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THE UNIVERSITY OF MELBOURNE

Incidence of galactic outflows: EAGLE vs SAMI

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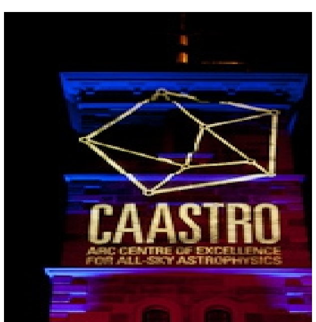
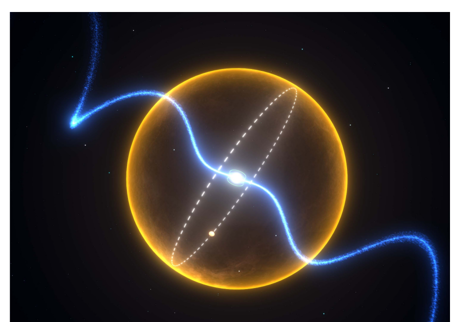


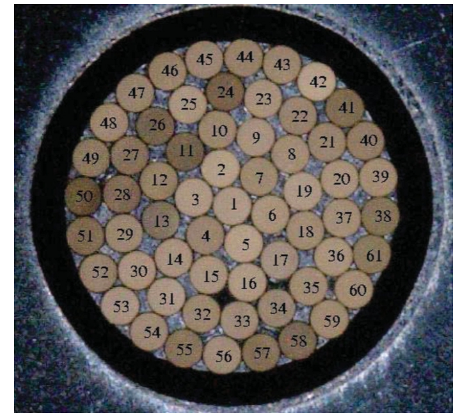


PEOPLE INVOLVED

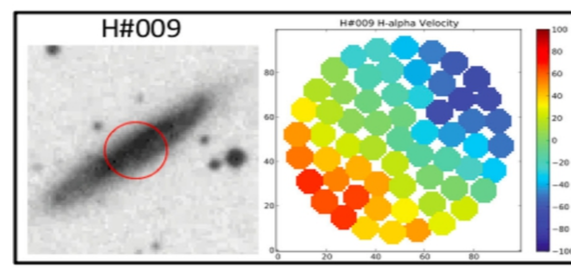
- **Luca Cortese (UWA)**
- **Chris Power (UWA)**
- **Stuart Wyithe (UoM)**
- **I-Ting Ho (ANU)**
- **Rob Crain (LJMU)**

+ 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 (reference) run with box size **L = 25 cMpc** and **2 x 752^3** DM+gas **particles**.

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

- 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)

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EAGLE STELLAR FEEDBACK

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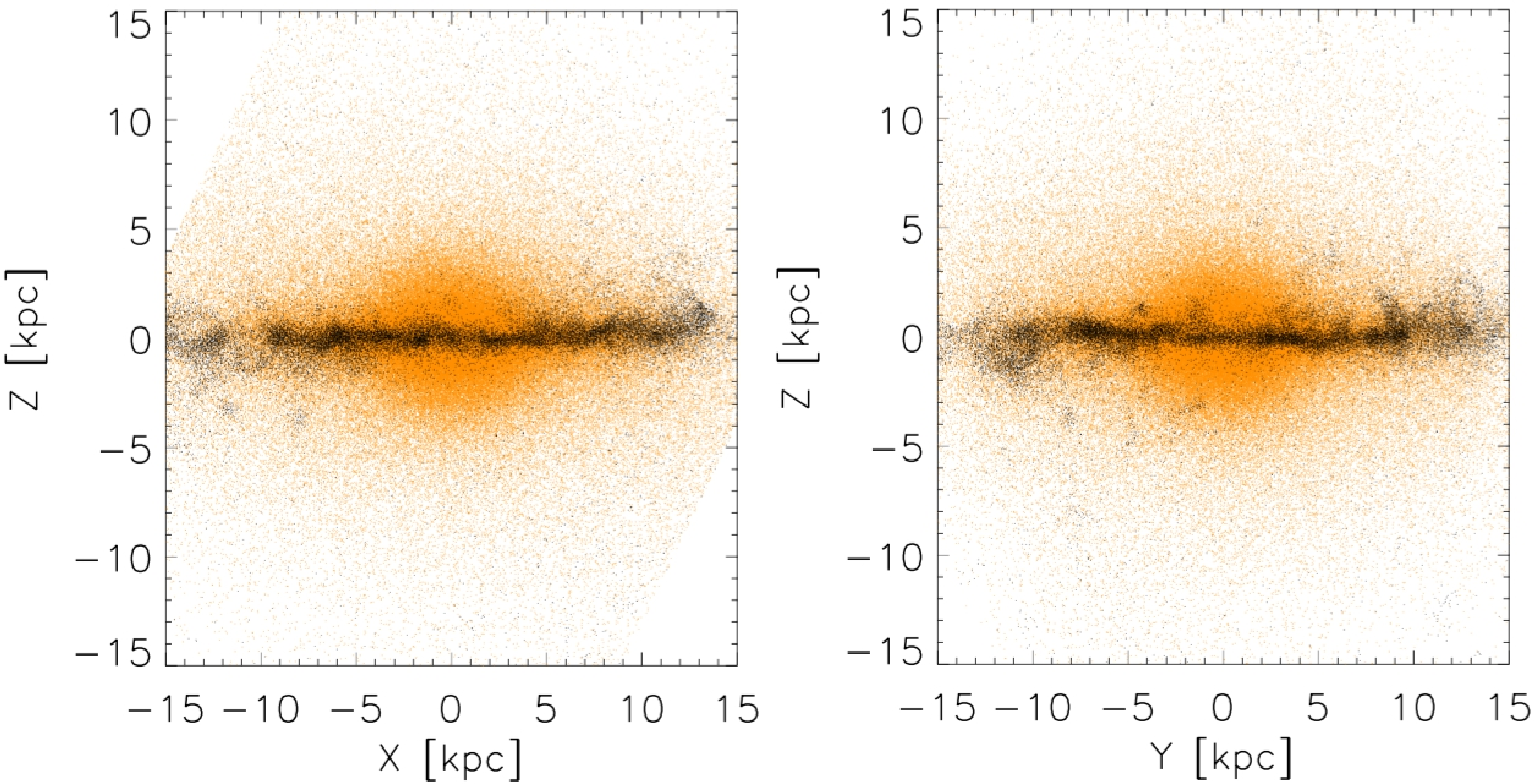
no extra parameters are needed to specify direction, velocity or mass loading factor of wind particles

