

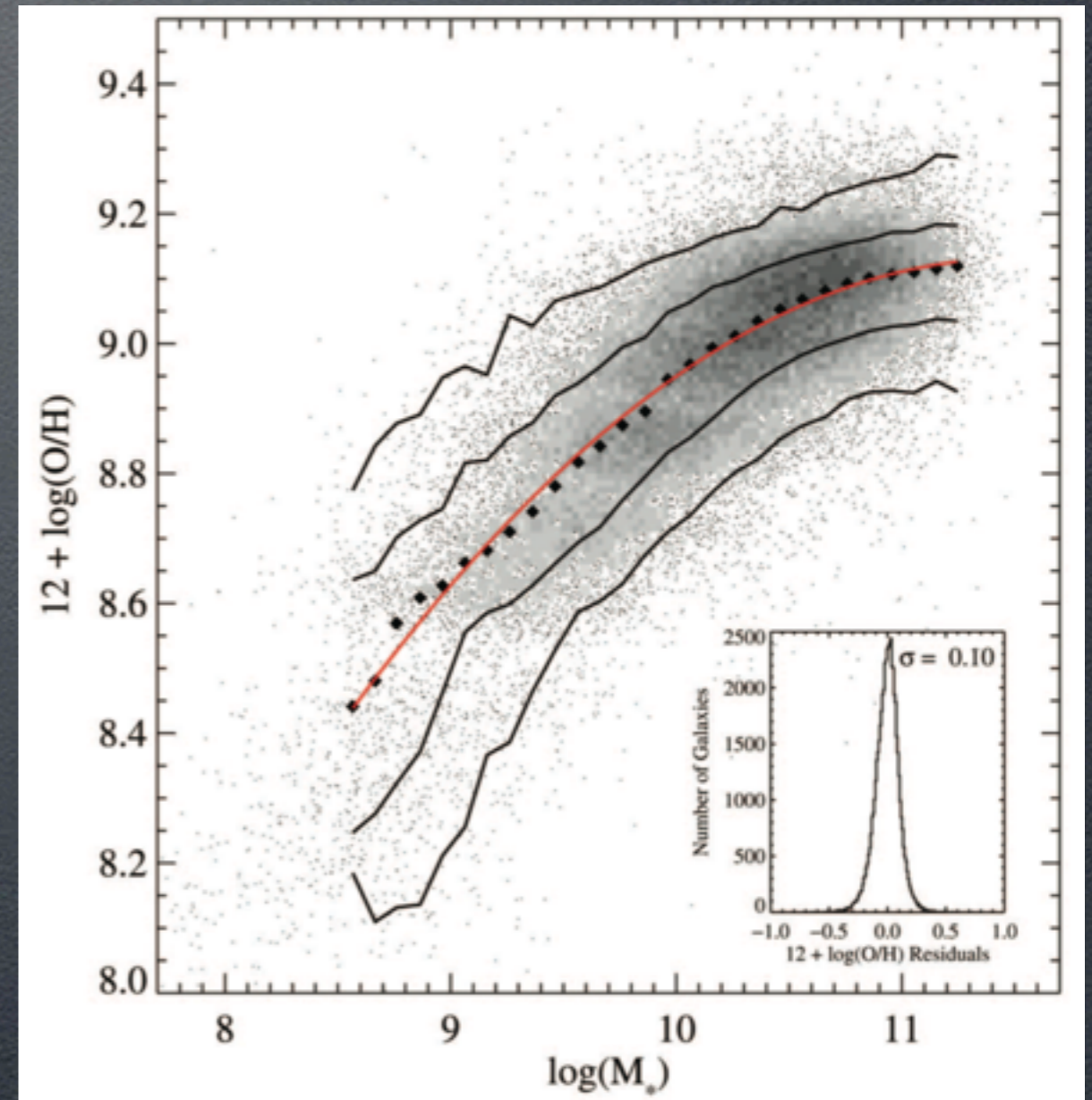
Facing the Metal uncertainty: SAMI galaxy metallicity maps and cautionary tales

Brent Groves
RSAA, ANU
(and SAMI & ANU Teams)



