An ESO/RadioNet Workshop
ESO Garching, 10–14 March 2014

3D2014

Gas and stars in galaxies: A multi-wavelength 3D perspective

Highlight talk session 4
Tuesday 12:15

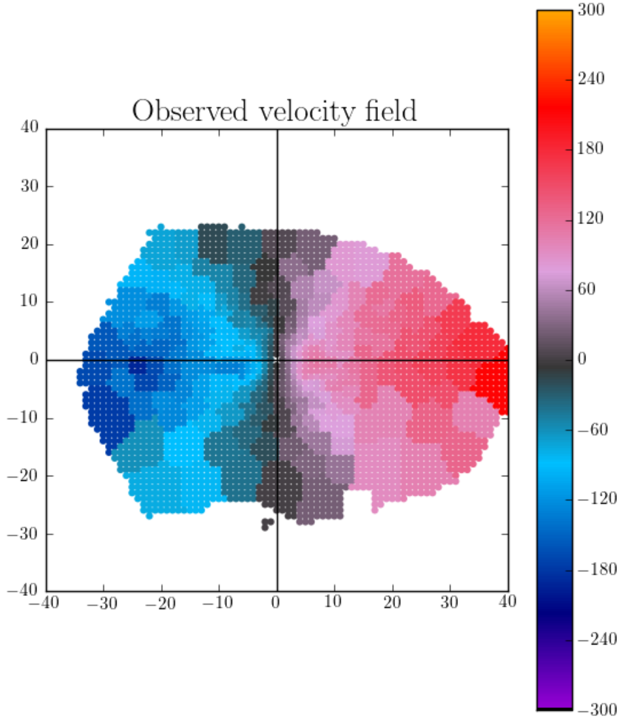
- **Bekeraite**
- **Barrera-Ballesteros**
- **Allen**
- **Scott**
- **Yan**

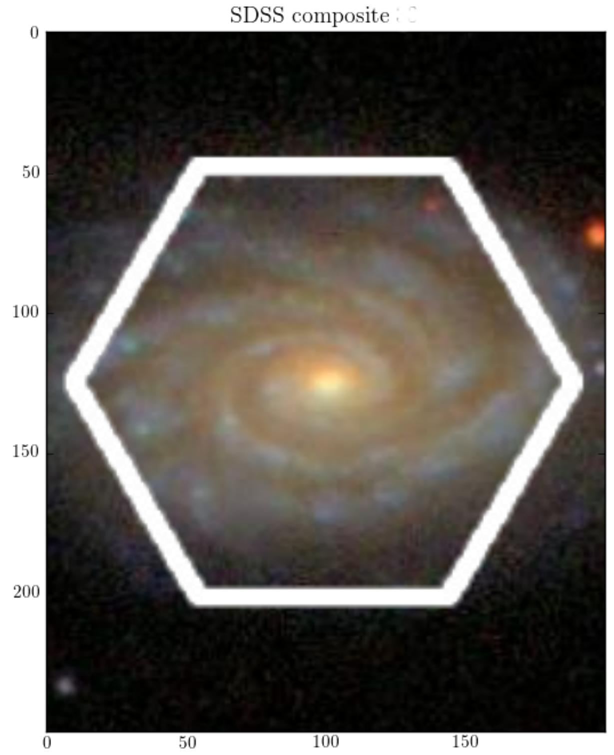
Towards an unbiased Tully-Fisher relation from CALIFA survey stellar velocity fields (#3)

S. Bekeraitė, J. Walcher, L. Wisotzki, M. Lyubenova, J. Falcón-Barroso, the CALIFA collaboration

March 10, 2014

Motivation



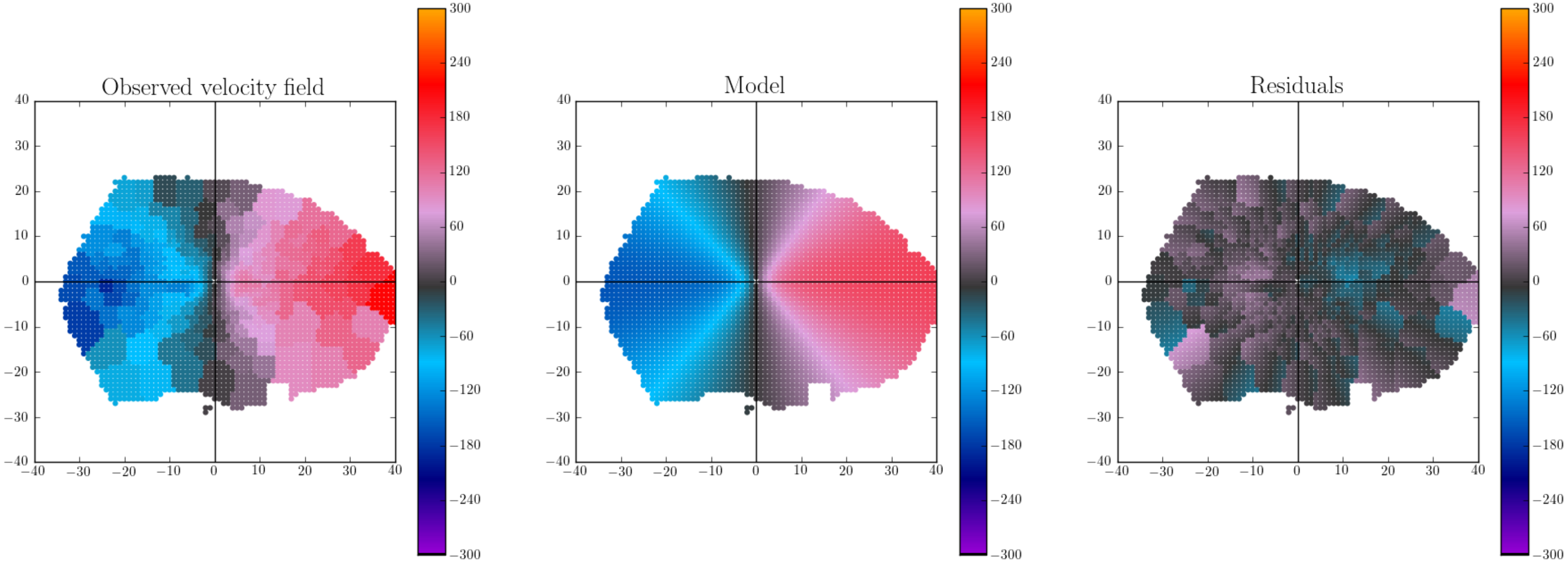


CALIFA:

- Coverage
- Diverse types of galaxies (kinematics, morphology, interaction state)
- Statistically well-defined sample, possible to perform volume and large scale structure corrections

Measuring the rotation velocity from CALIFA velocity fields

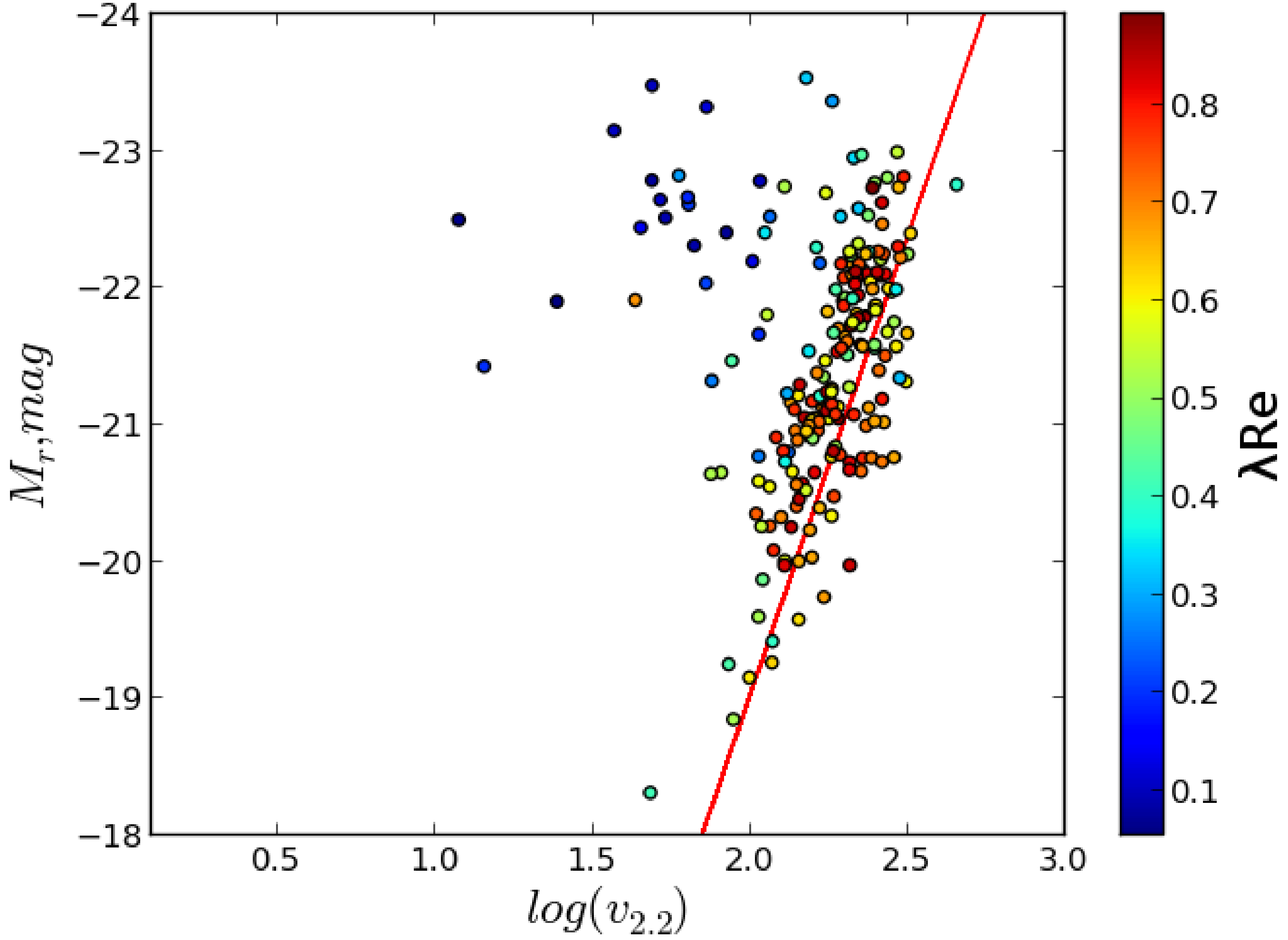
$$v(r) = v_0 + \frac{v_c}{(r^2+c^2)^{\frac{\gamma}{2}}}$$