(still a subresolution model)

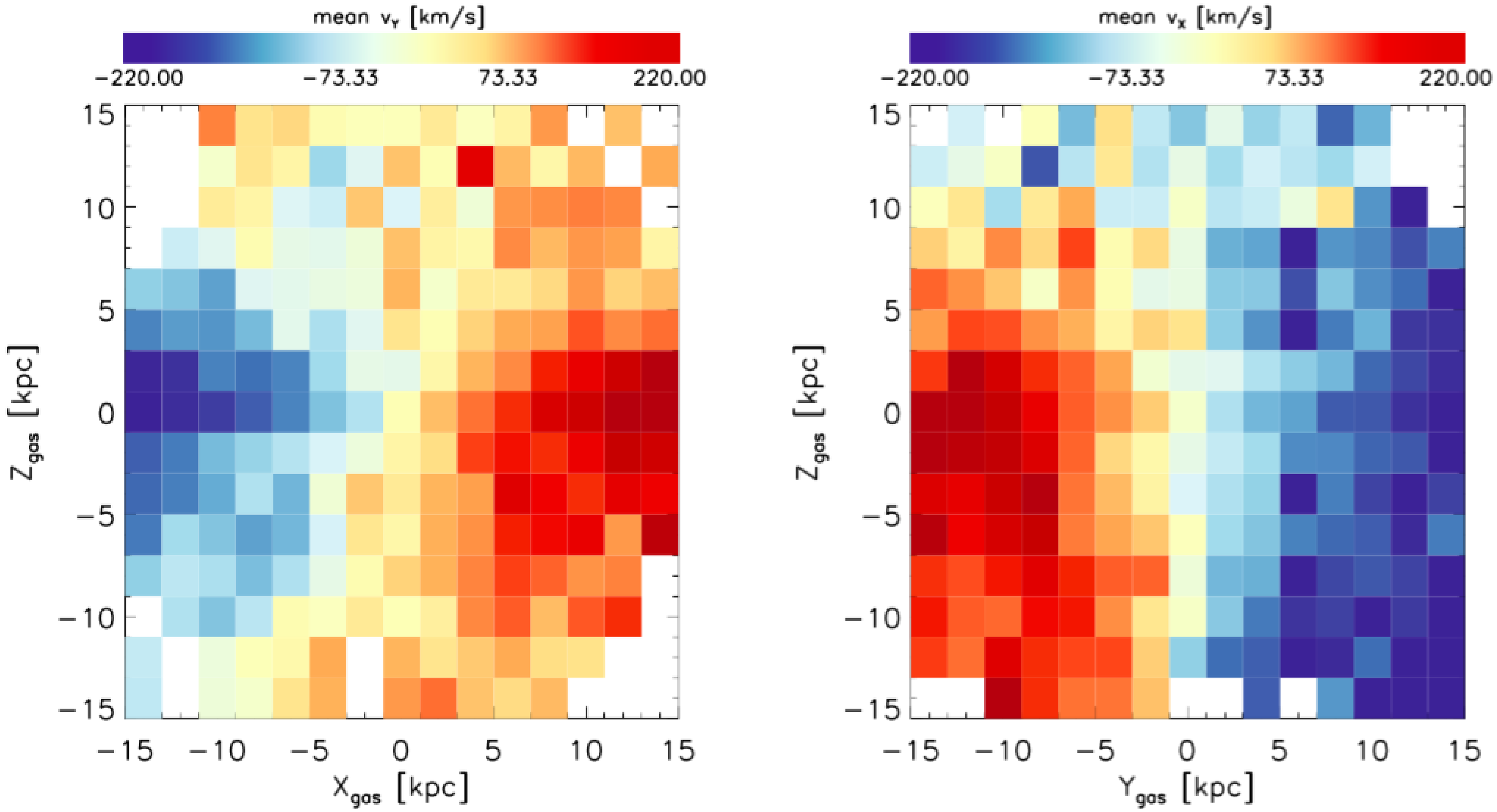
Crain et al. (2015)