Mass-Metallicity calibration

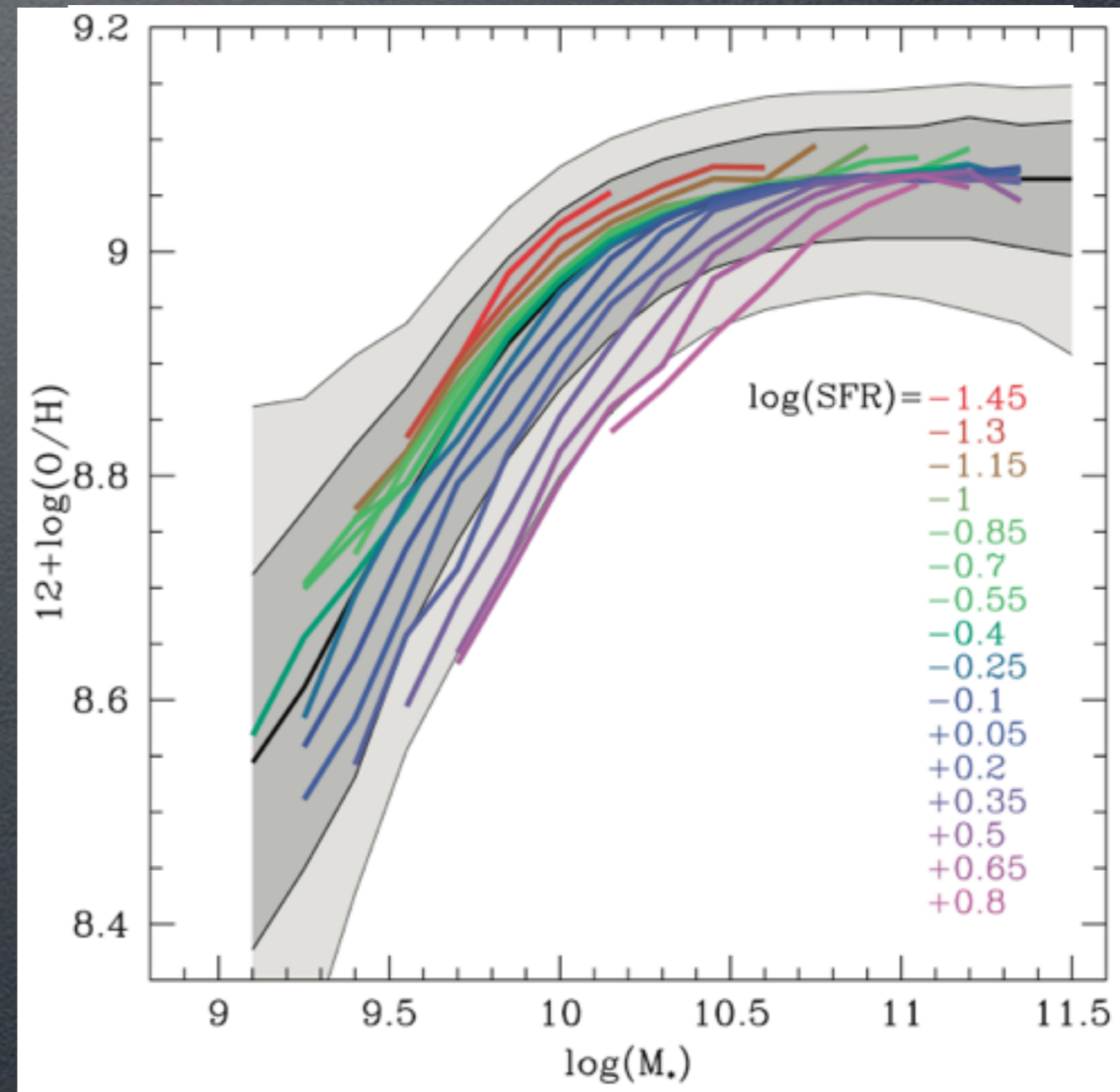
- SDSS demonstrated strong link between gas-phase metallicity and stellar mass in galaxies
- Arises due to formation history, feedback through outflows and feeding through inflows
- Measuring and Mapping O/H gives insight into galaxy formation process



Tremonti et al. (2004)

Mass-Metallicity calibration

- SDSS demonstrated strong link between gas-phase metallicity and stellar mass in galaxies
- Arises due to formation history, feedback through outflows and feeding through inflows
- Measuring and Mapping O/H gives insight into galaxy formation process




Mannucci et al. (2010)