A CALIFA velocity field, our model and residuals

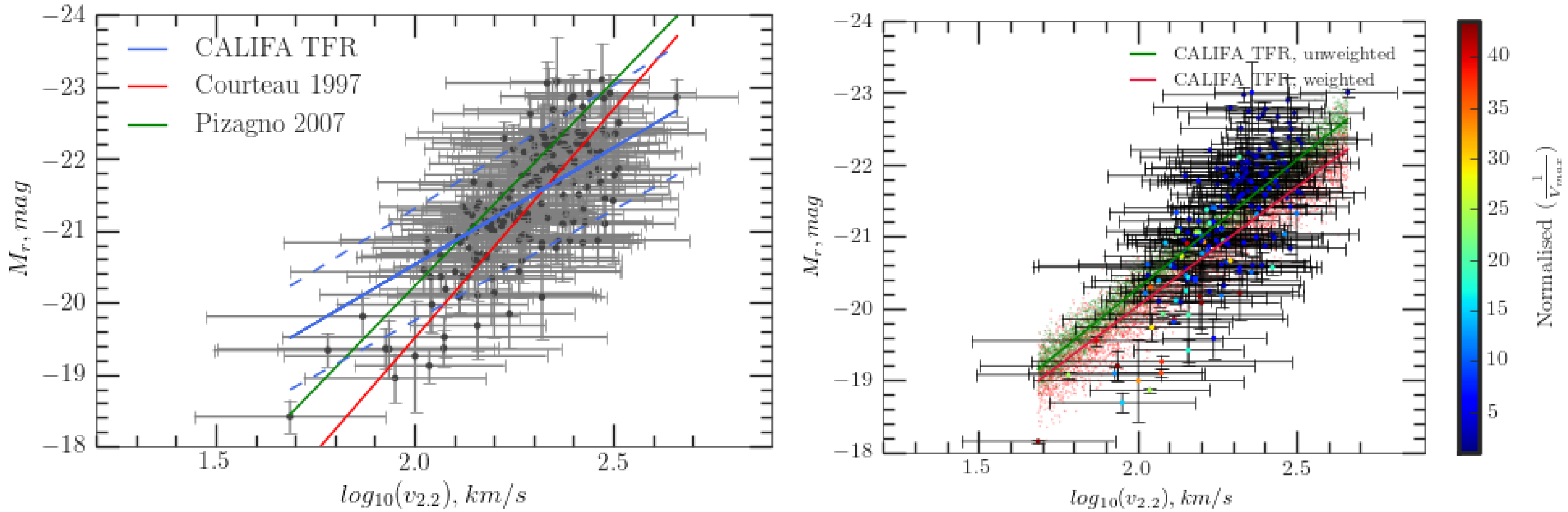
MCMC-based model selection provides full posterior distribution of model parameters: realistic uncertainties

Modelling the Tully-Fisher relation: data-driven outlier rejection



$v_{22} - M_r$ distribution, color-coded for inclination-corrected λ_{Re}

Results



Left: bivariate linear regression fit to the data. Right: $\frac{1}{V_{max}}$ weighted and unweighted models of the Tully-Fisher relation with intrinsic scatter

- IFU information helps to select the sample in a non-arbitrary, reproducible way
- Inclination is the largest source of velocity uncertainties and it is difficult to constrain precisely
- With CALIFA, we can try to obtain a volume-corrected Tully-Fisher relation

Kinematics of Major Mergers: The CALIFA perspective

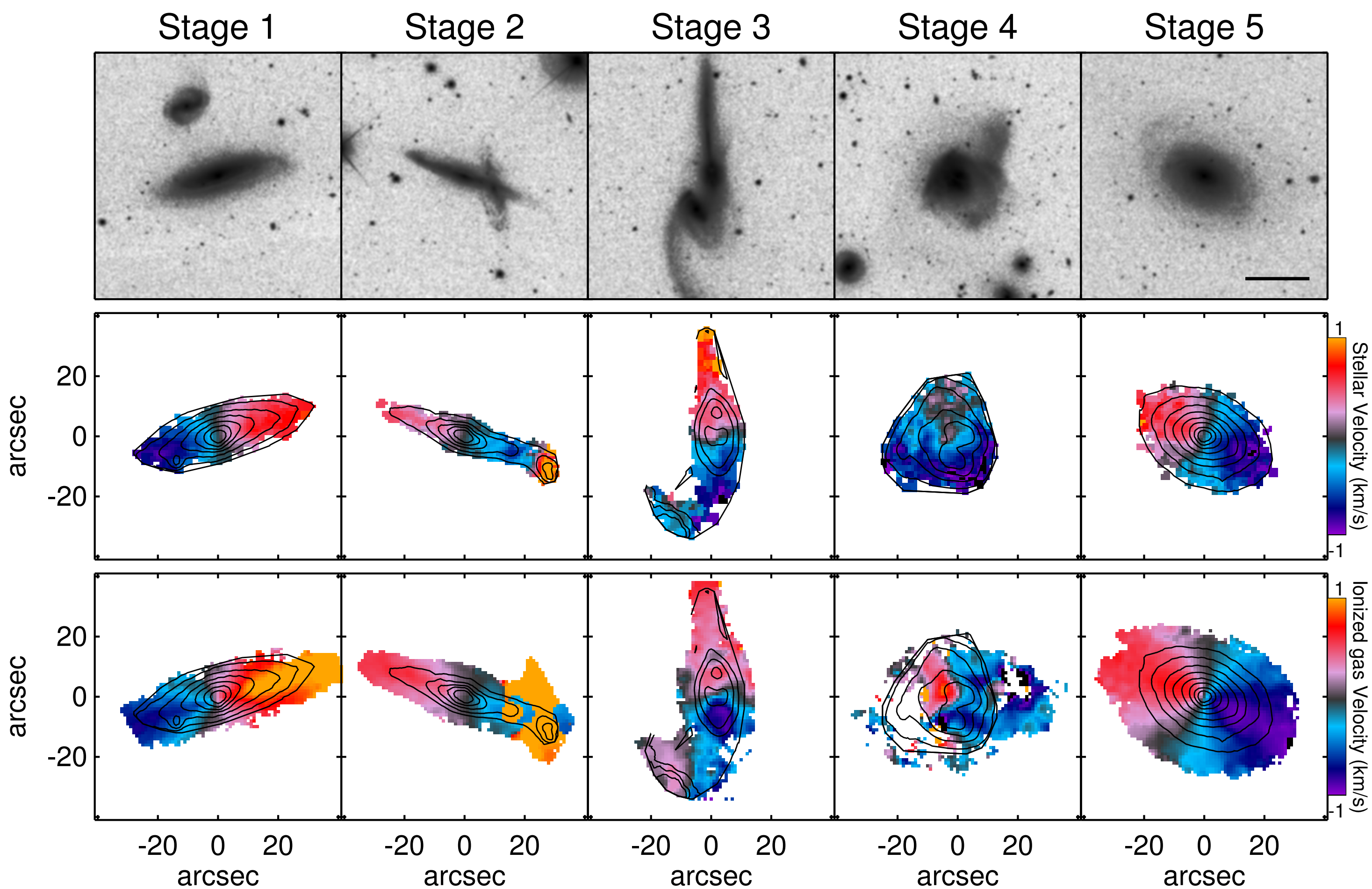
Jorge Barrera-Ballesteros

Begoña García-Lorenzo
Jesus Falcón-Barroso
Glenn van de Ven
CALIFA Collaboration

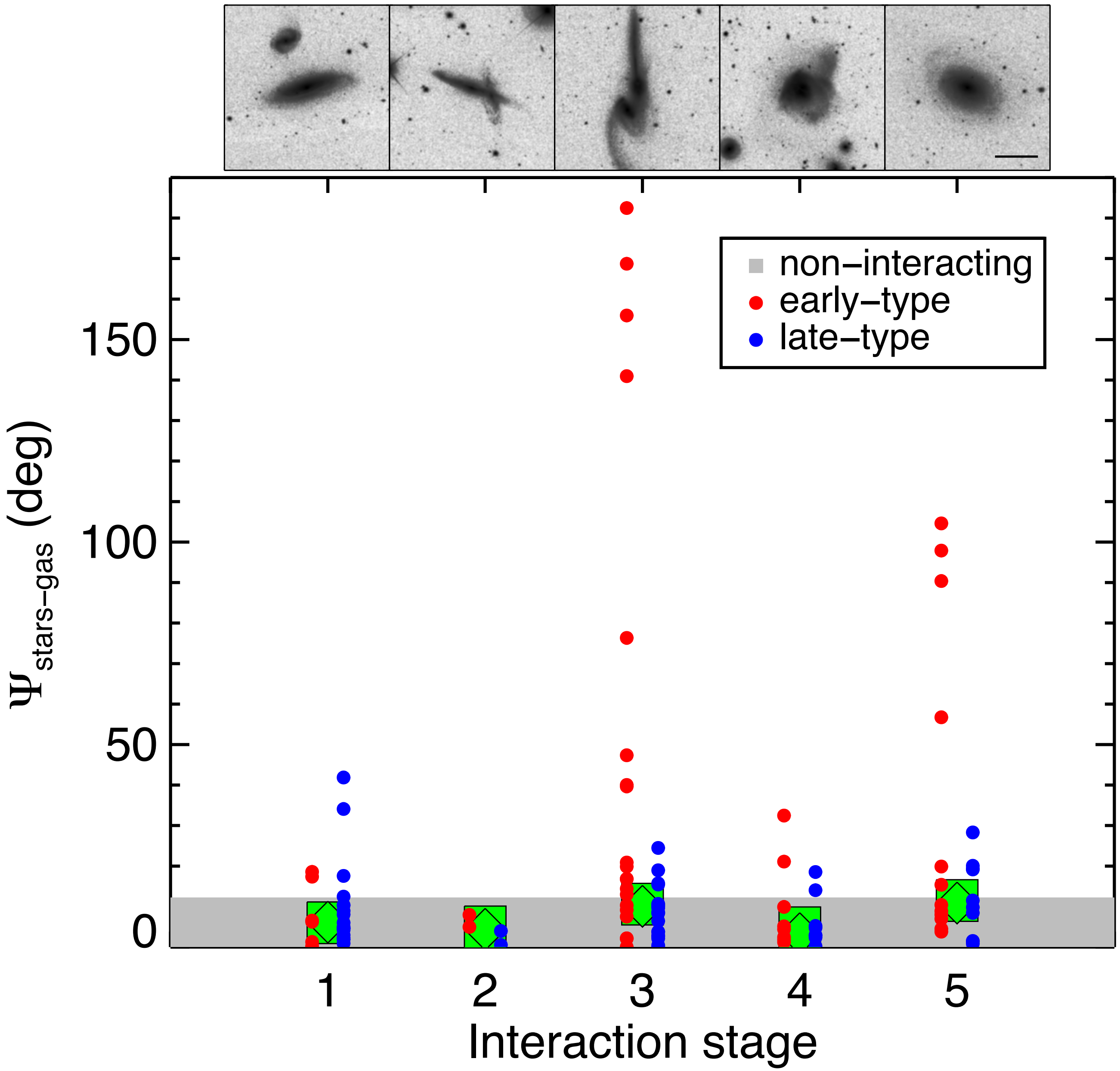
Instituto de Astrofísica de Canarias (IAC), Spain
Max Planck Institute for Astronomy (MPIA), Germany