GALACTIC CUBES

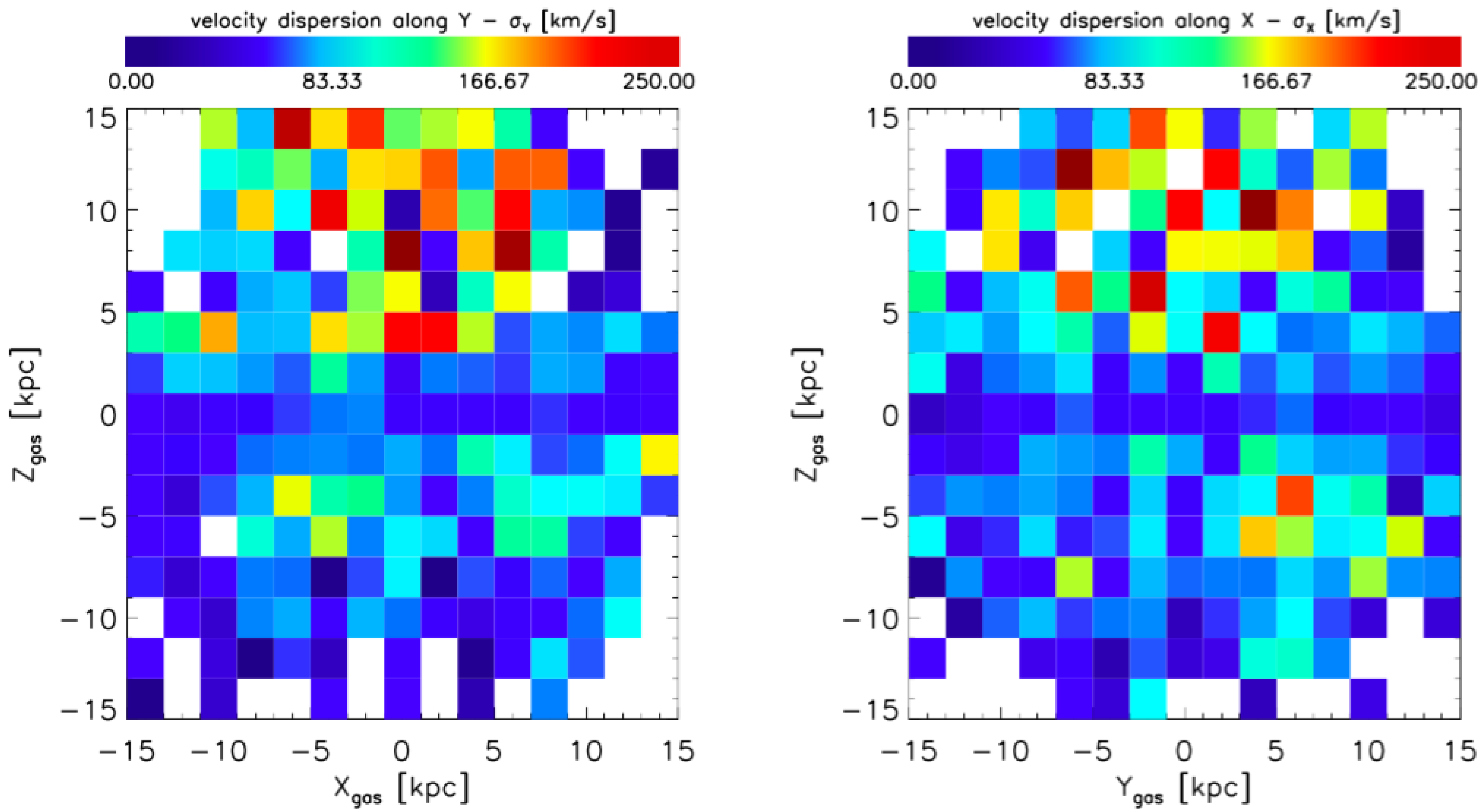
48 unperturbed disc galaxies with $M^* > 10^{10}$ M_{Sun} and SFR < 15.27 M_{Sun}/yr