The (metal-)poor outskirts

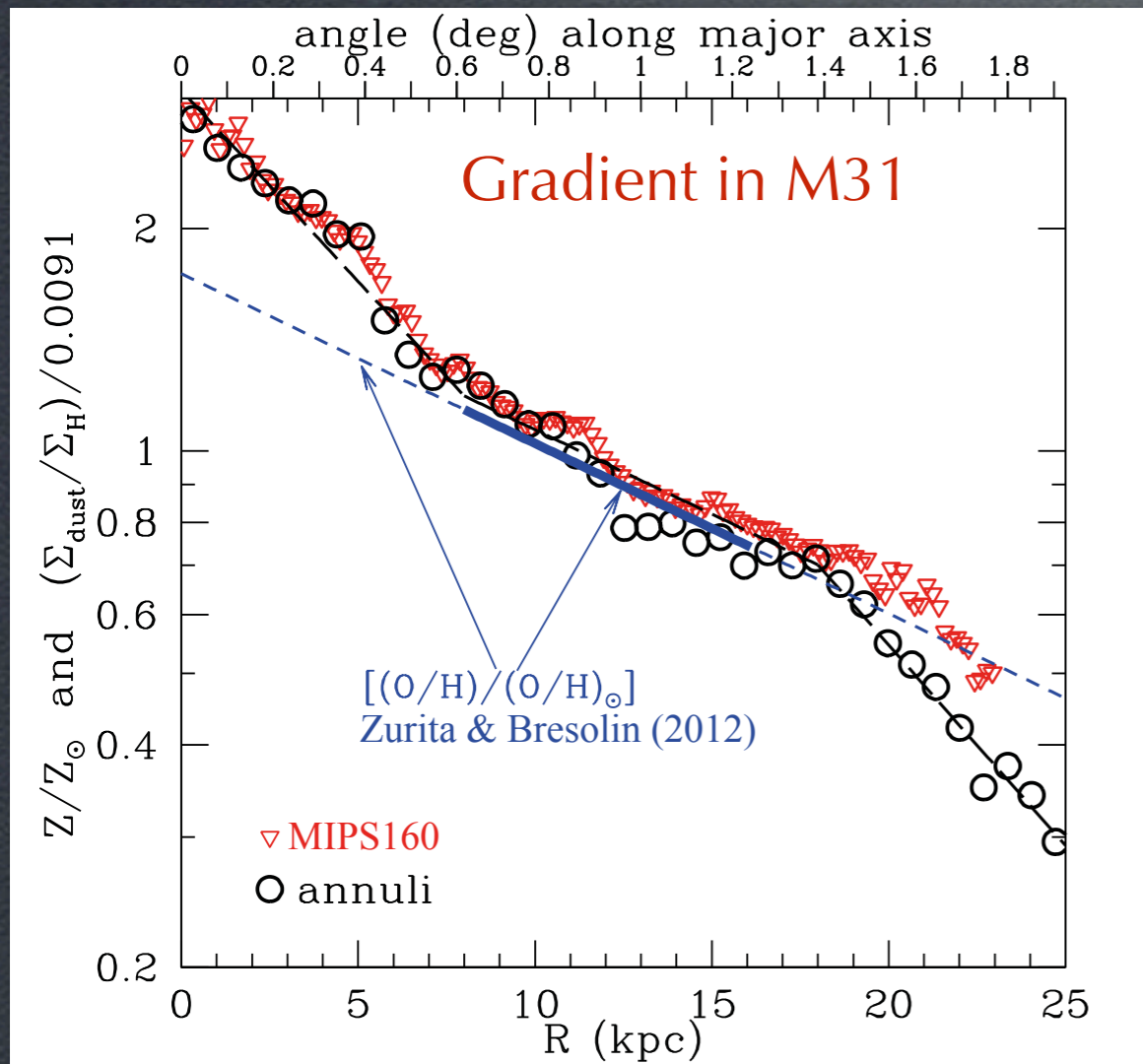
M31

- See a decline in O/H with galactocentric radius
- Clues to the growth and feeding of galaxies
- Insight into the next generation of stars
- Strong correlation between O/H and Dust/Gas



● Zurita & Bresolin (2012)
● Esteban et al. 2009
● Bresolin et al. 1999
▼ Galarza et al. 1999
◆ Blair et al. 1982
▲ Dennefeld & Kunth 1981

The (metal-)poor outskirts



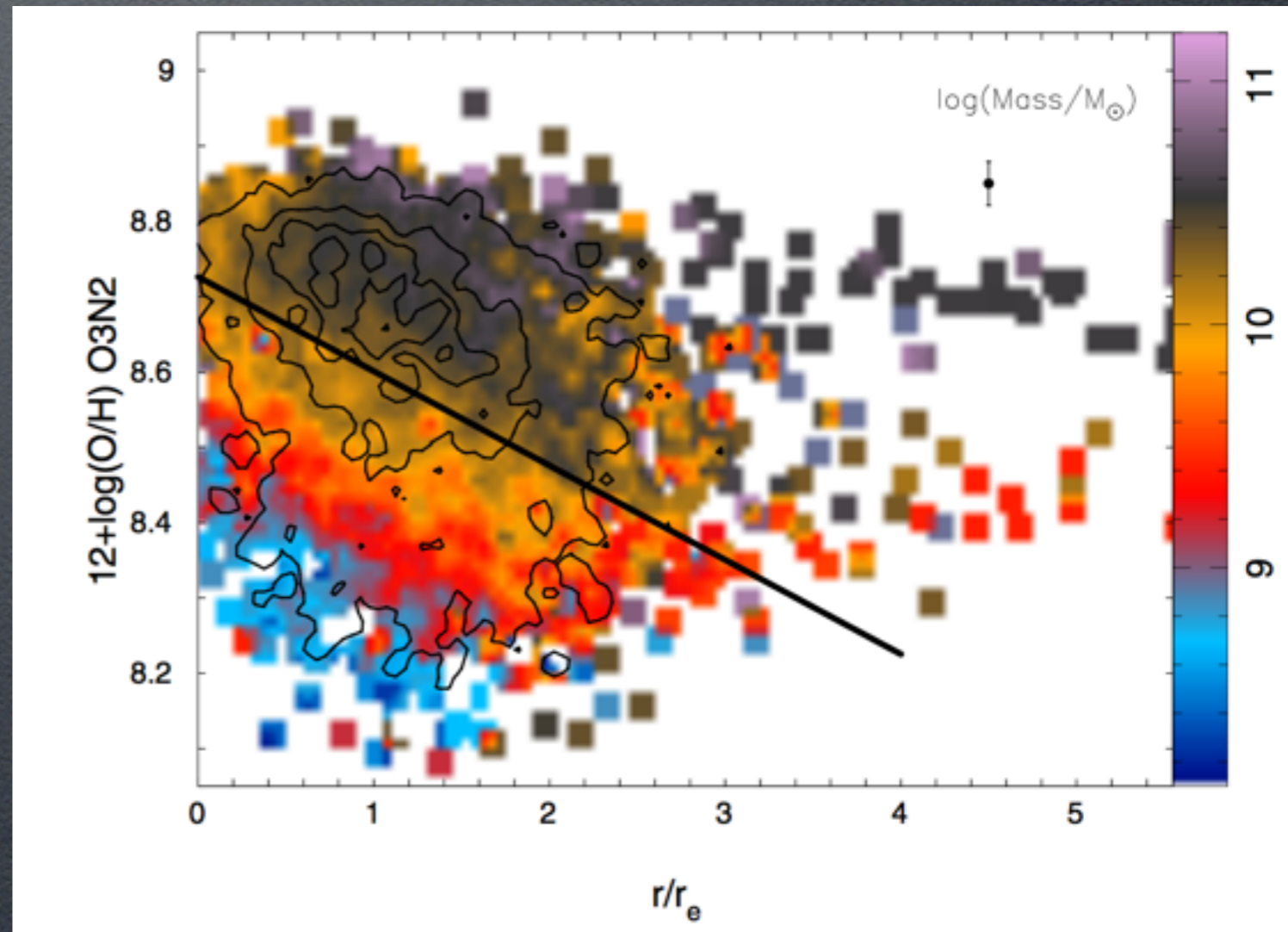
- See a decline in O/H with galactocentric radius
- Clues to the growth and feeding of galaxies
- Insight into the next generation of stars
- Strong correlation between O/H and Dust/Gas