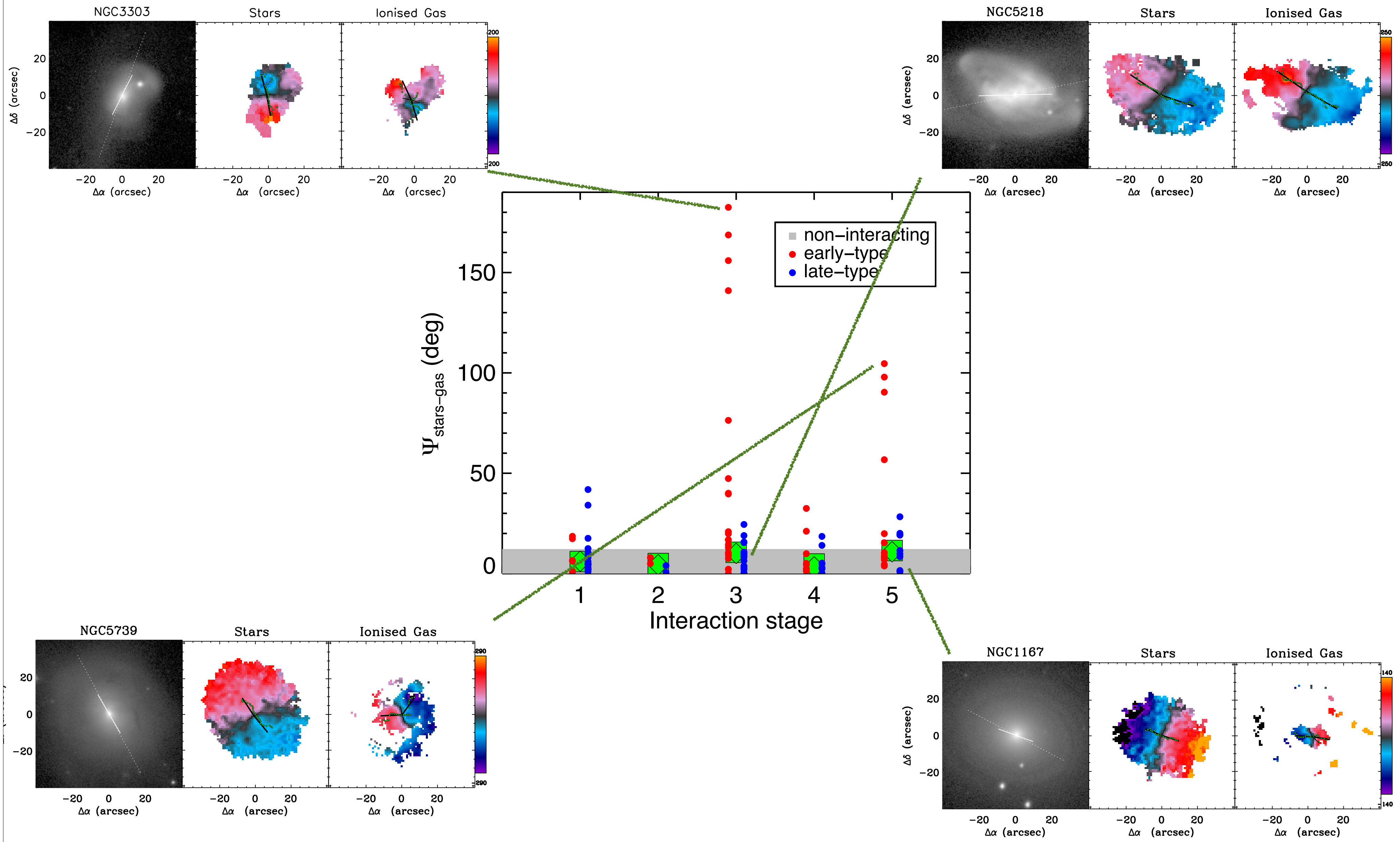
Major Mergers: Crucial for Galaxy Evolution

…However, galactic properties across the entire major merger are poorly studied observationally…

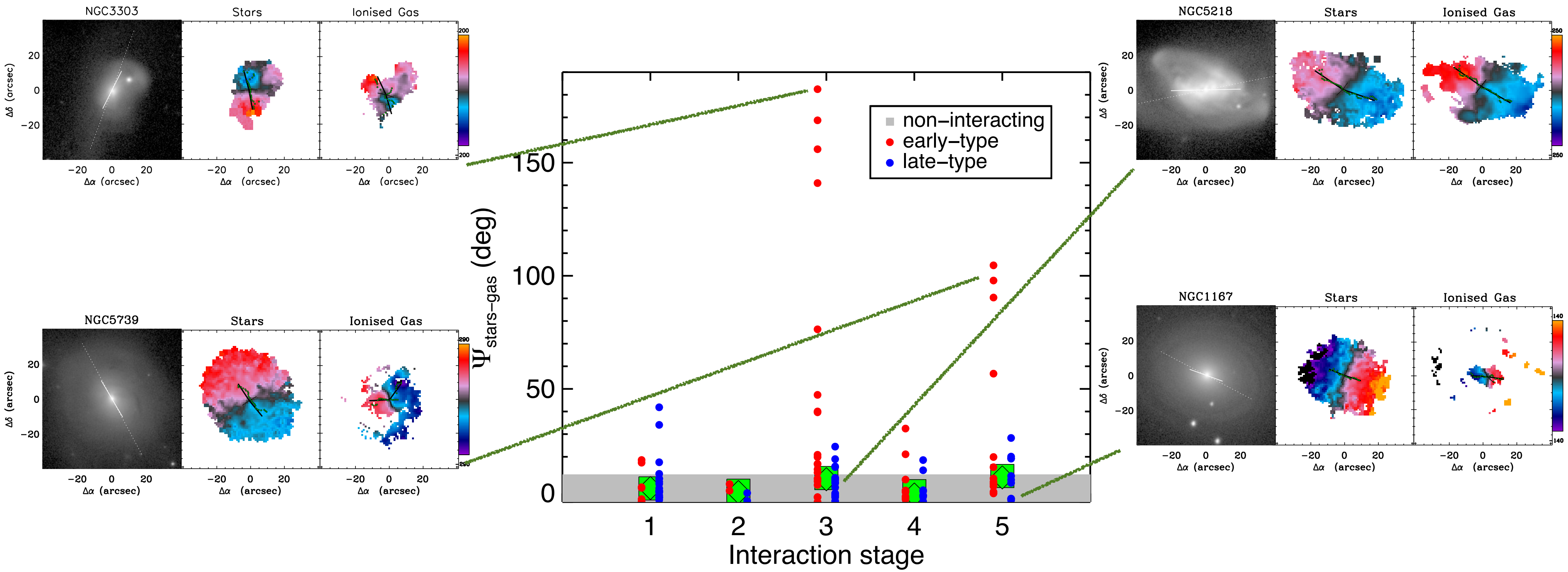


Kinematic PA alignment stars−gas





NGC3303
Stars
Ionised Gas
NGC5218
Stars
Ionised Gas
non–interacting
early–type
late–type
Ψstars–gas (deg)
Interaction stage
NGC5739
Stars
Ionised Gas
NGC1167
Stars
Ionised Gas
Δα (arcsec)
Δδ (arcsec)



misaligned (> 30°) **~10 %**

- early-type galaxies
- interaction stage 3 or 5

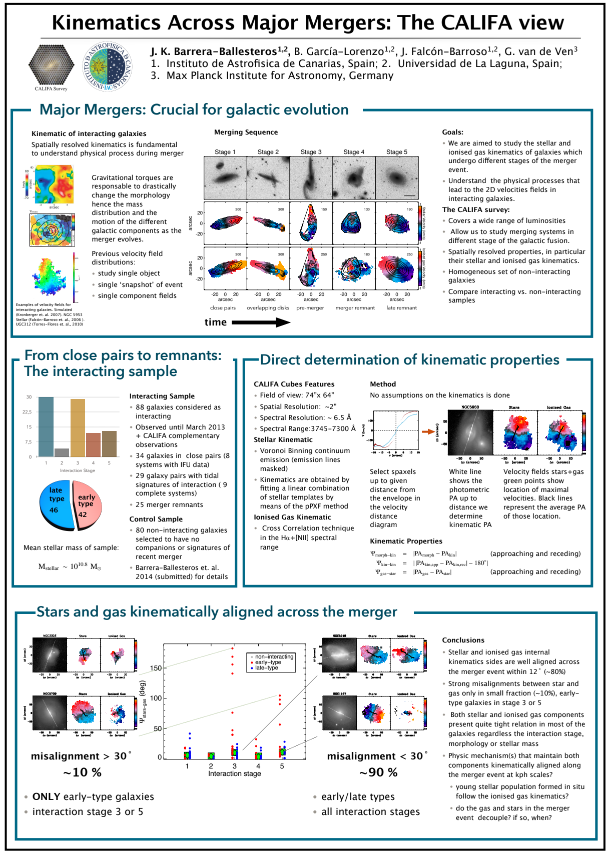
aligned (< 30°) **~90 %**

- early- & late-type galaxies
- all stages of merger

Stellar and gas kinematics match well across the merger event.

