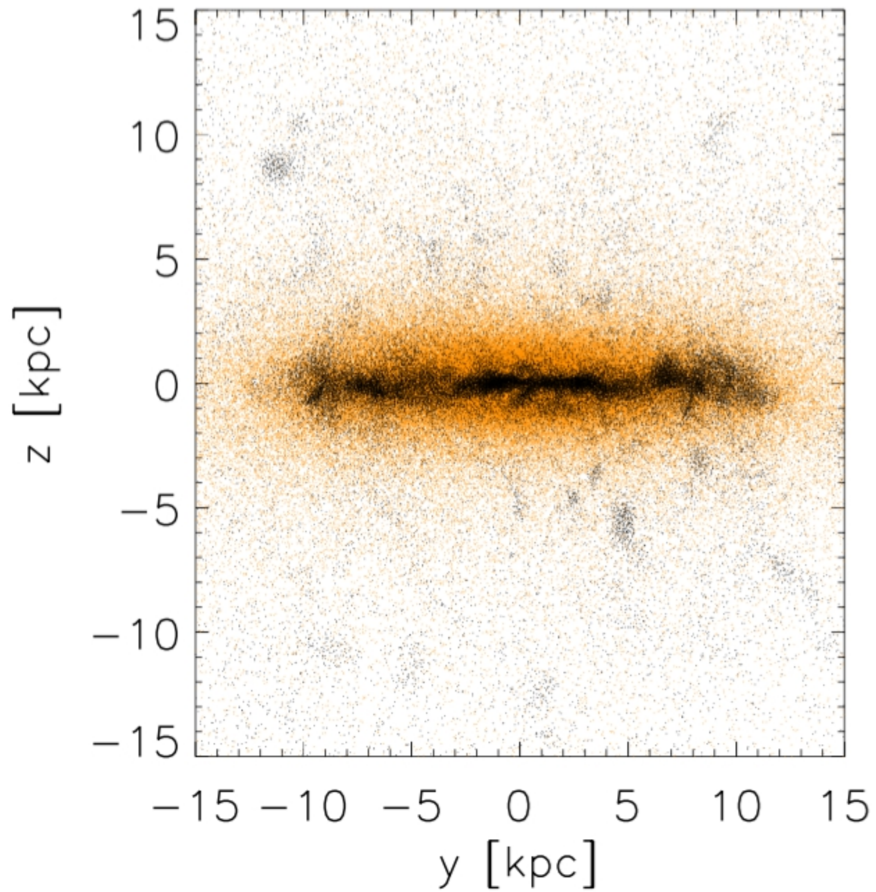
see C Lagos' & R Crain's talks tomorrow and Friday...

GALACTIC CUBES

43 unperturbed disc galaxies with:

9.0 < log (M^*/M_{Sun}) < 10.8 and 0.07 M_{Sun}/yr < SFR < 6.8 M_{Sun}/yr





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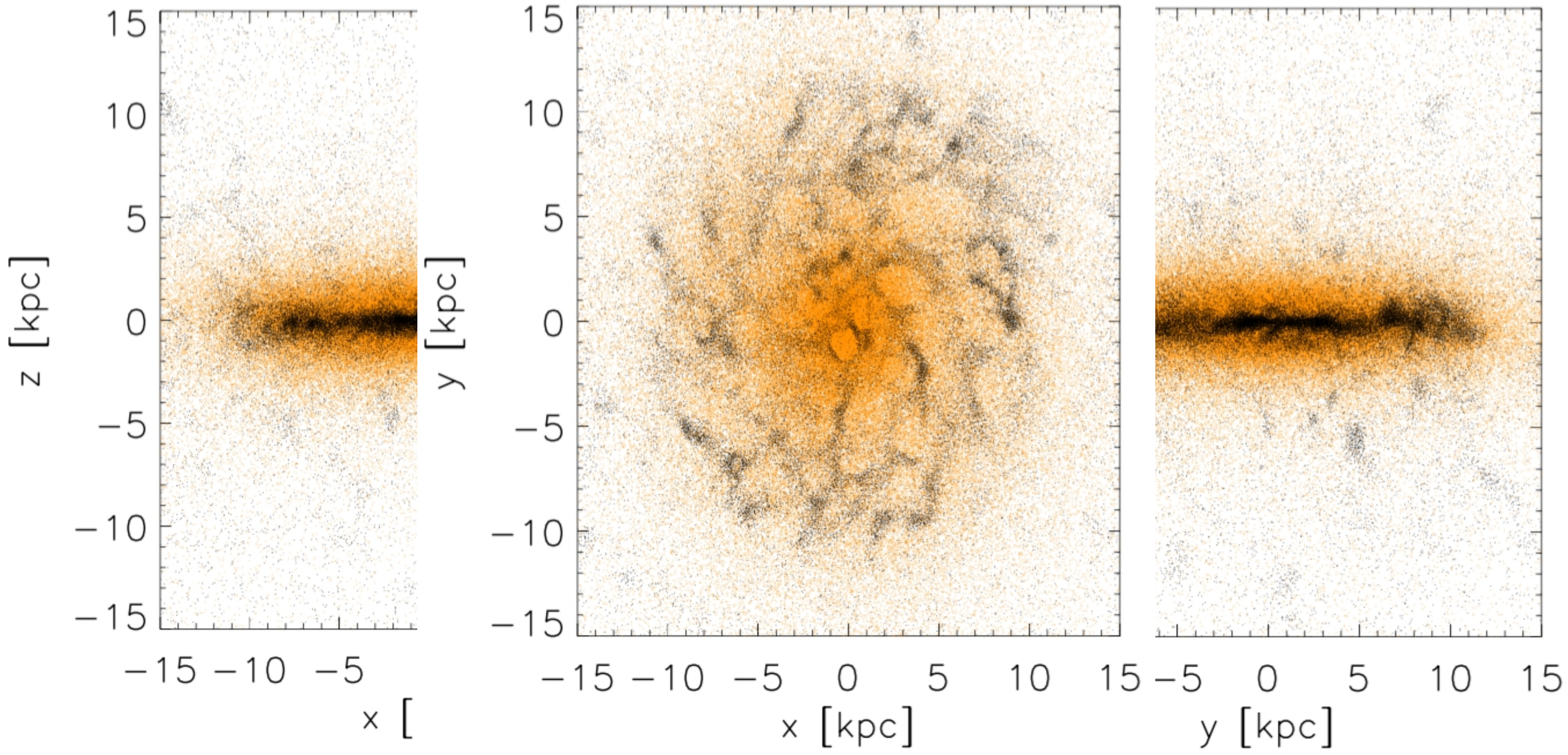
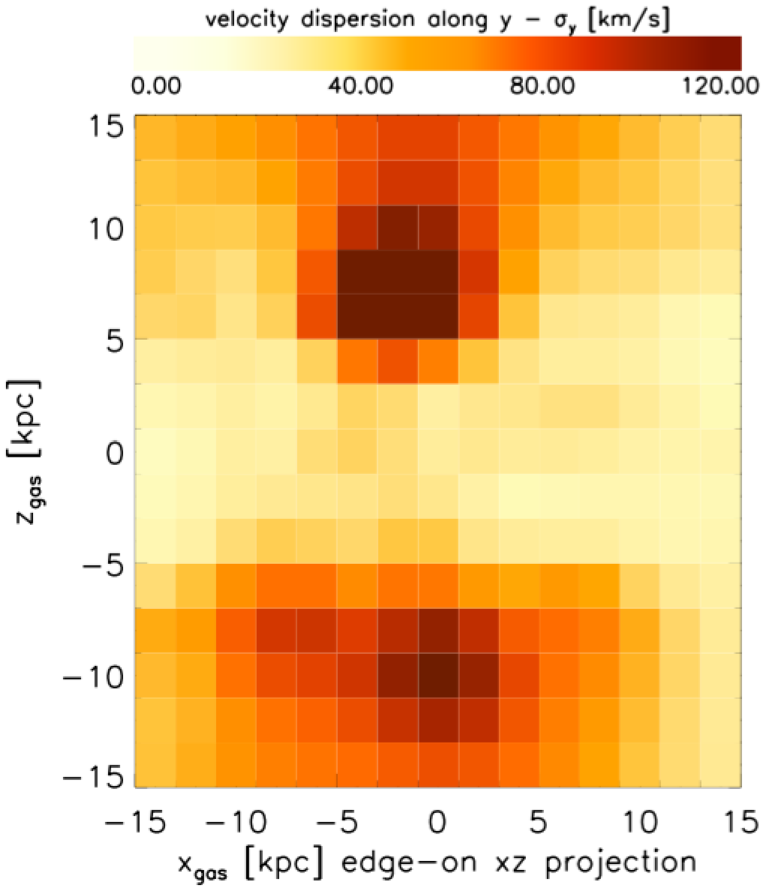
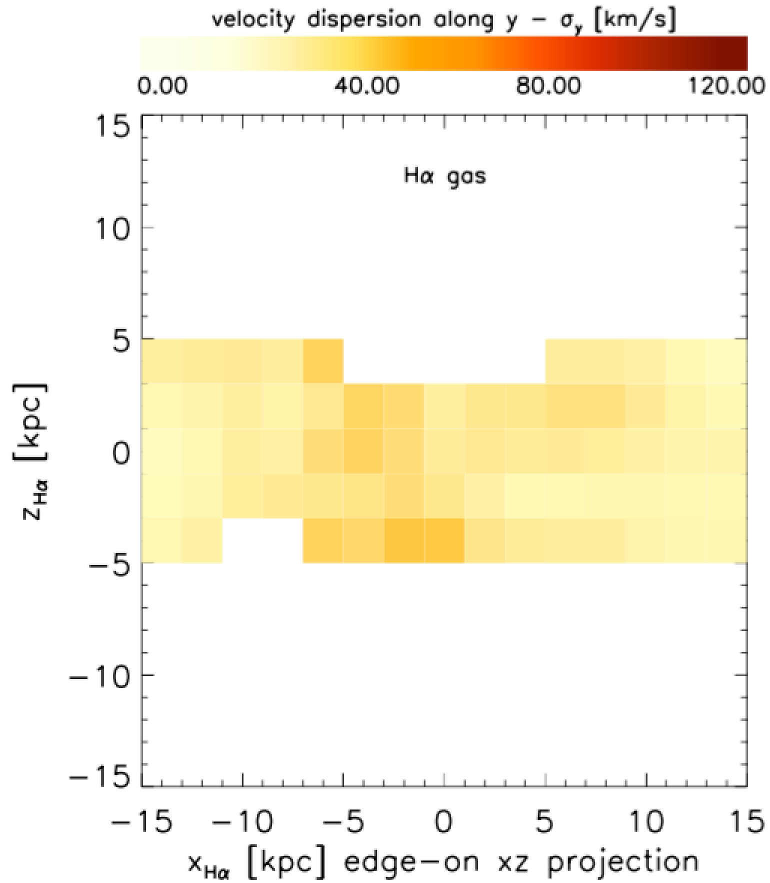