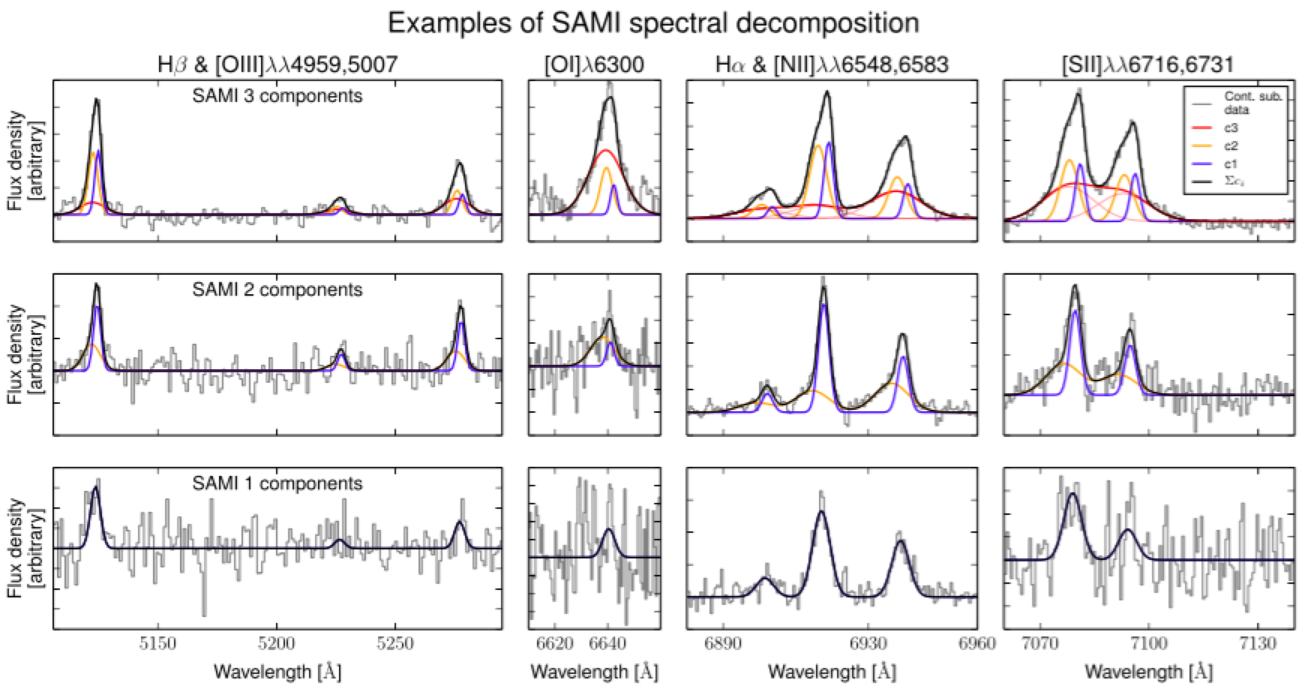
ROTATIONAL VELOCITY MAPS

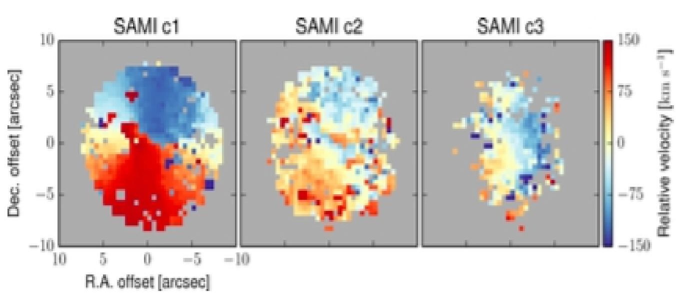


VELOCITY DISPERSION MAPS



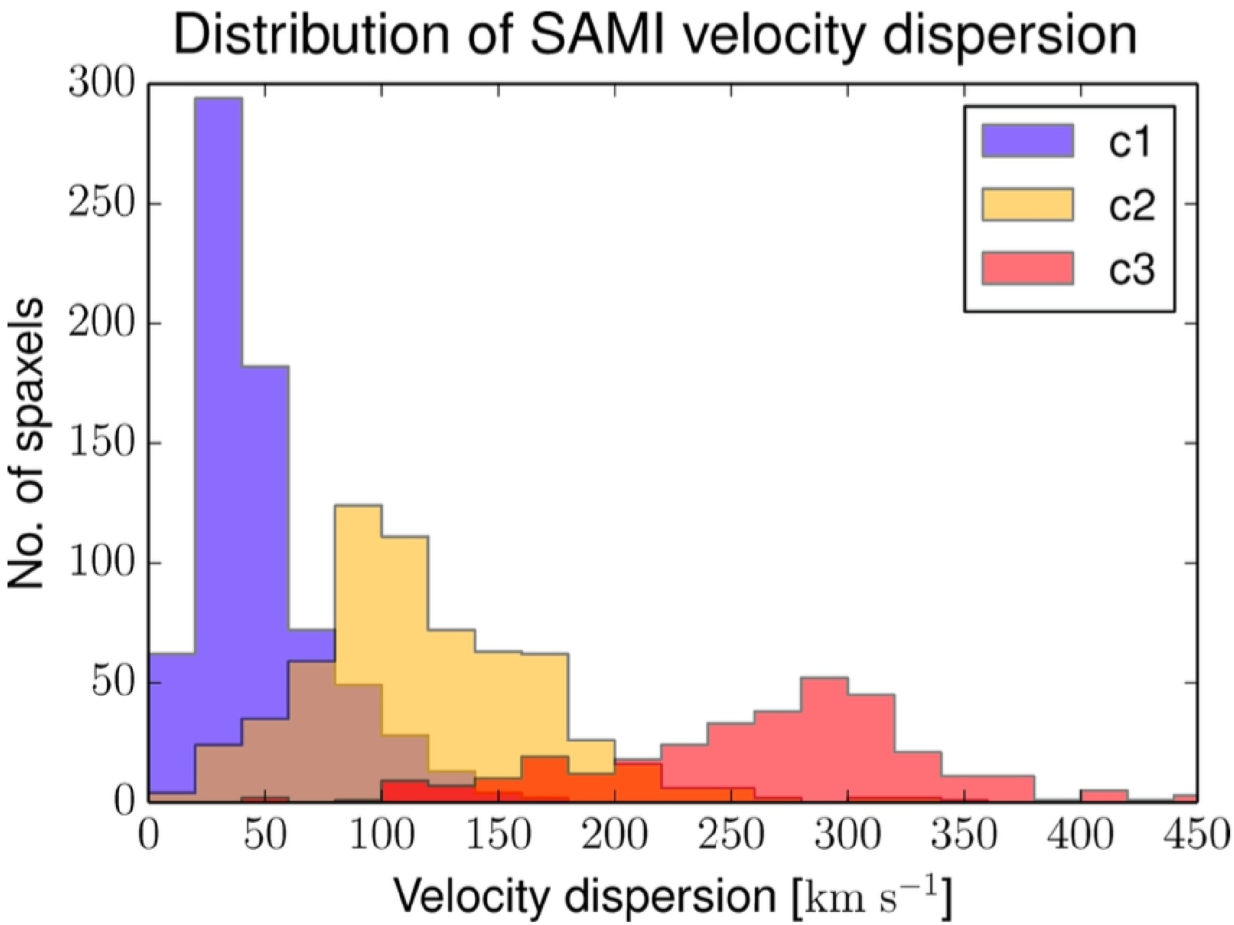
OBS: Ho et al. (2014)