Stellar and gas kinematics match well across the merger event.

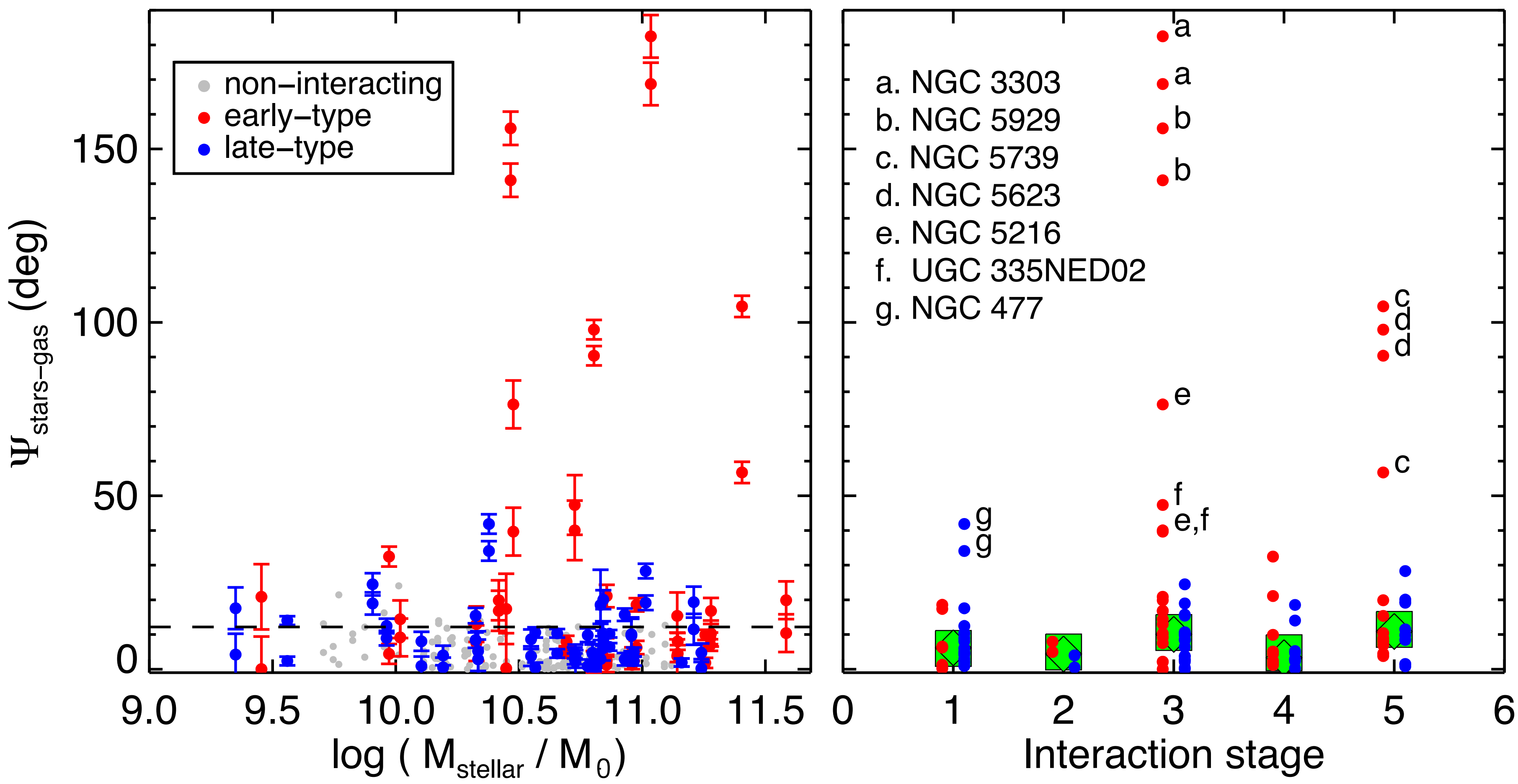
Learn more at poster # 1!



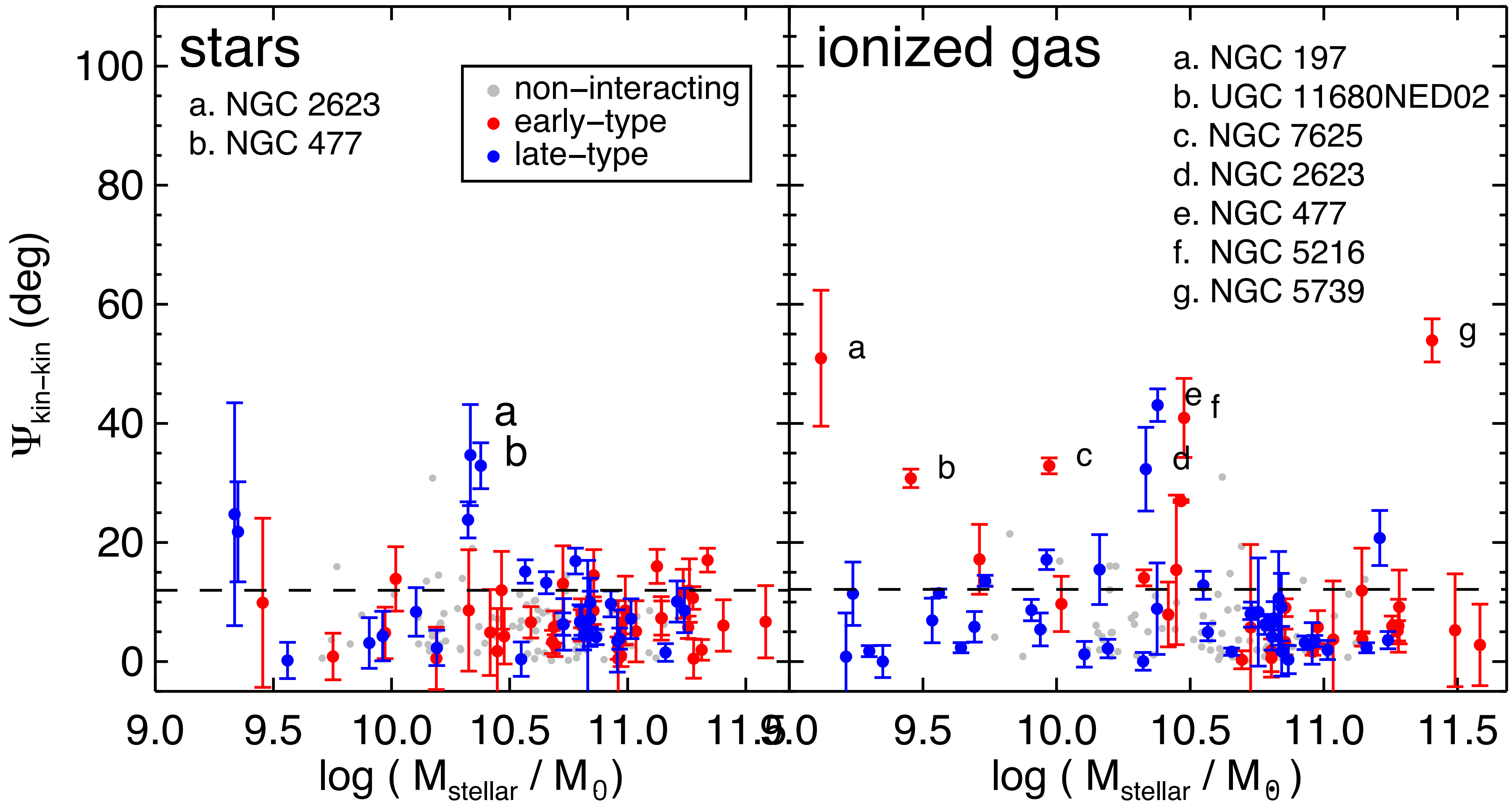
Thanks!

Additional Material

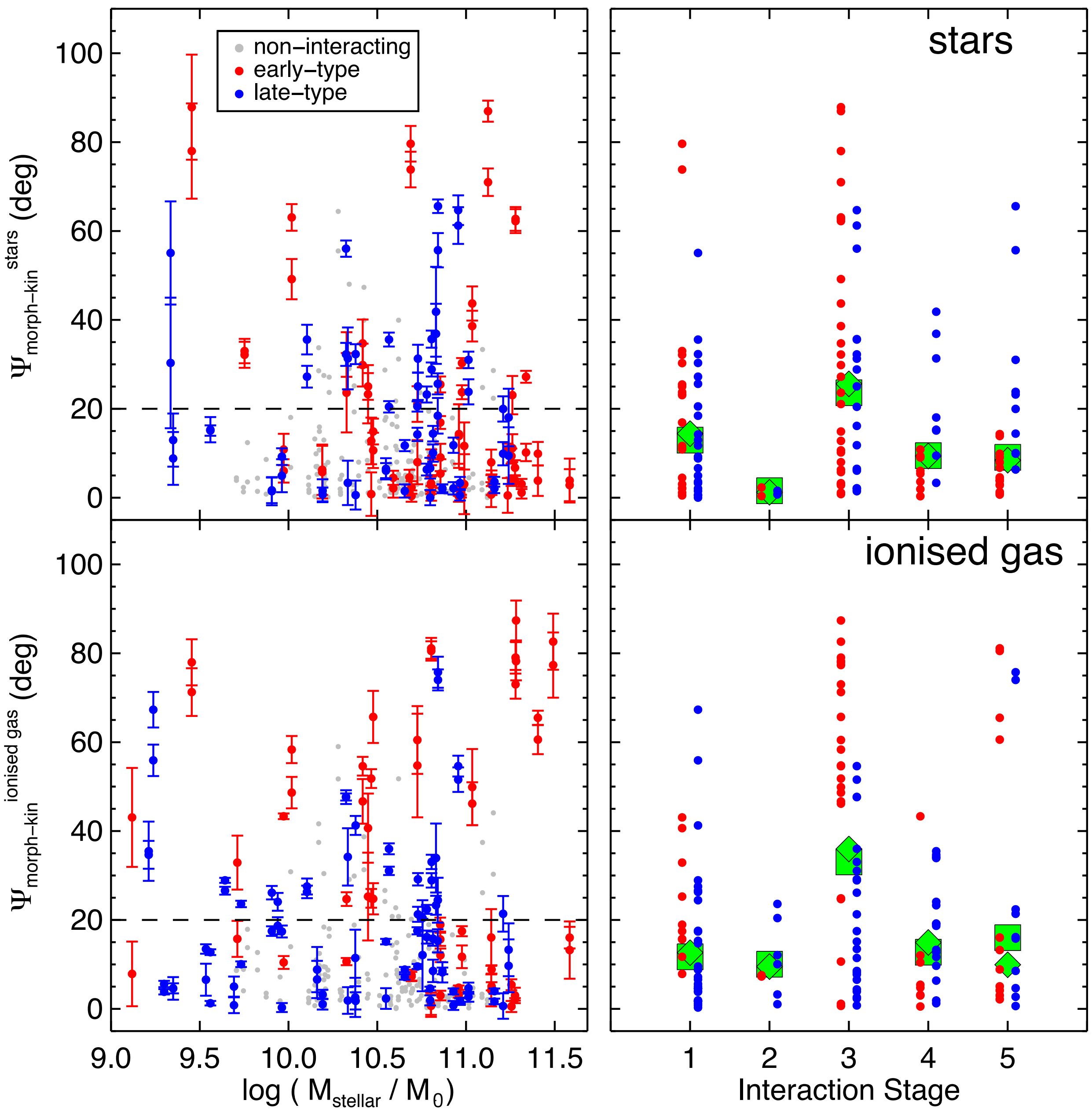
Misalignment stars-gas with respect to stellar mass