VELOCITY DISPERSION MAPS

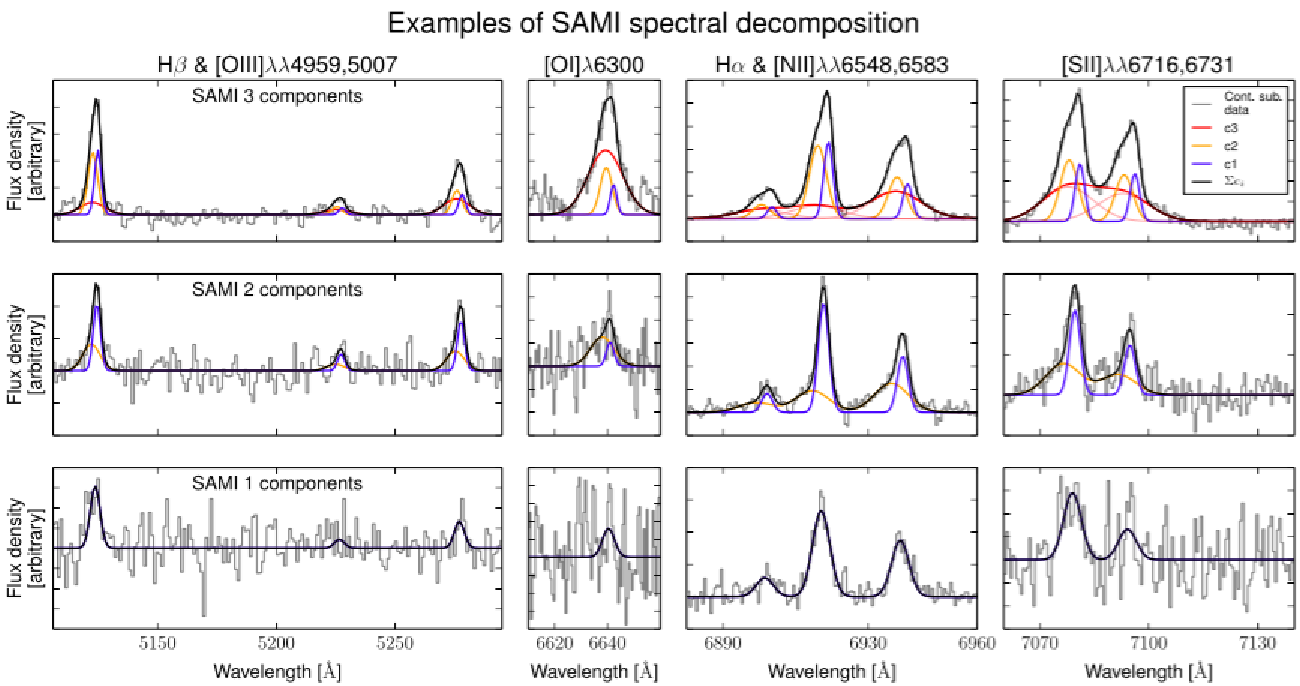


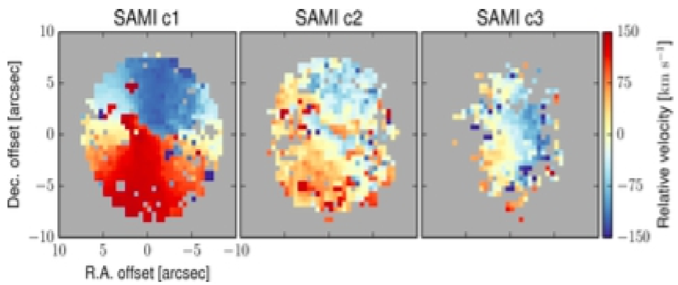
all gas



Hα gas: pixels with $3.8 < \log (T/K) < 4.2$

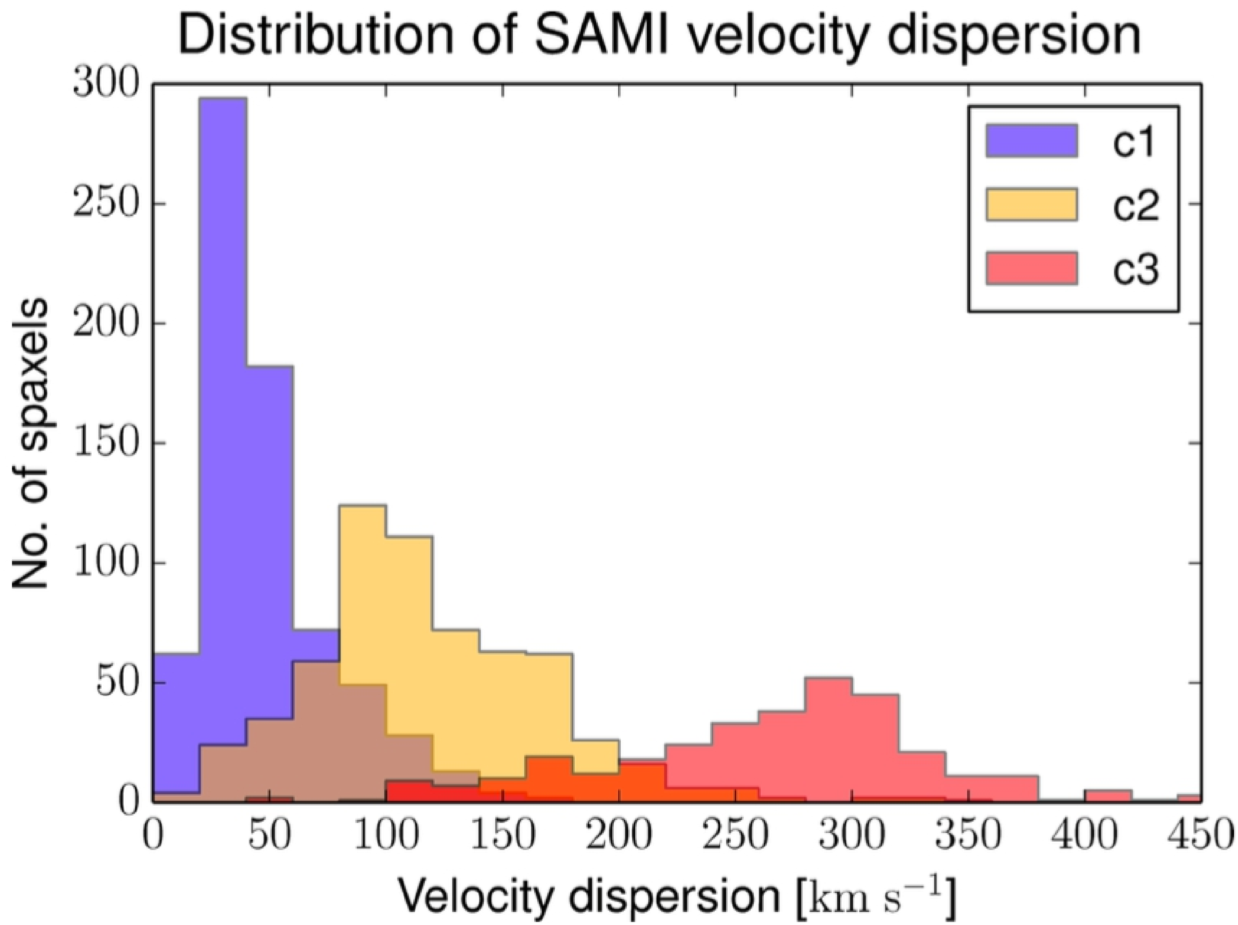
OBS: Ho et al. (2014)





SDSS J090005.05+000446.7: prototypical isolated disc galaxy with outflows at $z = 0.054$

OBS: Ho et al. (2014)



SDSS J090005.05+000446.7: prototypical isolated disc galaxy with outflows at *z = 0.054*