Draine, BG et al. (2014)

See also Groves et al. (2015)

Always feeling poor at R_e

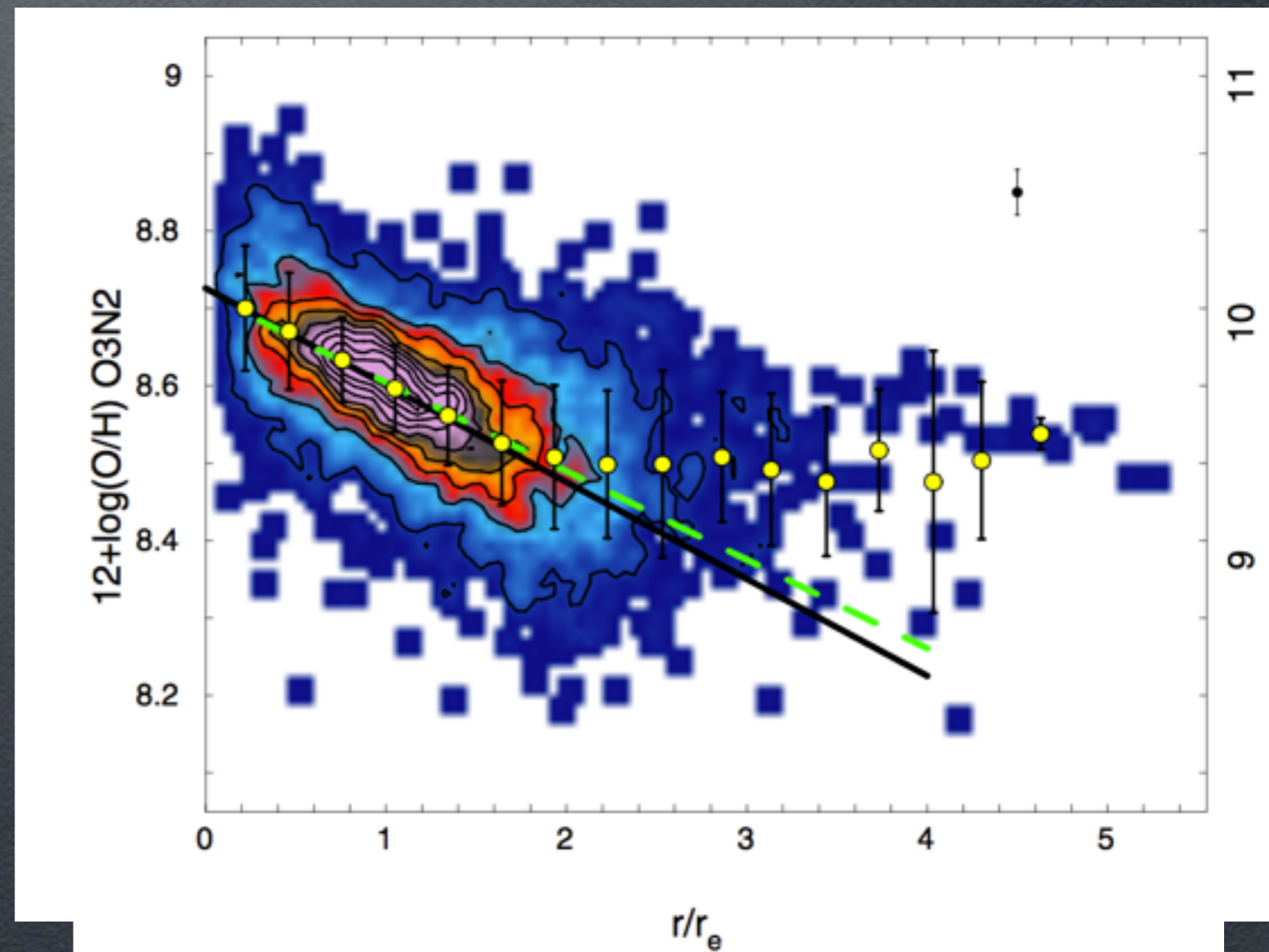
- Integral field surveys like CALIFA, MaNGA and SAMI greatly increased metal maps
- See a decline with radius
- Yet normalised to R_e , see a constant gradient, $\alpha_{(O/H)}$!