Internal kinematic misalignements



Morpho-kinematic misalignements



Where does star formation stop?

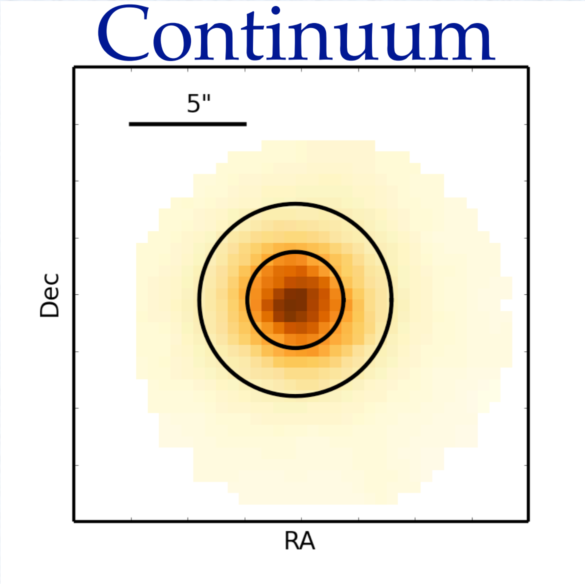
James Allen - University of Sydney

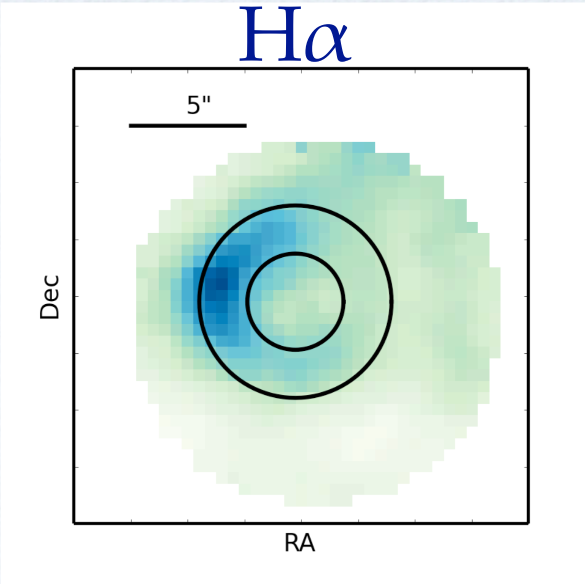
Star formation is suppressed in high density environments

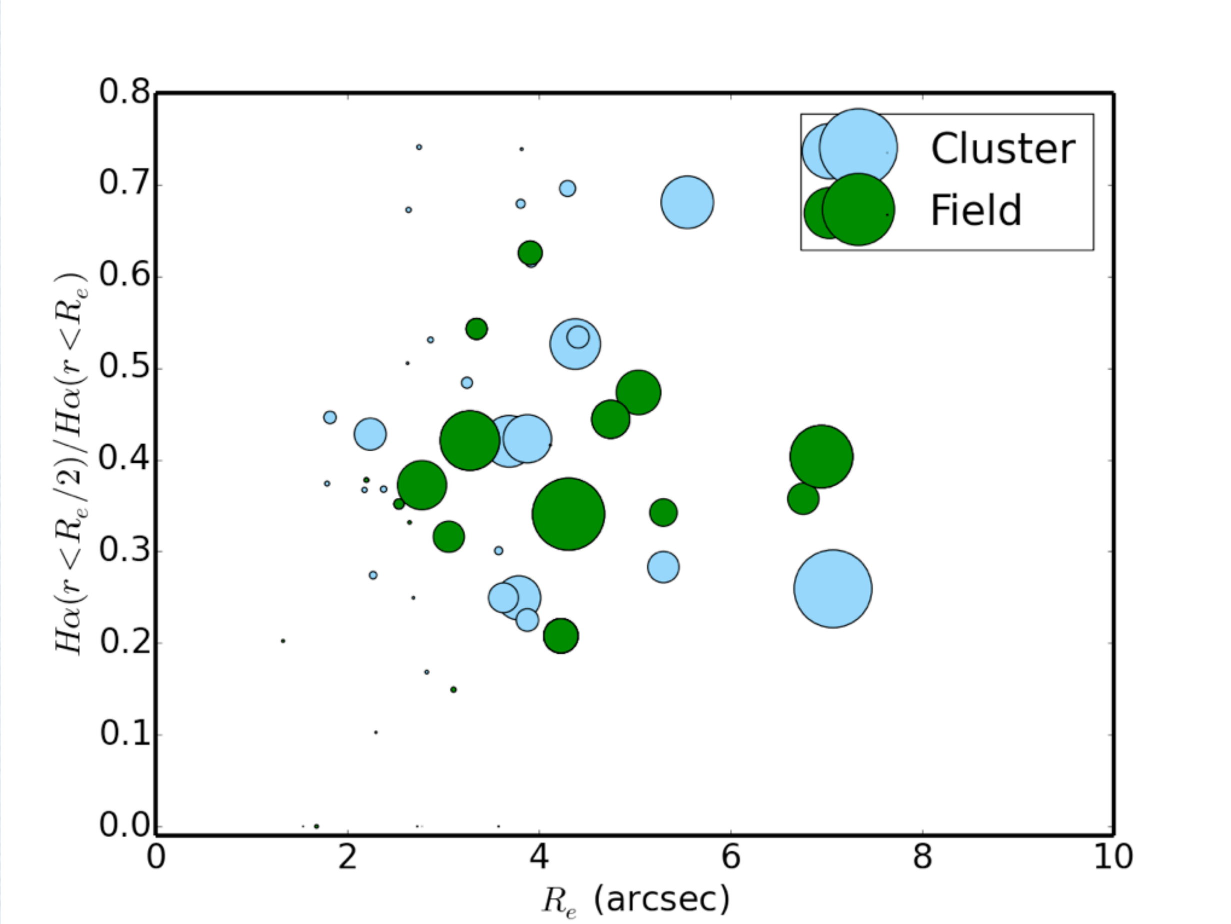
How?

Where?

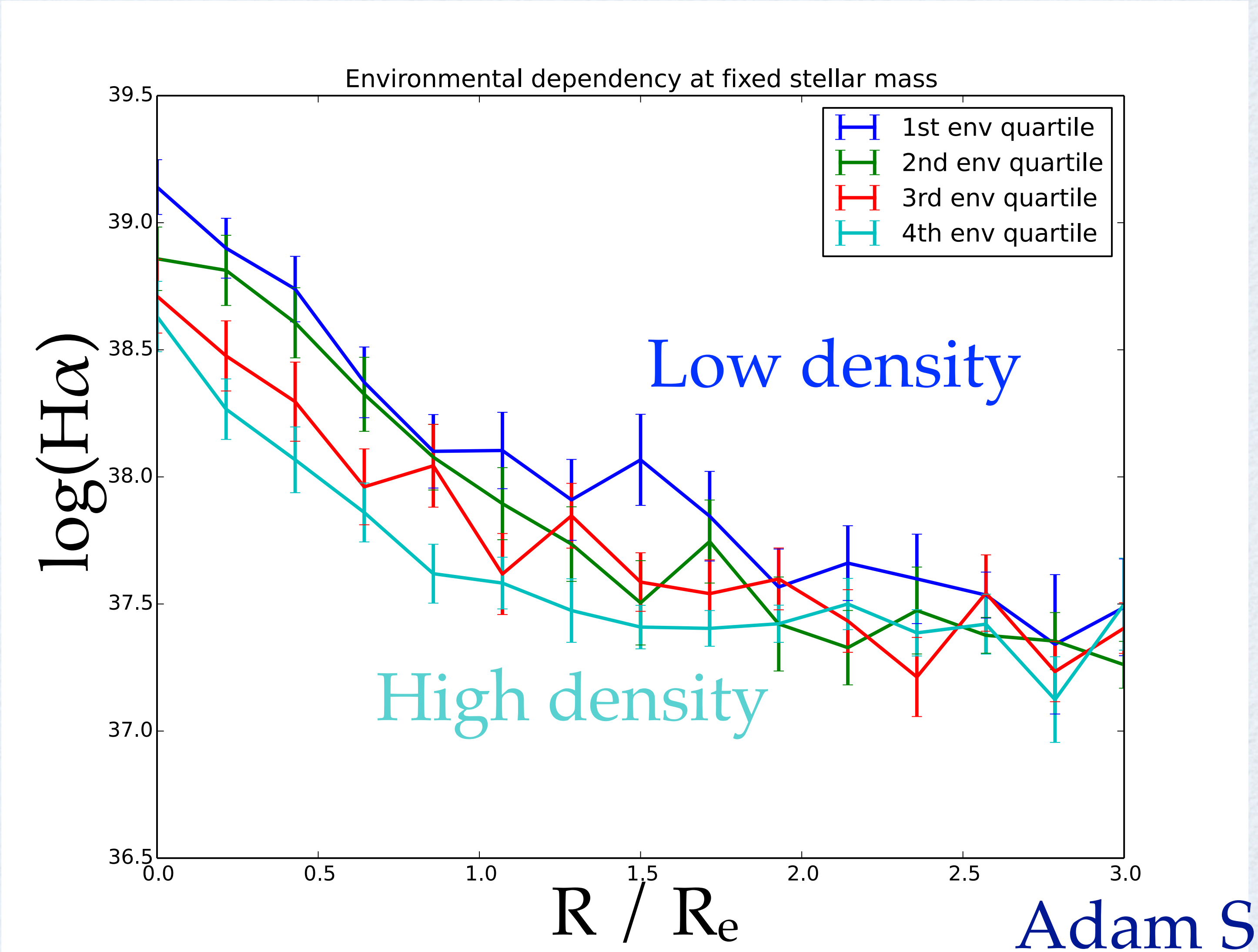
How concentrated is star formation?