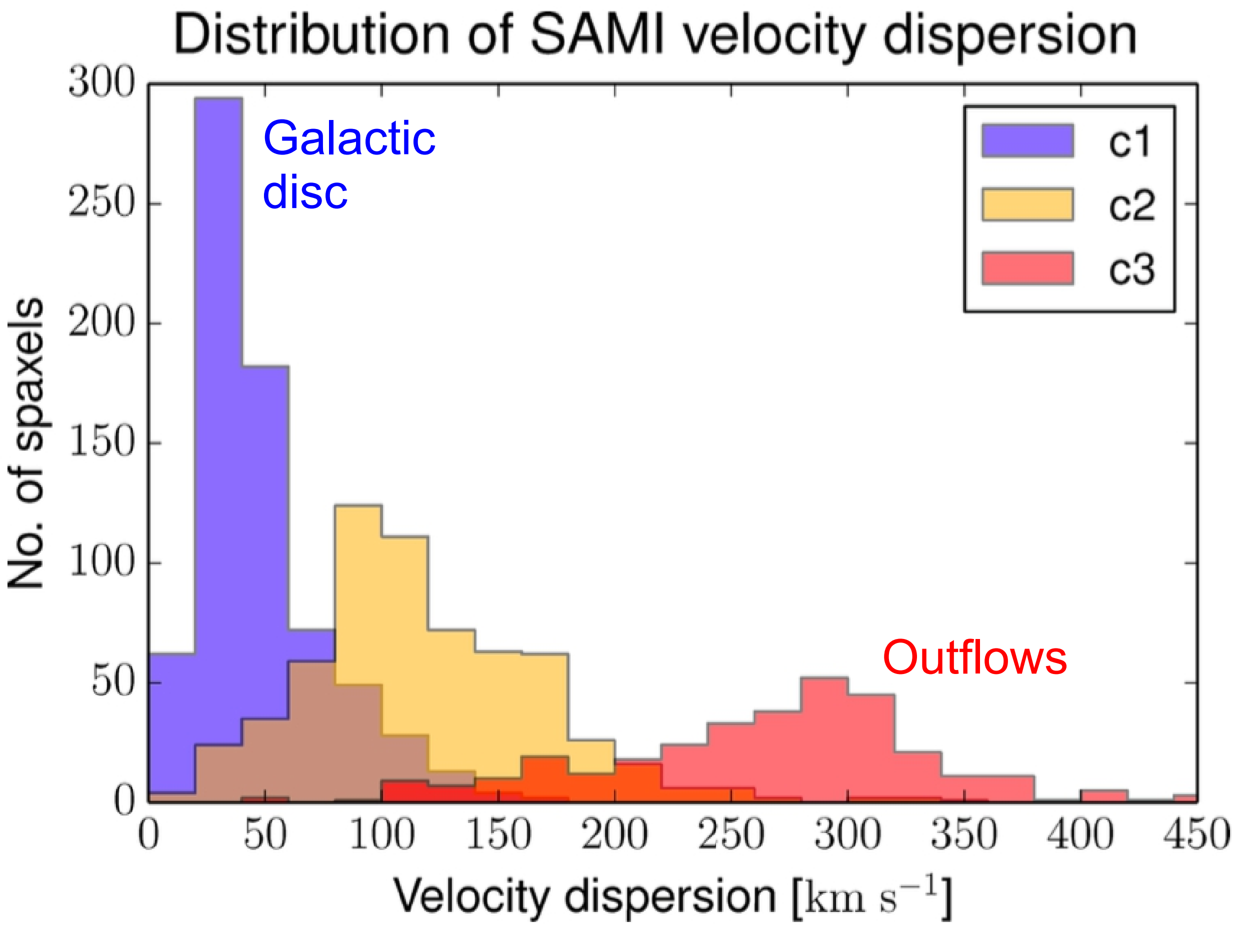
SDSS J090005.05+000446.7: prototypical isolated disc galaxy with outflows at $z = 0.054$

OBS: Ho et al. (2014)



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

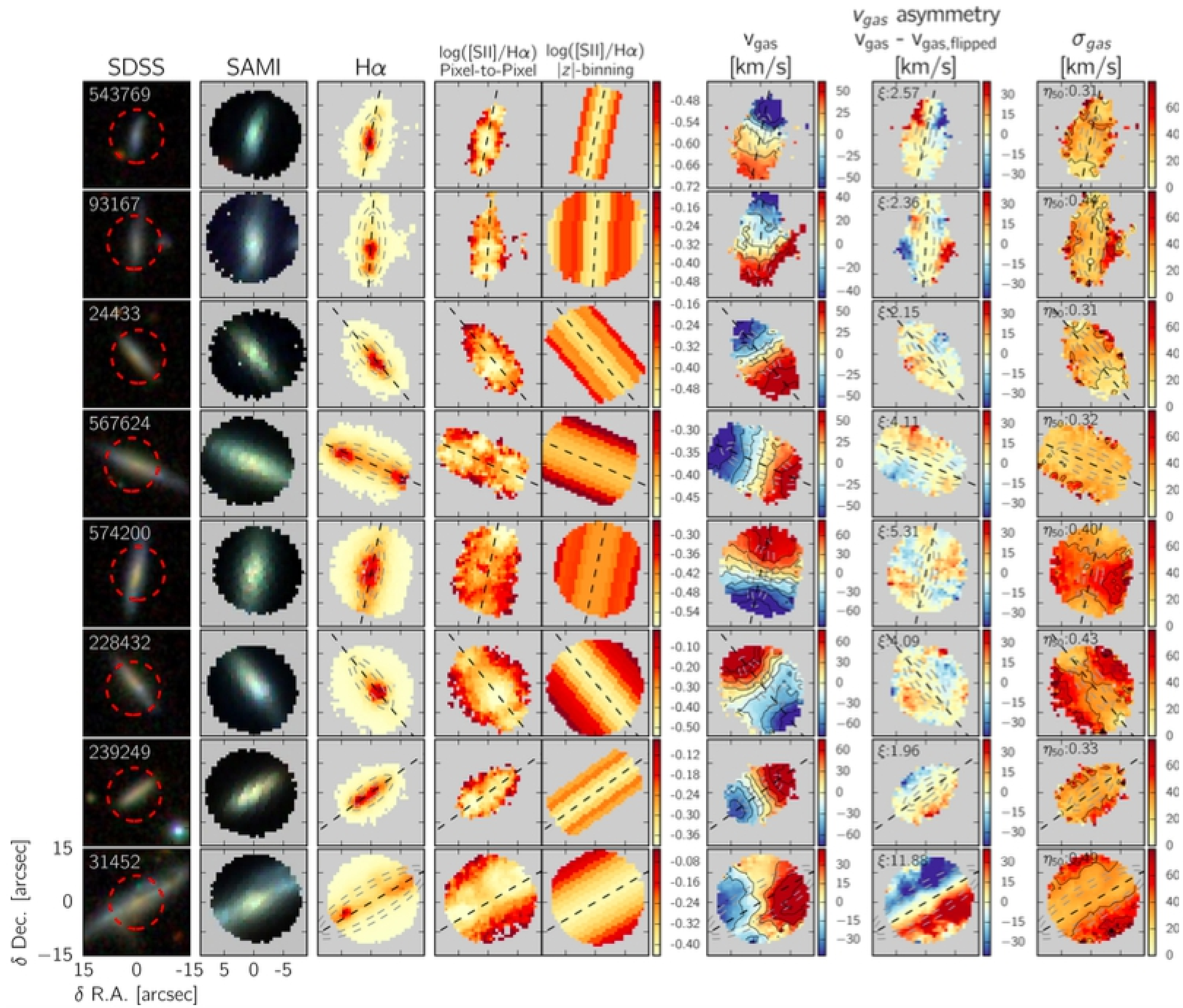
OBS: Ho et al. (2014)