Sanchez et al. (2014)
see also Ho et al. (2015)

Always feeling poor at R_e

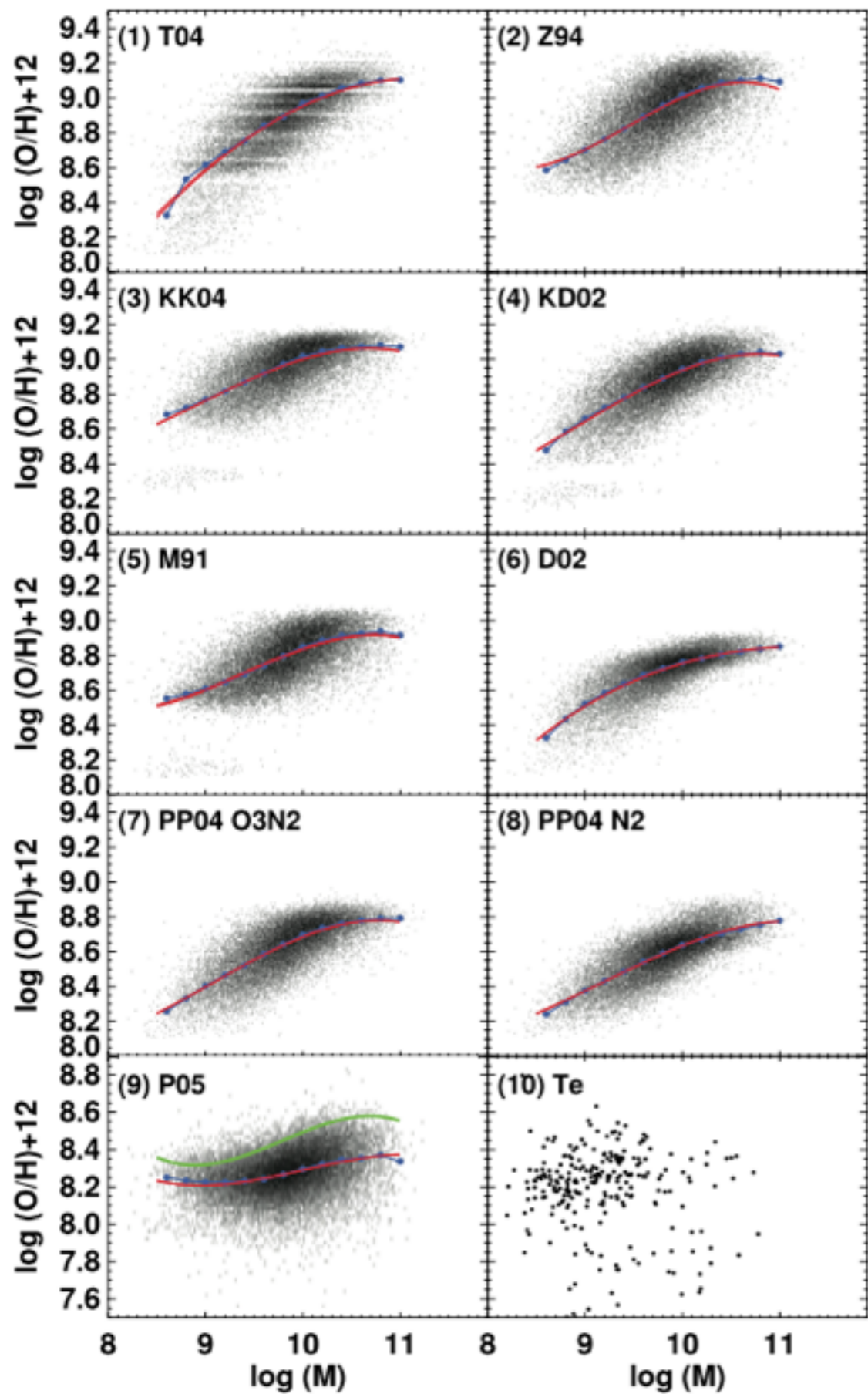
- Integral field surveys like CALIFA, MaNGA and SAMI greatly increased metal maps
- See a decline with radius
- Yet normalised to R_e , see a constant gradient, $\alpha_{(O/H)}$!



Sanchez et al. (2014)
see also Ho et al. (2015)