Do star formation profiles vary with environment?



Adam Schaefer

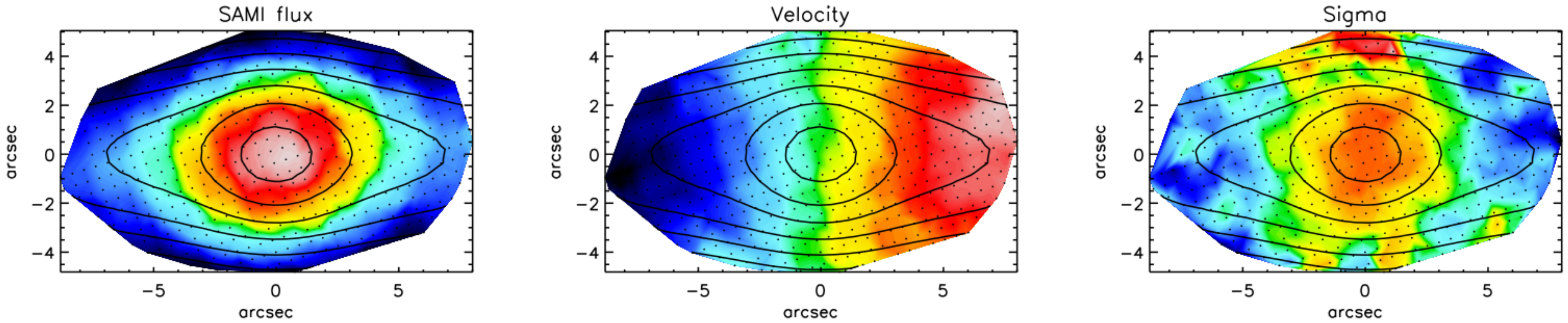
Dynamical Modelling of SAMI Galaxies

Nic Scott (University of Sydney) and the SAMI Team
ESO 3D2014, Tuesday 11th March

THE UNIVERSITY OF SYDNEY

CAASTRO
ARC CENTRE OF EXCELLENCE FOR ALL-SKY ASTROPHYSICS

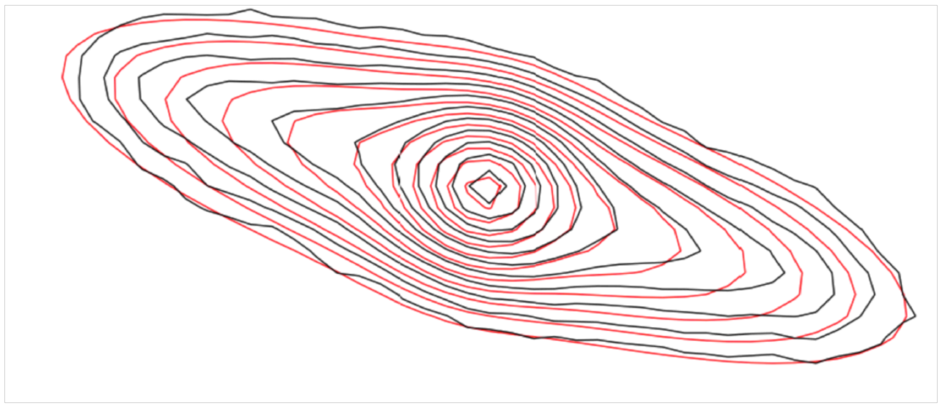
Dynamical Modelling



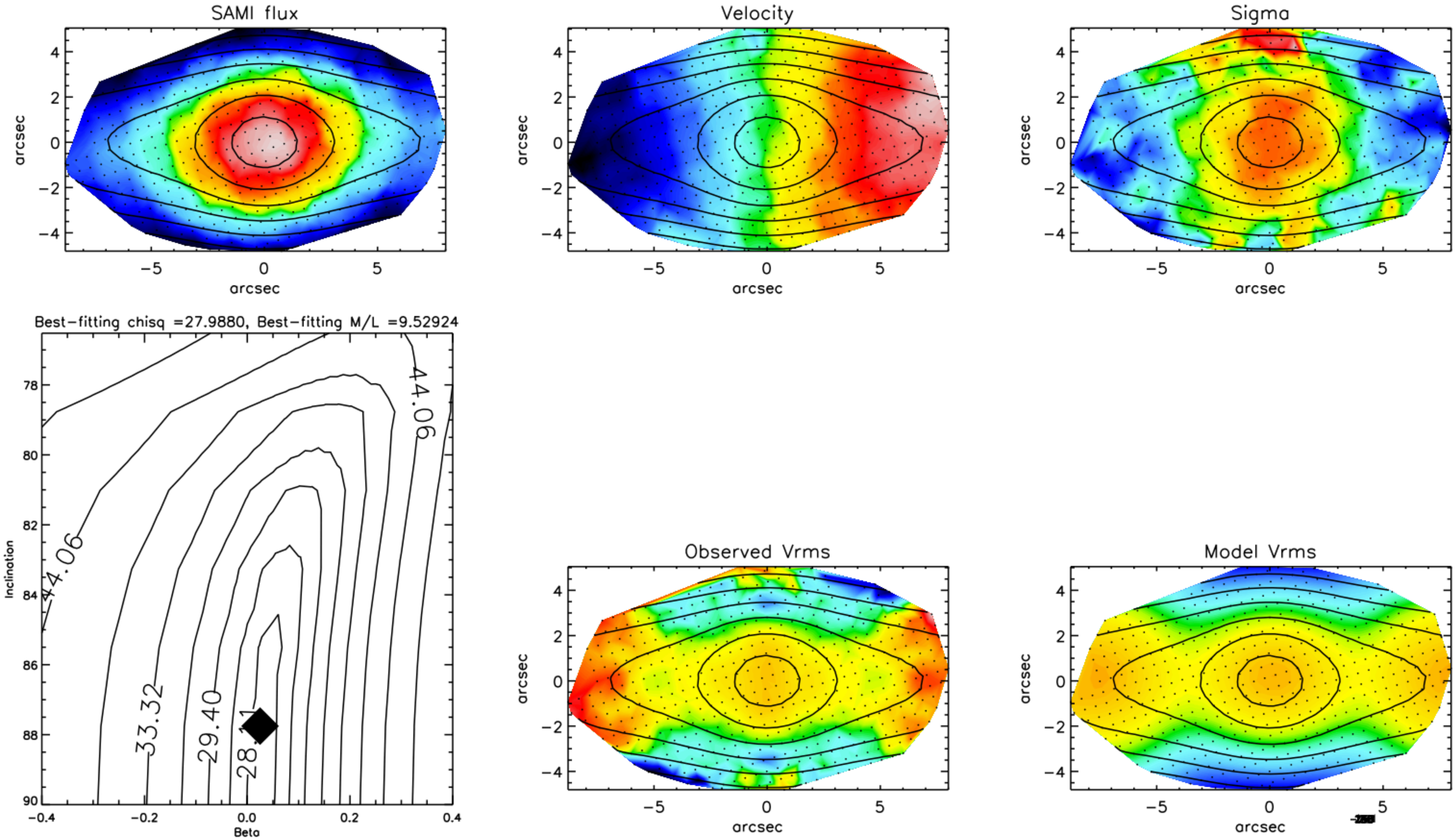
› Input Multi Gaussian Expansion model of the surface brightness

› Predict stellar kinematics for a range of inclinations, M/Ls and anisotropies

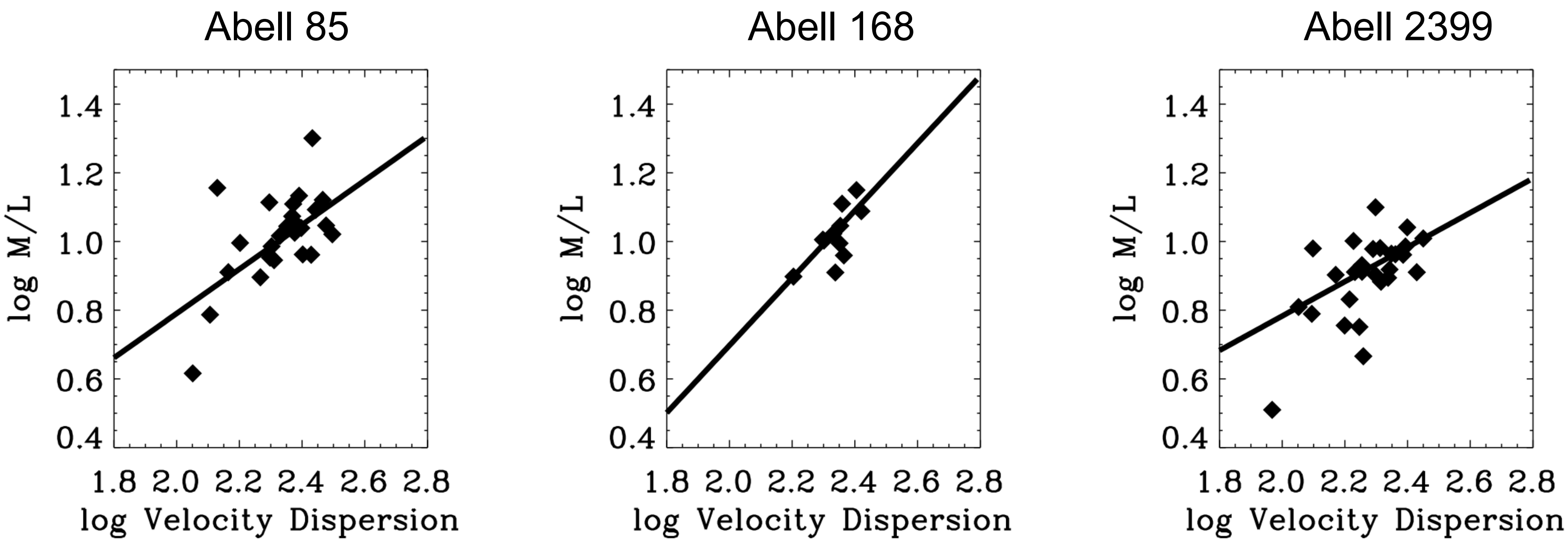
› Fit to observed SAMI kinematics to constrain parameters