NB: for observations, *velocity dispersion = line broadening*

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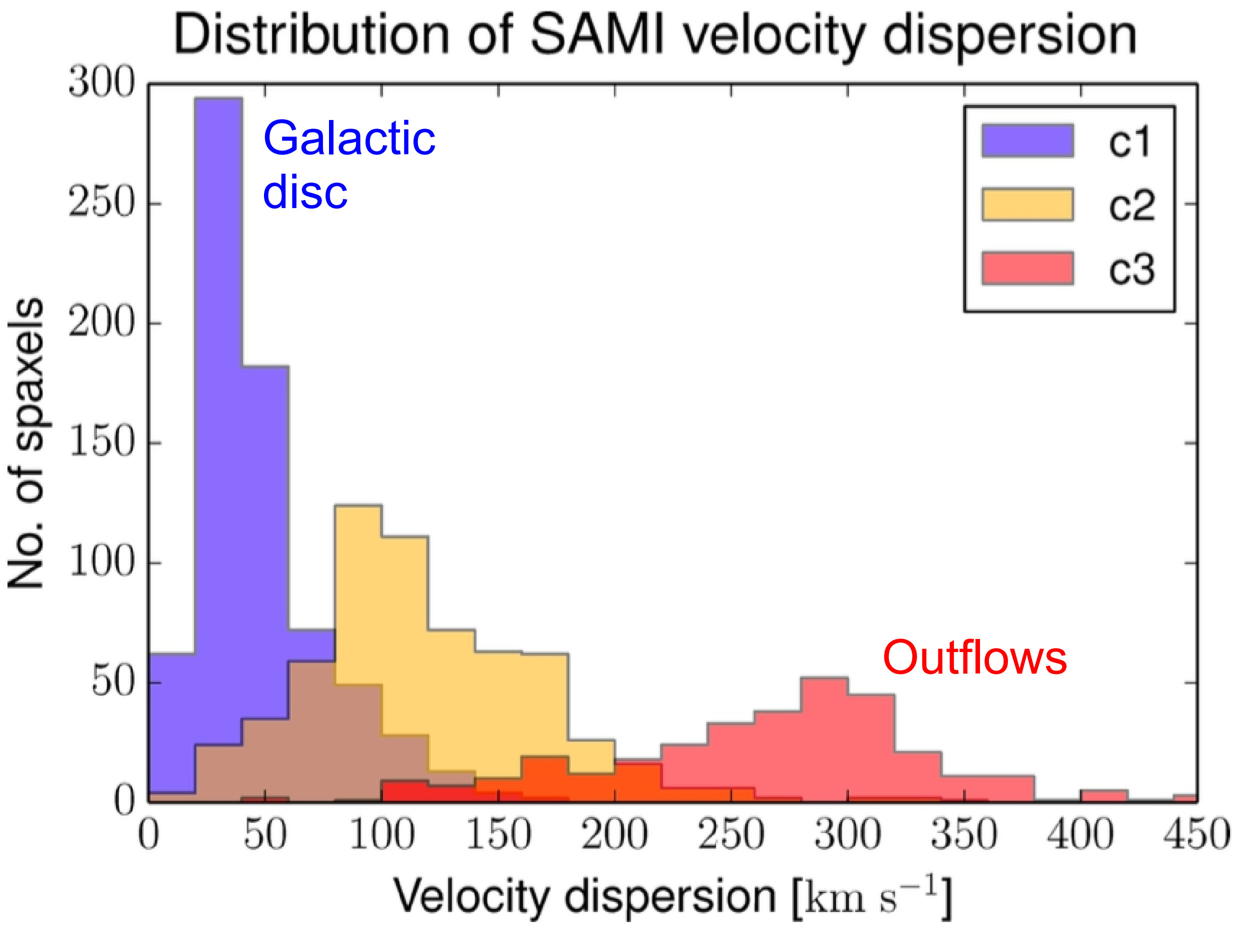

SDSS J090005.05+000446.7: prototypical isolated disc galaxy with outflows at *z = 0.054*