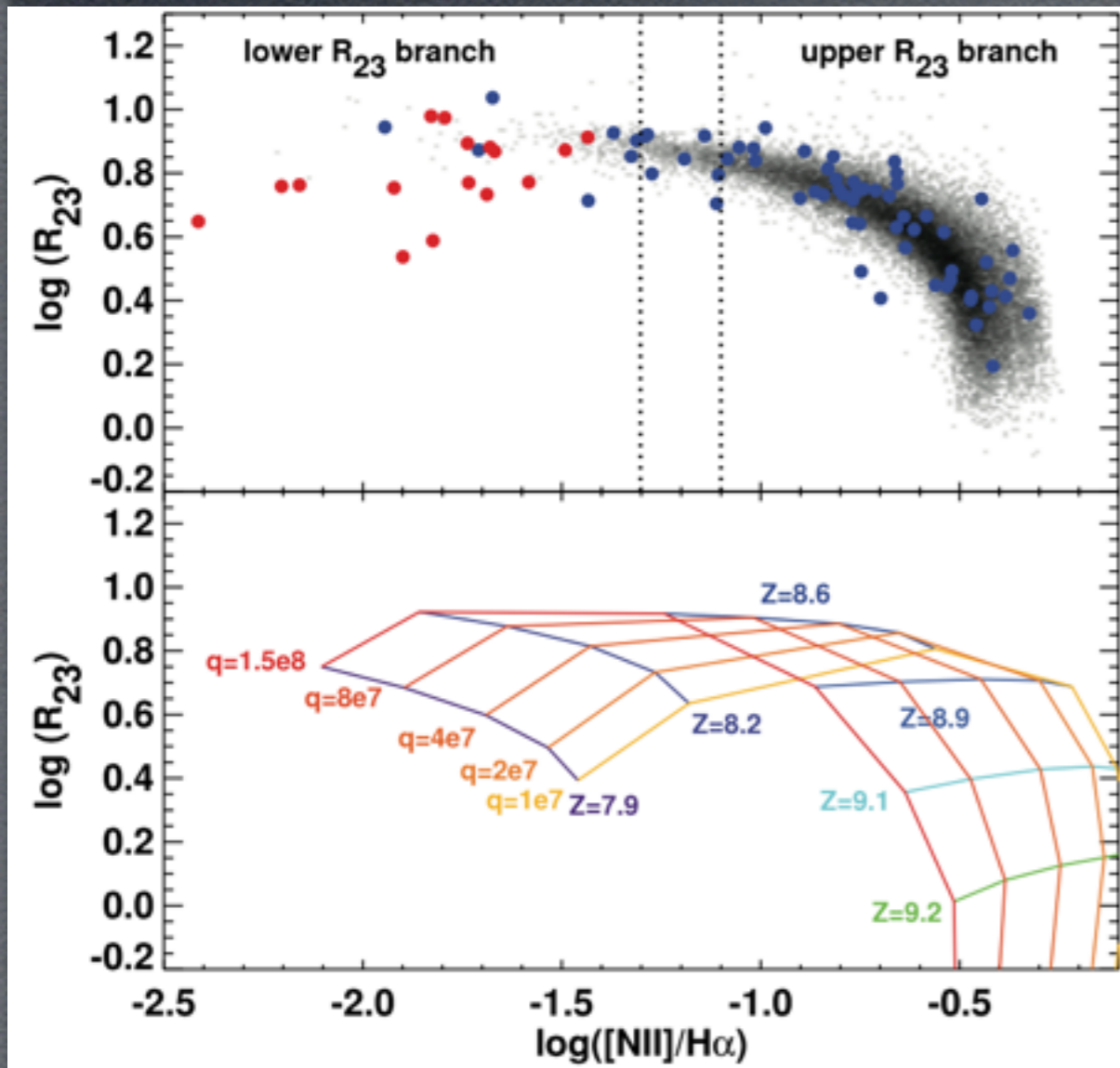
Metal Madness

- Yet we know the O/H determined depends STRONGLY on the diagnostic used



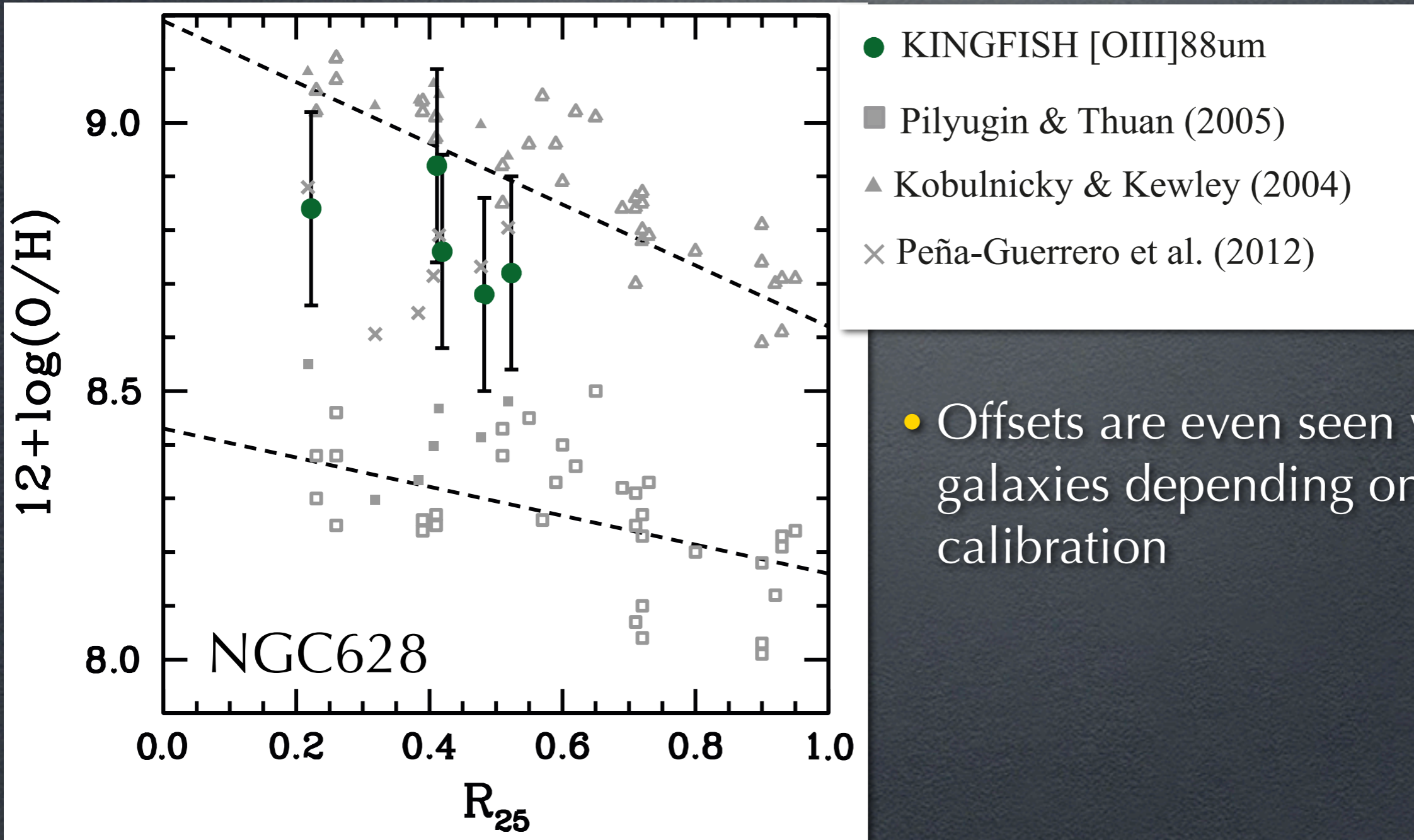
Metal Madness

- Yet we know the O/H determined depends STRONGLY on the diagnostic used
- These diagnostics are all dependent on physical conditions in ISM (pressure, ionisation)
- Also dependent on the models used (even T_e method!)



Kewley & Ellison (2008)

Metal Madness