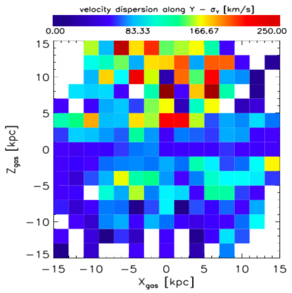
SDSS J090005.05+000446.7: prototypical isolated disc galaxy with outflows at *z = 0.054*

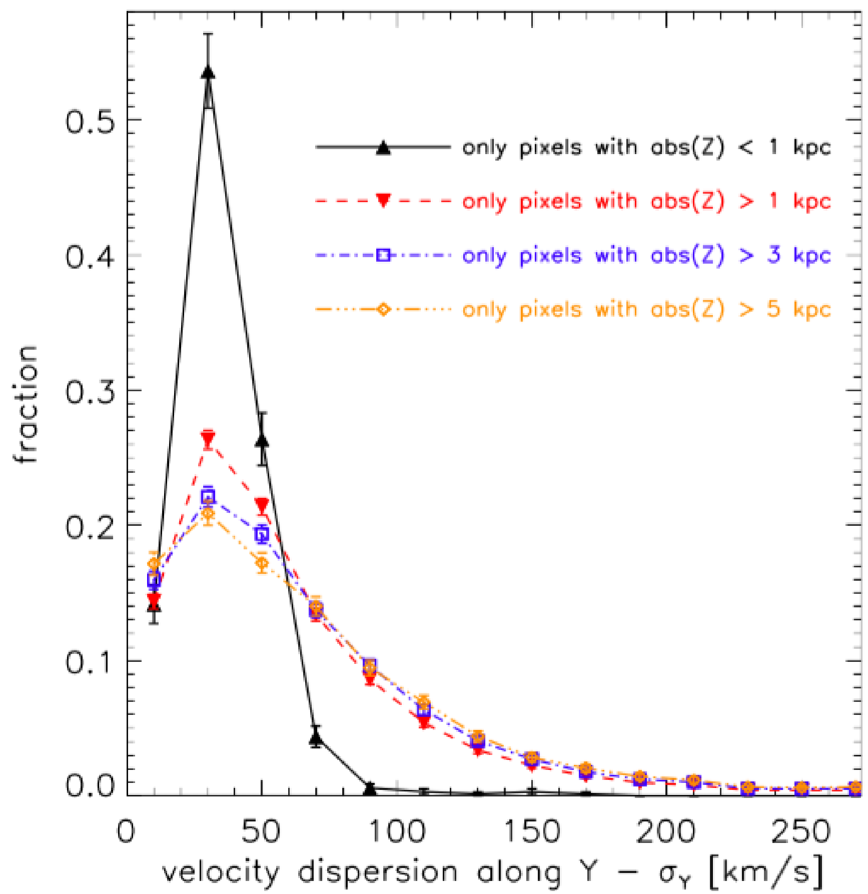
OBS: Ho+...+Tescari+(2016)