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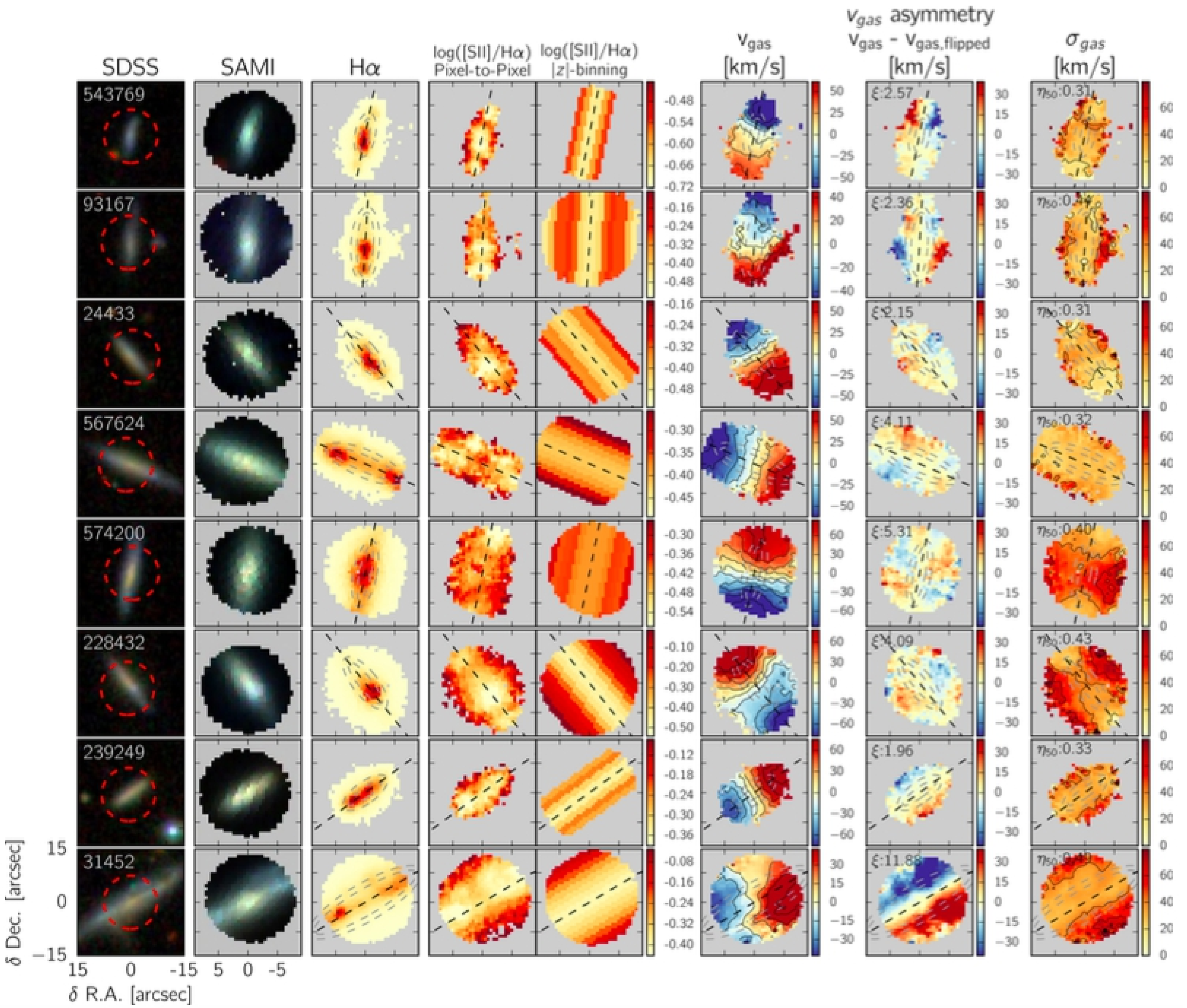
OBS: Ho+...+Tescari+(2016)