- Offsets are even seen within galaxies depending on the calibration

Croxall, Smith, BG, et al. (2013)
(& Moustakas et al., 2010 Data)

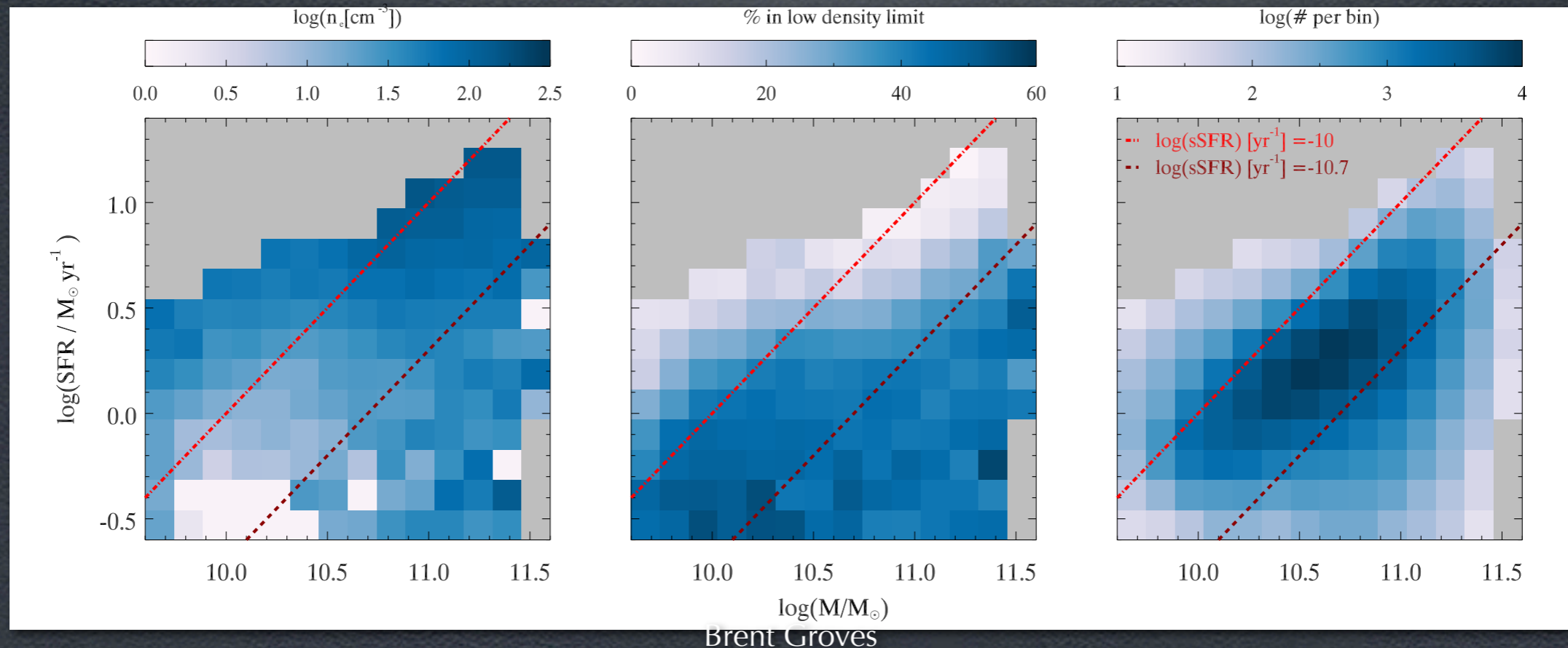
Feeling dense?



Melanie
Kaasinen

- In the high- z Universe we see an increase in gas phase density from [OII] 3726/3729 ratio
- Locally see the same with with \uparrow SFR in SDSS with [SII] 6716/6731 ratio
- Metallicity diagnostics depend on ISM density/
Pressure!