40 local edge-on galaxies



DISC COMPONENT & OUTFLOWS





DISC COMPONENT & OUTFLOWS

low-σ ↔ galactic disc

high-σ ↔ outflows

WEAK DEPENDENCE ON GALACTIC PROPERTIES

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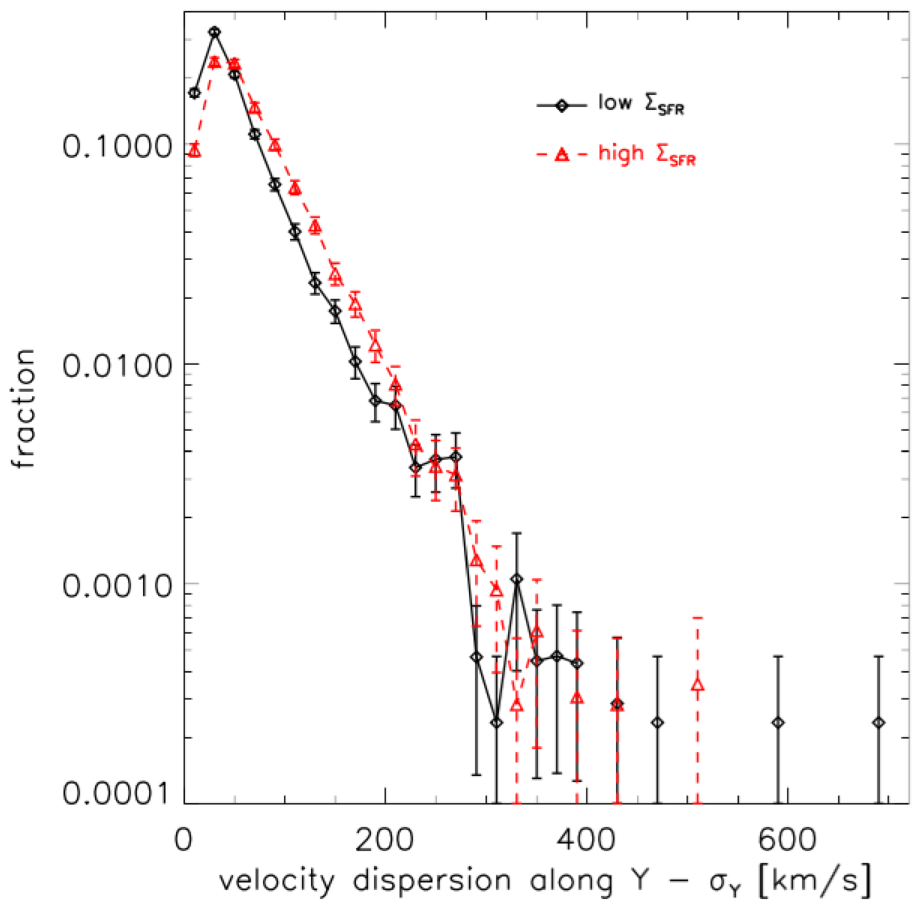
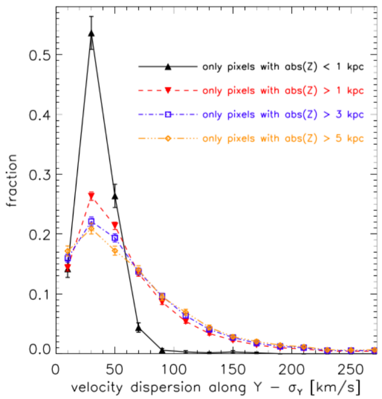
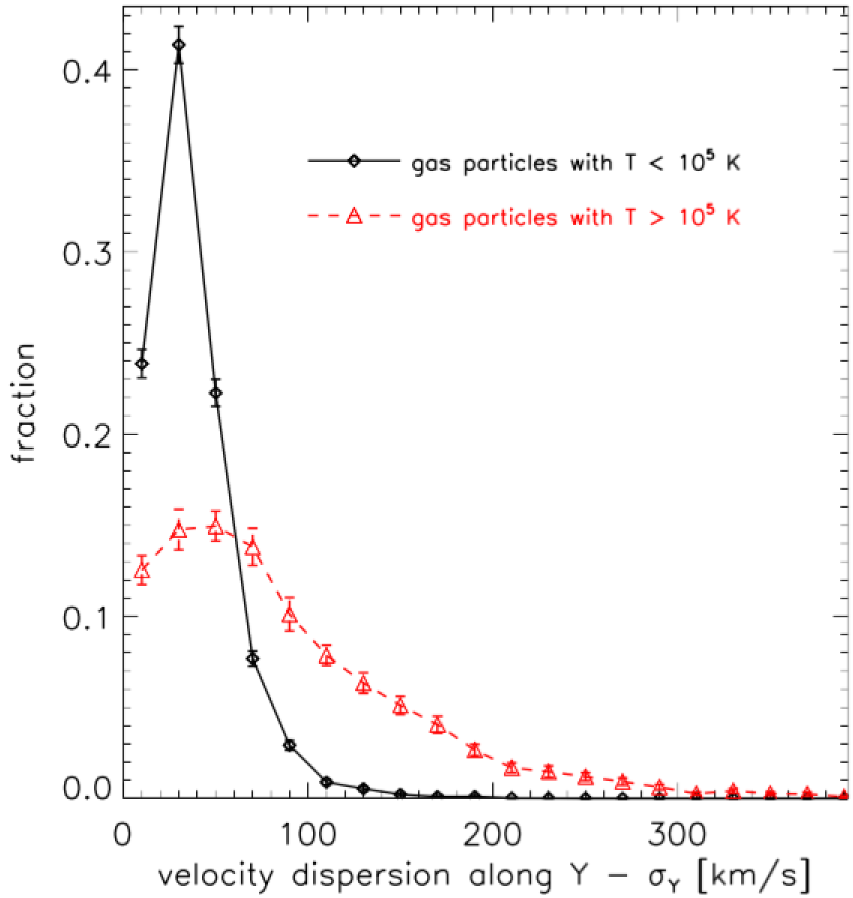
Ho et al. (2016): on average, wind galaxies have higher Σ_{SFR}