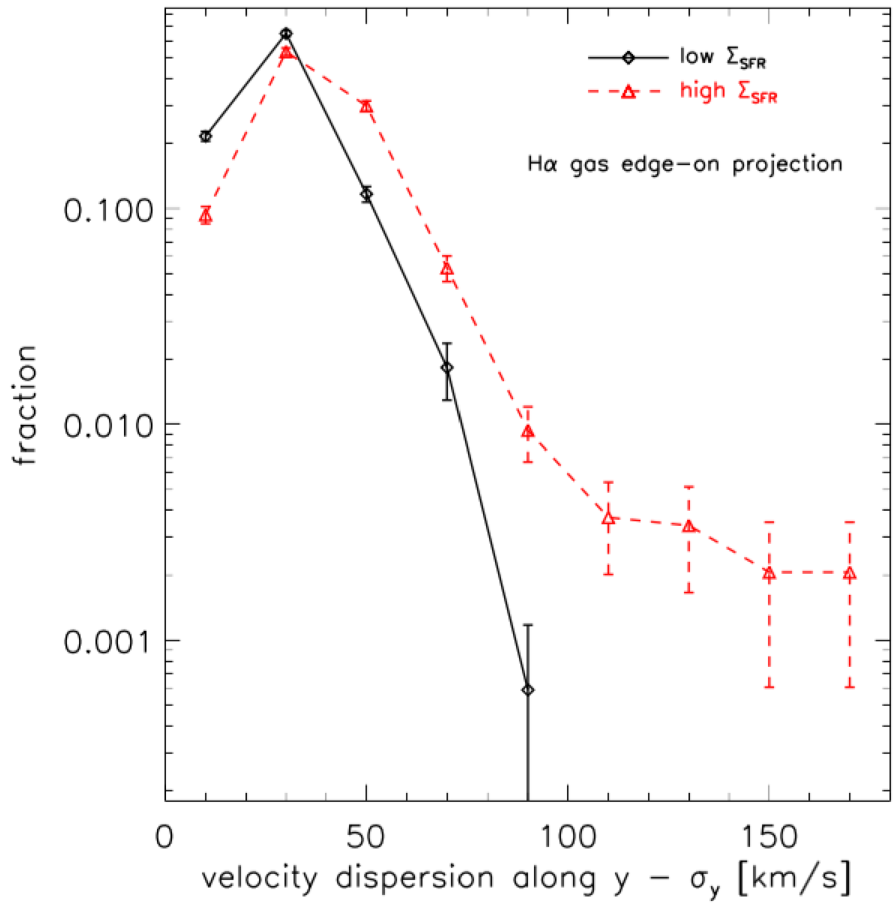
40 local edge-on galaxies



SIMS: SFR SURFACE DENSITY

Ho et al. (2016): on average, wind galaxies have higher Σ_{SFR}

Hα gas



red: high SFR surface density

black: low Σ_{SFR}

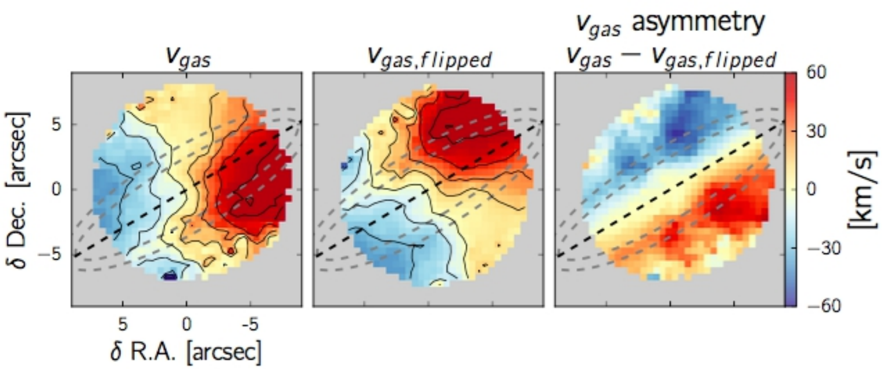
log $\Sigma_{SFR,m}$ = -2.77 [M_{Sun} yr^{-1} kpc^{-2}]

$$\Sigma_{\rm SFR} = {\rm SFR}/(2\pi r_{50}^2)$$

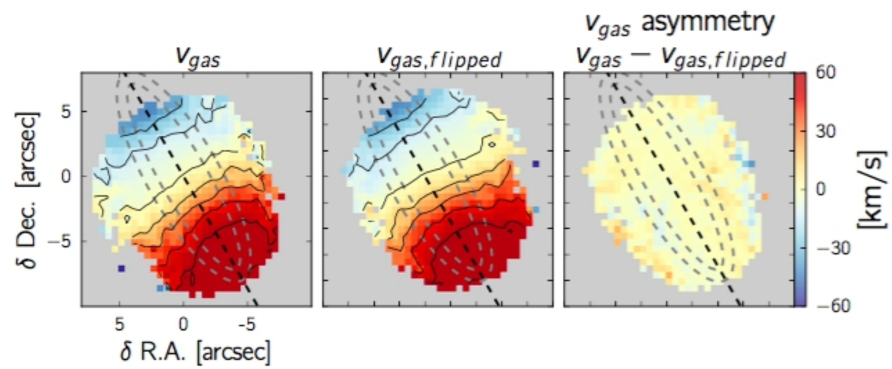
OBS: Ho+...+Tescari+(2016)

ASYMMETRY
of the extraplanar gas

winds



no winds



$$\eta_{50} = \sigma_{50}/v_{rot},$$

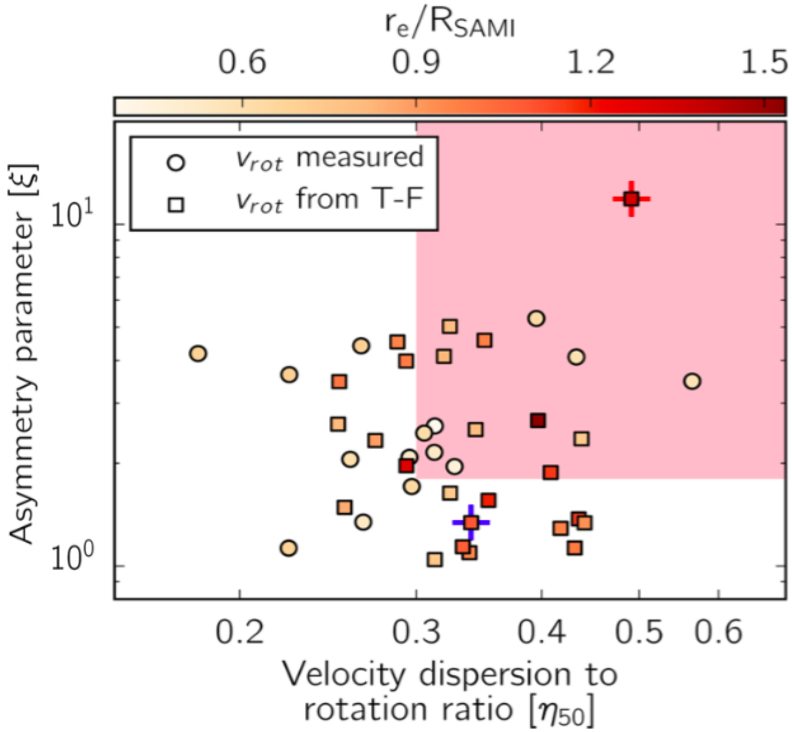
where σ_{50} is the median velocity dispersion of all spaxels outside $1\tilde{r}_e$ with S/N(Hα) > 5.