Dynamical Modelling



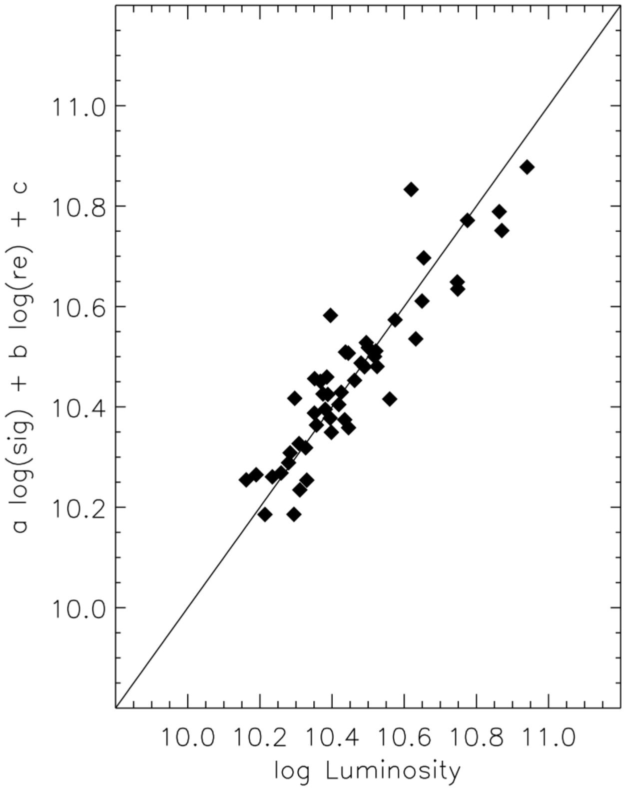
Mass-to-light ratio vs. velocity dispersion

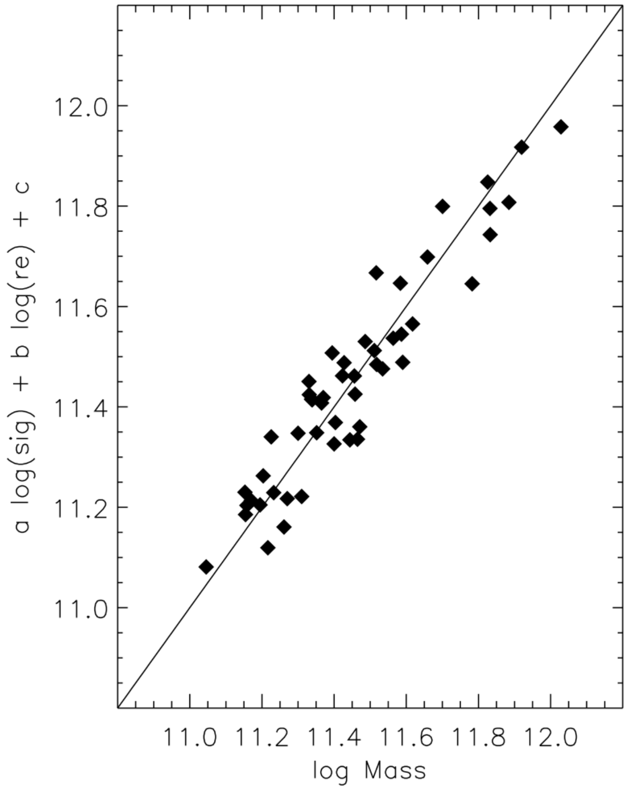


- Find a tight relationship between M/L and velocity dispersion in each of the three SAMI Pilot clusters
- Scatter ~ 8%
- Slopes between 0.55 and 0.72, consistent with each other and literature

The Fundamental and Mass Planes

a = 1.1±0.5
b = 1.0±0.2





a = 1.7±0.4
b = 1.1±0.2

- Compared to Fundamental Plane (see Colless talk), the Mass Plane (M-Re-sigma) is i) tighter and ii) closer to the Virial Prediction

Upcoming Work

› Dynamical models for 1000s of galaxies from the SAMI galaxy survey

› Compare dynamical masses from stellar kinematics, ionized and atomic gas

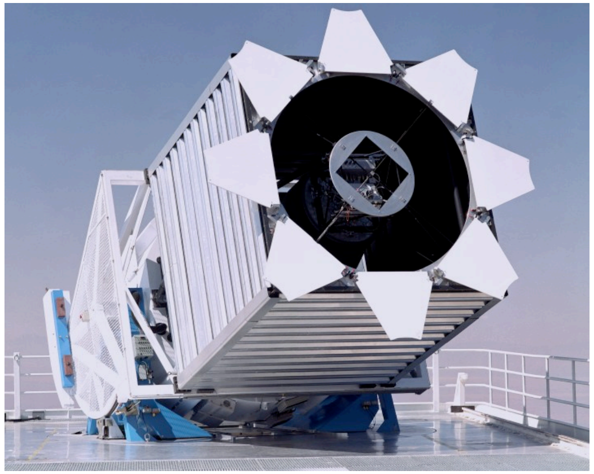
› Study variation of M/L, dark matter fraction and IMF as a function of:

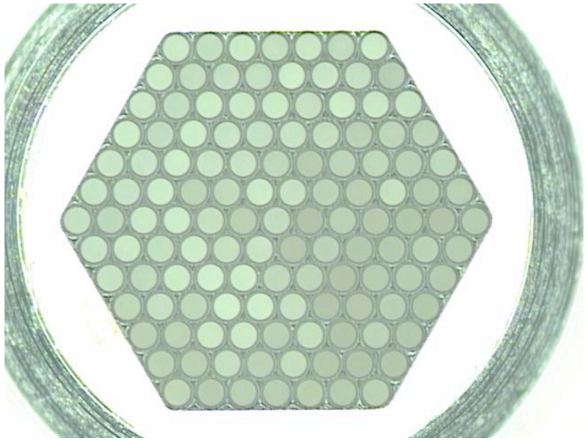
- mass
- environment,
- morphological type