σ-distribution weakly dependent on M* and sSFR

IMPACT OF TEMPERATURE



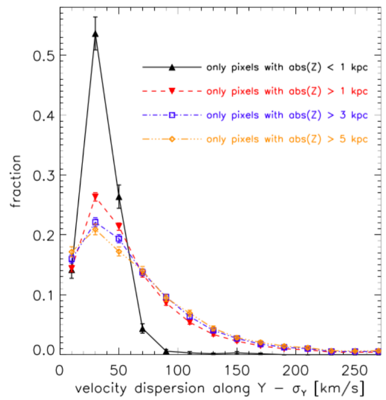


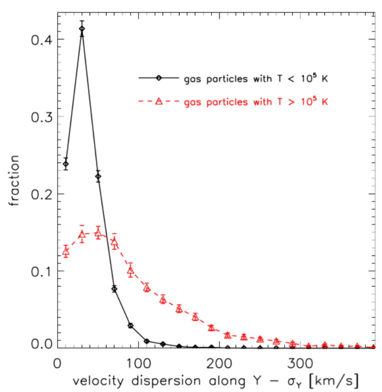
IMPACT OF TEMPERATURE

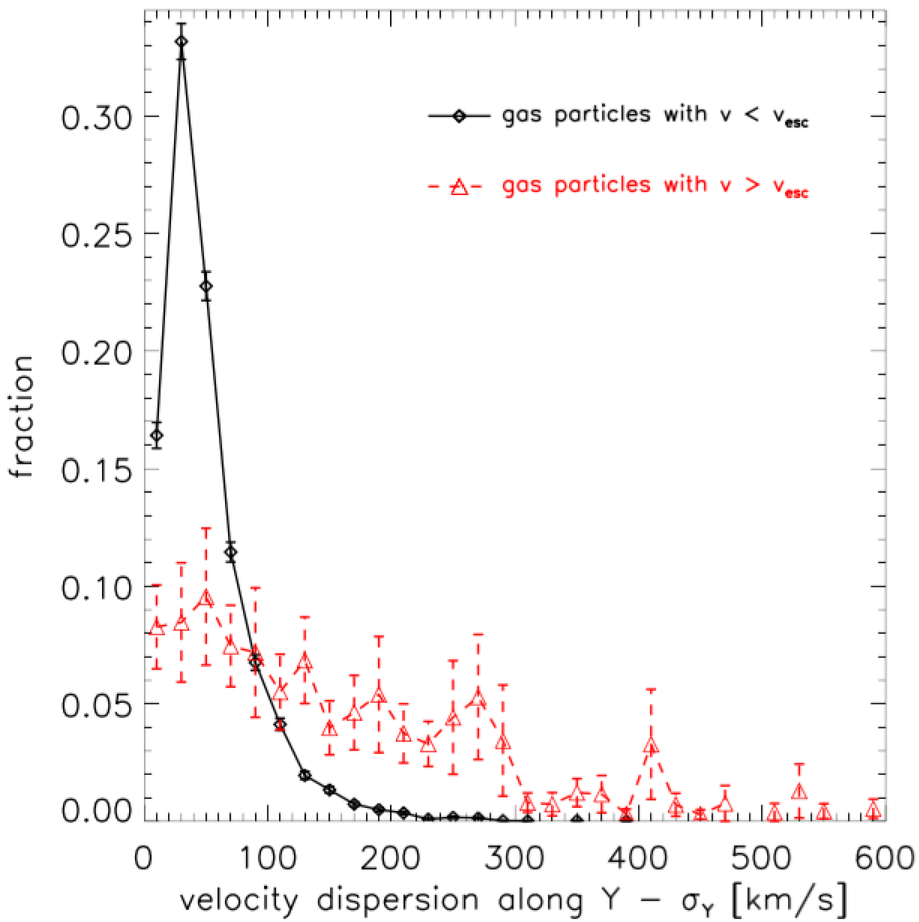
low-σ ↔ galactic disc ↔ gas with $T < 10^5$ K

high-σ ↔ outflows ↔ gas with $T > 10^5$ K

GALACTIC WINDS





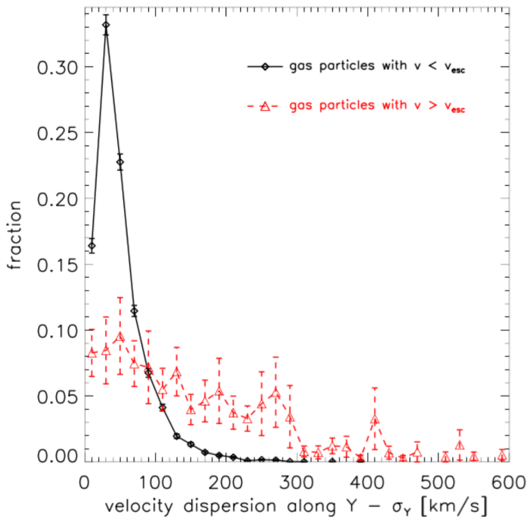


GALACTIC WINDS

low-σ ↔ galactic disc ↔ gas with $T < 10^5$ K

high-σ ↔ galactic winds ↔ gas with $T > 10^5$ K

GALACTIC WINDS



- Min fraction of particles with $v > v_{\rm esc}$: 0.12 %;
- Max fraction of particles with $v > v_{\rm esc}$: 16.91 %;
- Mean fraction of particles with $v > v_{\rm esc}$: 1.37 %.

This translates into:

- Min ejected mass: $\Delta \rm M_{w,min} = 1.36 \times 10^6\ M_\odot$;
- Max ejected mass: $\Delta \rm M_{w,max} = 1.44 \times 10^8\ M_\odot$;
- Mean ejected mass: $\langle \Delta \rm M_w \rangle = 1.48 \times 10^7\ M_\odot$.

- $l_{\rm f,min} = 7.77 \times 10^{-4}$;
- $l_{\rm f,max} = 1.54$;
- $\langle l_{\rm f} \rangle = 6.76 \times 10^{-2}$.

where $l_{\rm f}$ is the (adimensional) wind mass loading factor.

$$\dot{\rm M}_{\rm w} = \frac{\Delta \rm M_w}{t_{\rm w}} = l_{\rm f} \times \rm SFR$$

CONCLUSIONS

- Galactic winds appear ubiquitous in EAGLE galaxies...

- ...but it is hard to correlate outflowing activity and galaxy properties when EAGLE sims are treated like SAMI obs.

- Simulations can help the interpretation of IFS data.

- Additional quantitative analyses in Tescari et al. (2016)...