$$\xi = \frac{\tilde{\xi}_+ + \tilde{\xi}_-}{2},$$

where

$$\tilde{\xi}_{+/-} = \underset{r_{+/-} > \tilde{r}_e}{\mathrm{std}} \left(\frac{v_{gas} - v_{gas,flipped}}{\sqrt{Err(v_{gas})^2 + Err(v_{gas,flipped})^2}} \right).$$

OBS: Ho+...+Tescari+(2016)



15/40 wind dominated galaxies

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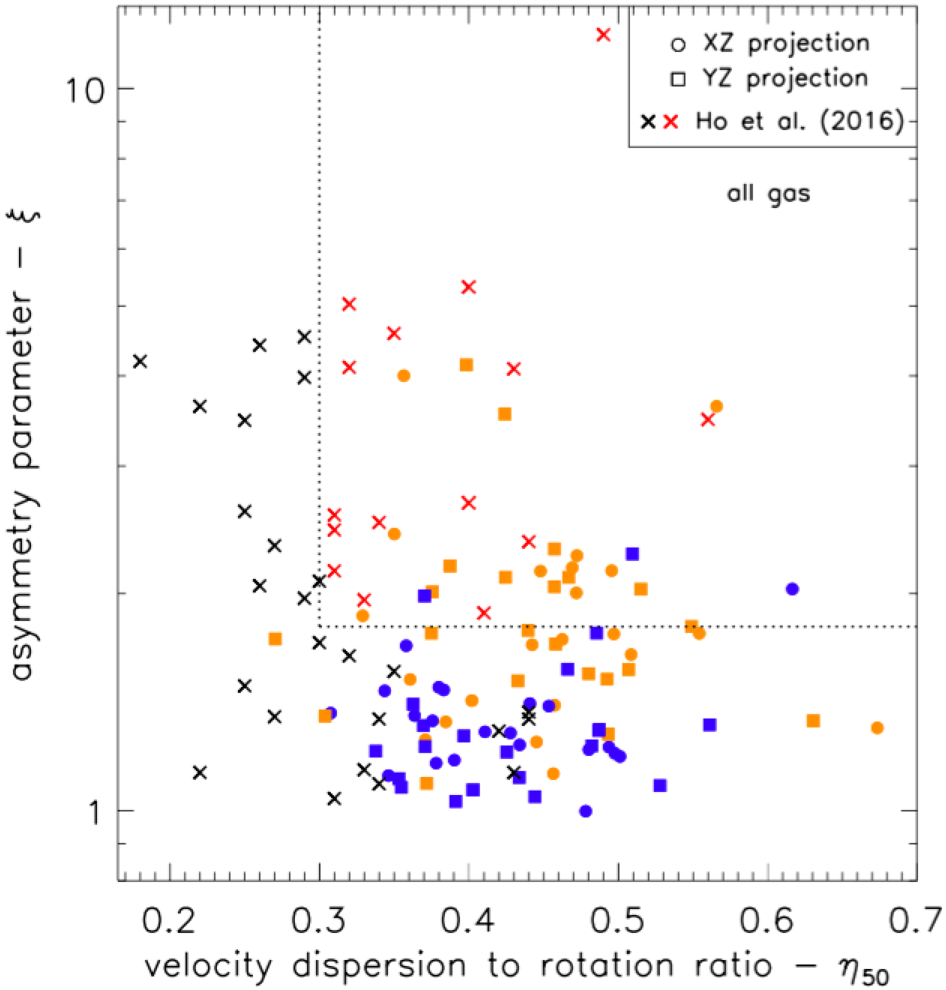
ASYMMETRY IN EAGLE



orange: high SFR surface density

blue: low Σ_{SFR}

log $\Sigma_{SFR,m}$ = -2.77 [M_{Sun} yr^{-1} kpc^{-2}]

all gas

CONCLUSIONS

- We confirm that galaxies with higher Σ_{SFR} have more extended velocity dispersion distributions = signature of outflows.

- The asymmetry parameter correlates with wind activity and Σ_{SFR}.

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- We confirm that galaxies with higher Σ_{SFR} have more extended velocity dispersion distributions = signature of outflows.

- The asymmetry parameter correlates with wind activity and Σ_{SFR}.

- Simulations help the interpretation of IFS data...

- ...and observations help improve simulations (in EAGLE not enough cold gas entrained in hot winds).

- Much more in Tescari et al. (in prep)...