sami galaxy survey

SDSS-IV/MaNGA
Mapping Nearby Galaxies at APO

Renbin Yan (University of Kentucky) for the MaNGA Team

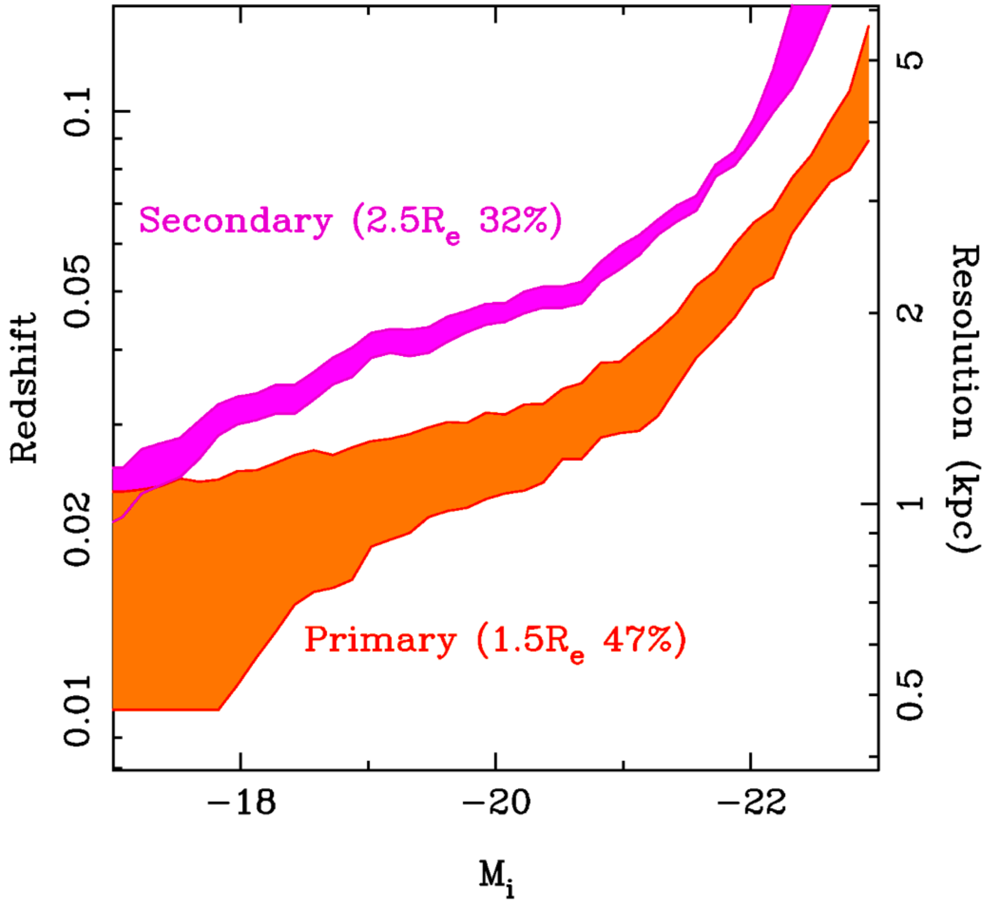


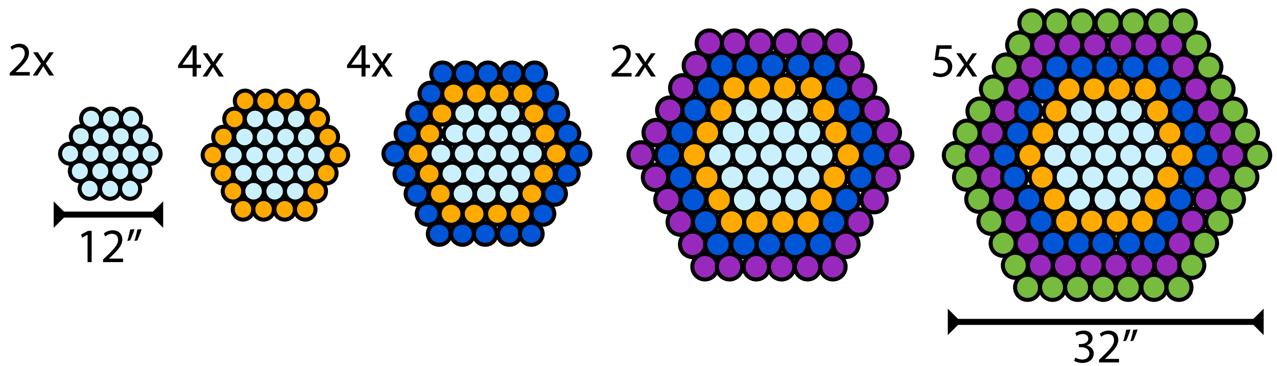


- Part of SDSS-IV.
- Multi-object IFS: 17 galaxies per 7 sq. deg. pointing
- 10,000 galaxies in 6 years.
- Spatial resolution: 2.5″ (1-2kpc);
  spectral resolution: 50-70 km/s (sigma);
  spectral coverage: 3500-10,500A.
- Median S/N per A of 5.5 per fiber in r-band at 1.5Re.
- Had a successful prototype observation run,
  currently commissioning the production hardware.
  Survey observation begins on July 1st !

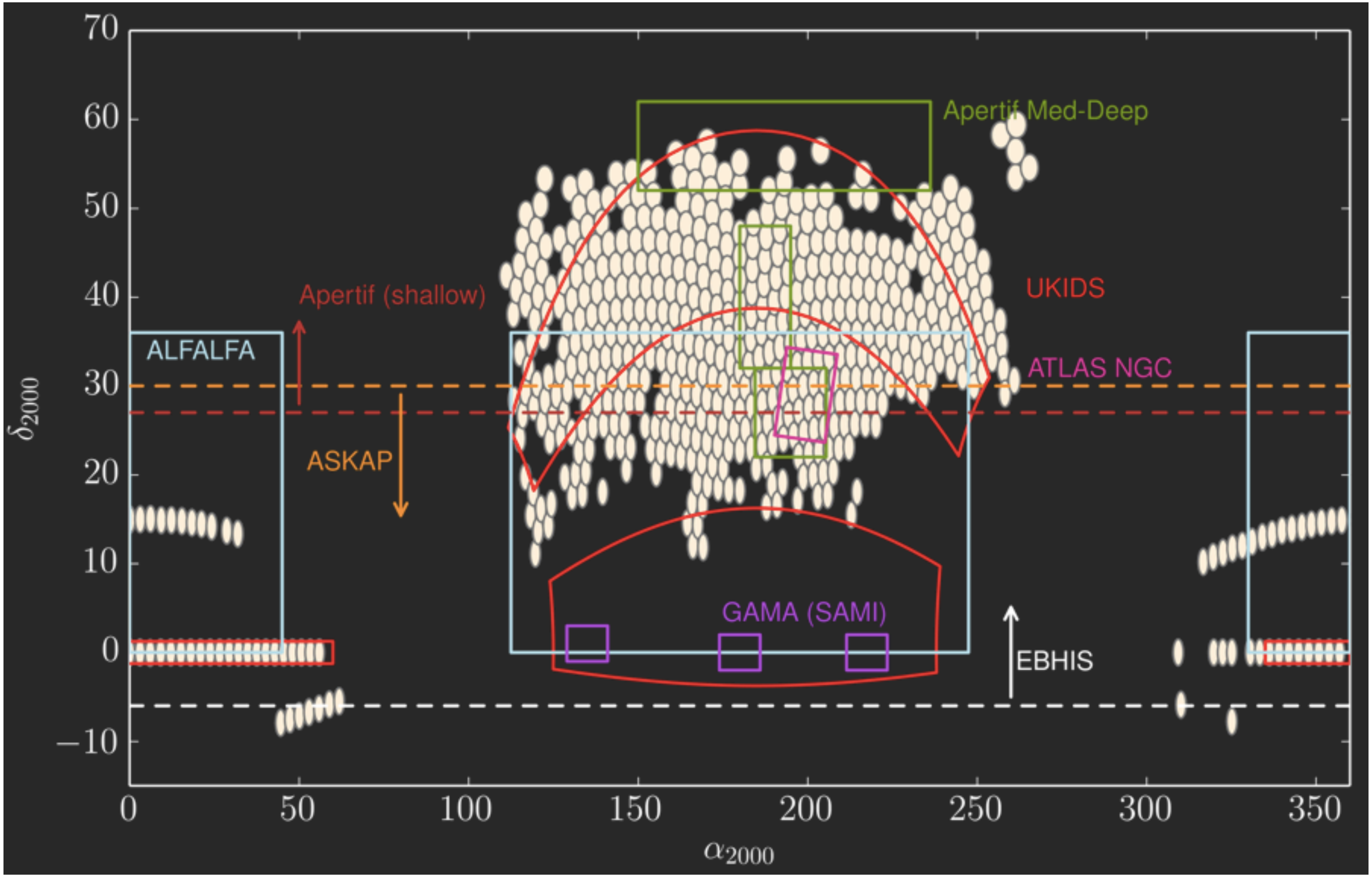
Target Selection

- Flat stellar mass distribution
- Uniform spatial coverage in units of Re
  - 2/3 of the sample covered to 1.5Re
  - 1/3 of the sample covered to 2.5Re
- Simple selection based on M_i and redshift.
- No size or inclination cuts



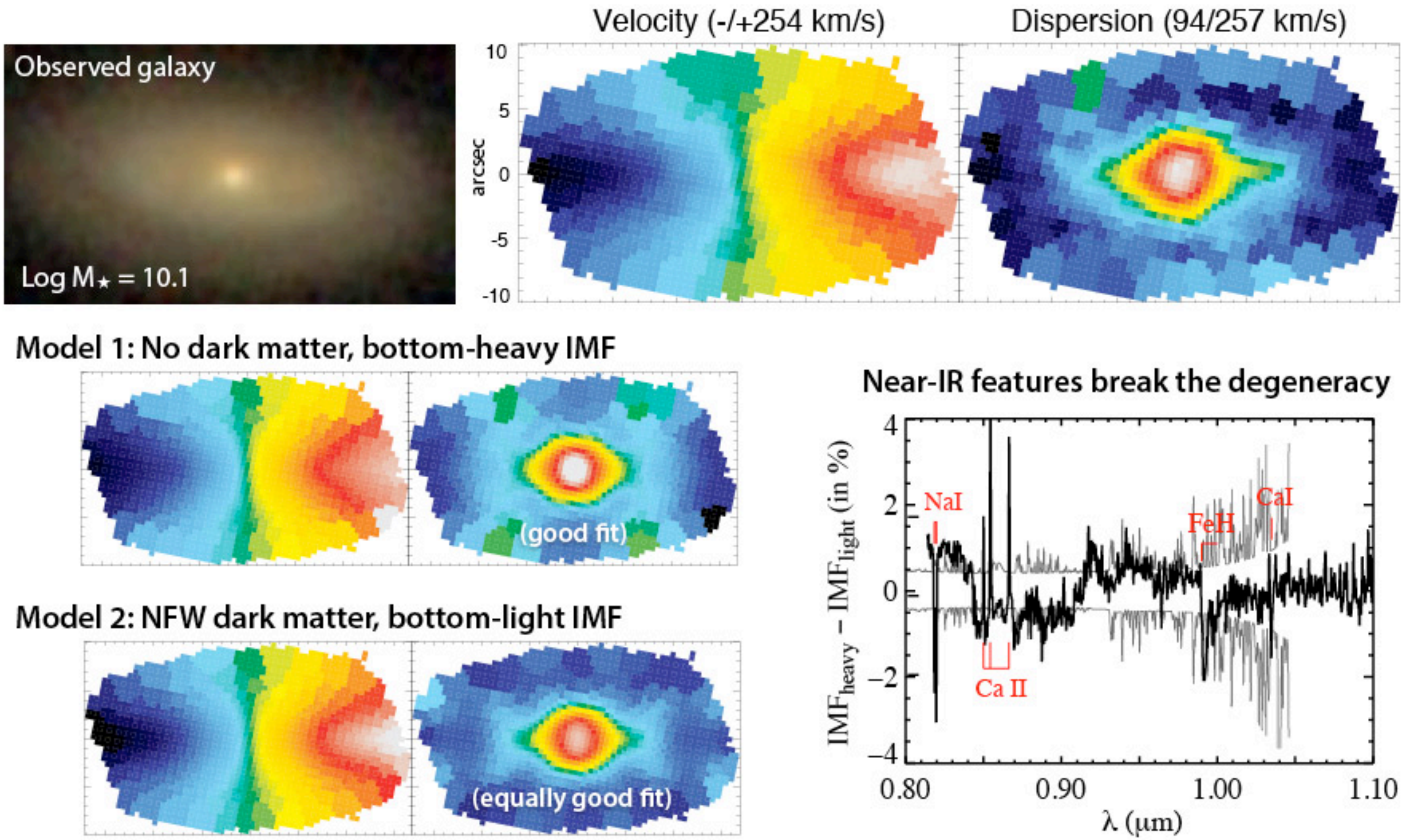


Current Field Choice



Let us know which fields we should prioritize.

Example science outcome



Plot made by K. Bundy, C. Conroy, & R. van den Bosch

See Poster #44 for more information on MaNGA