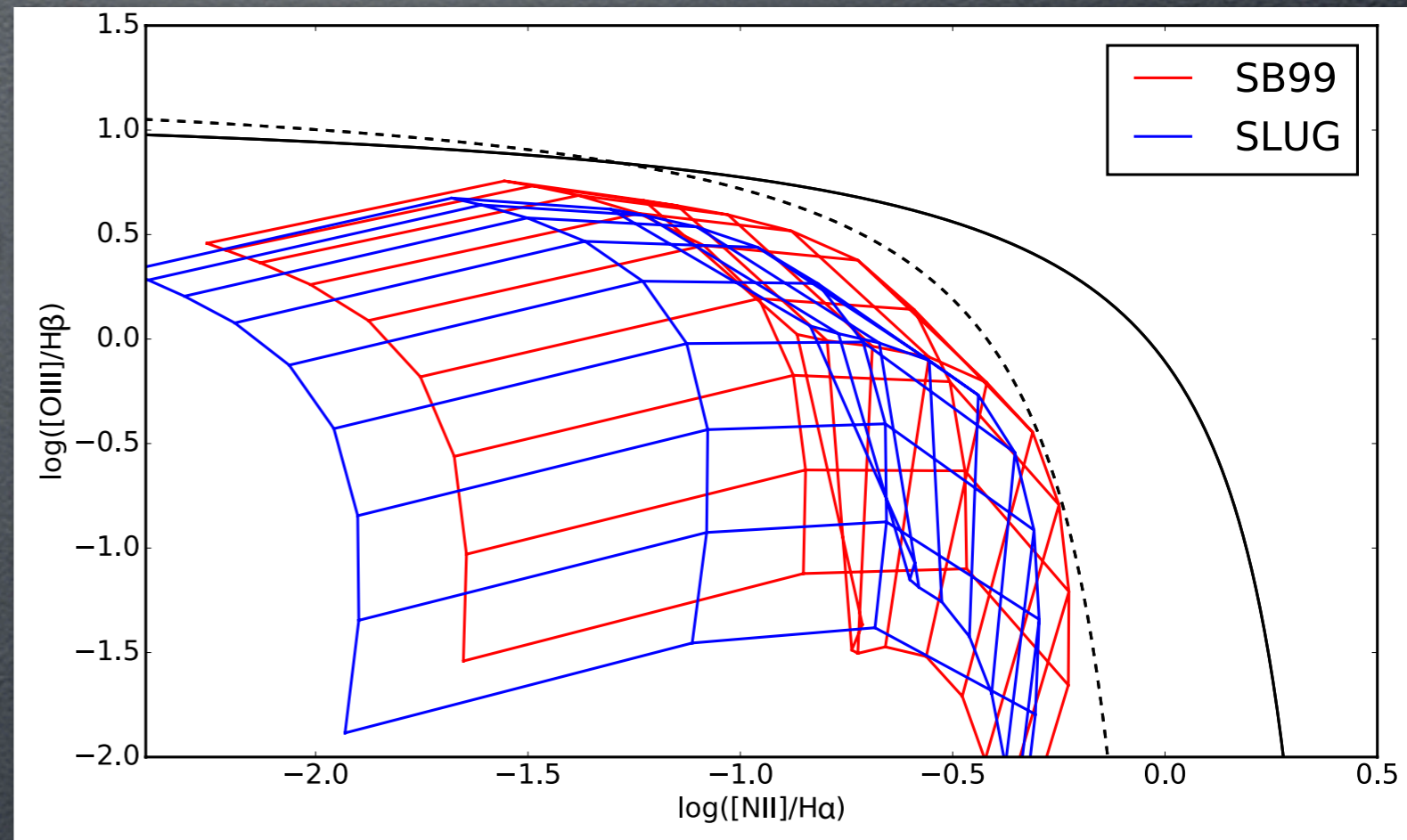
Kaasinen, BG, LK et al. (subm.)



Synthesizing Systematics

D'Agostino, BG, LK et al. (in prep.)

- The basis models also have severe impacts
- Starburst99 (Leitherer+99,03)
- SLUG (da Silva+14)
- Using same stellar tracks & atmospheres
- but different interpolation
- This leads to different strong line metal calibrations!



Joshua
D'Agostino



Metallicity

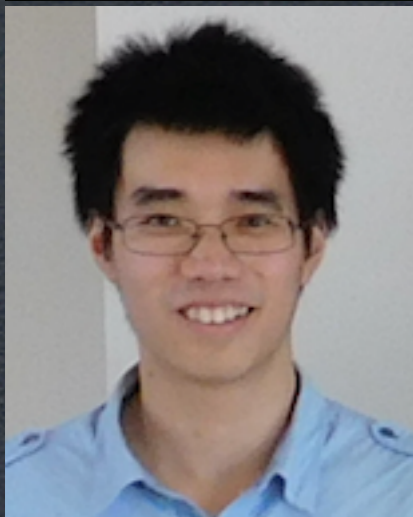
GAMA492414



5"
└───┘

- SAMI galaxies with high H α S/N
- Face on
- Significant fraction of fibres

- Test multiple metallicity diagnostics on resolved data!



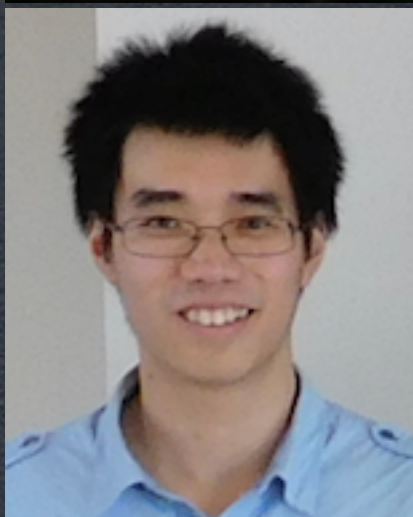
Henry
Poetrodjojo

Metallicity

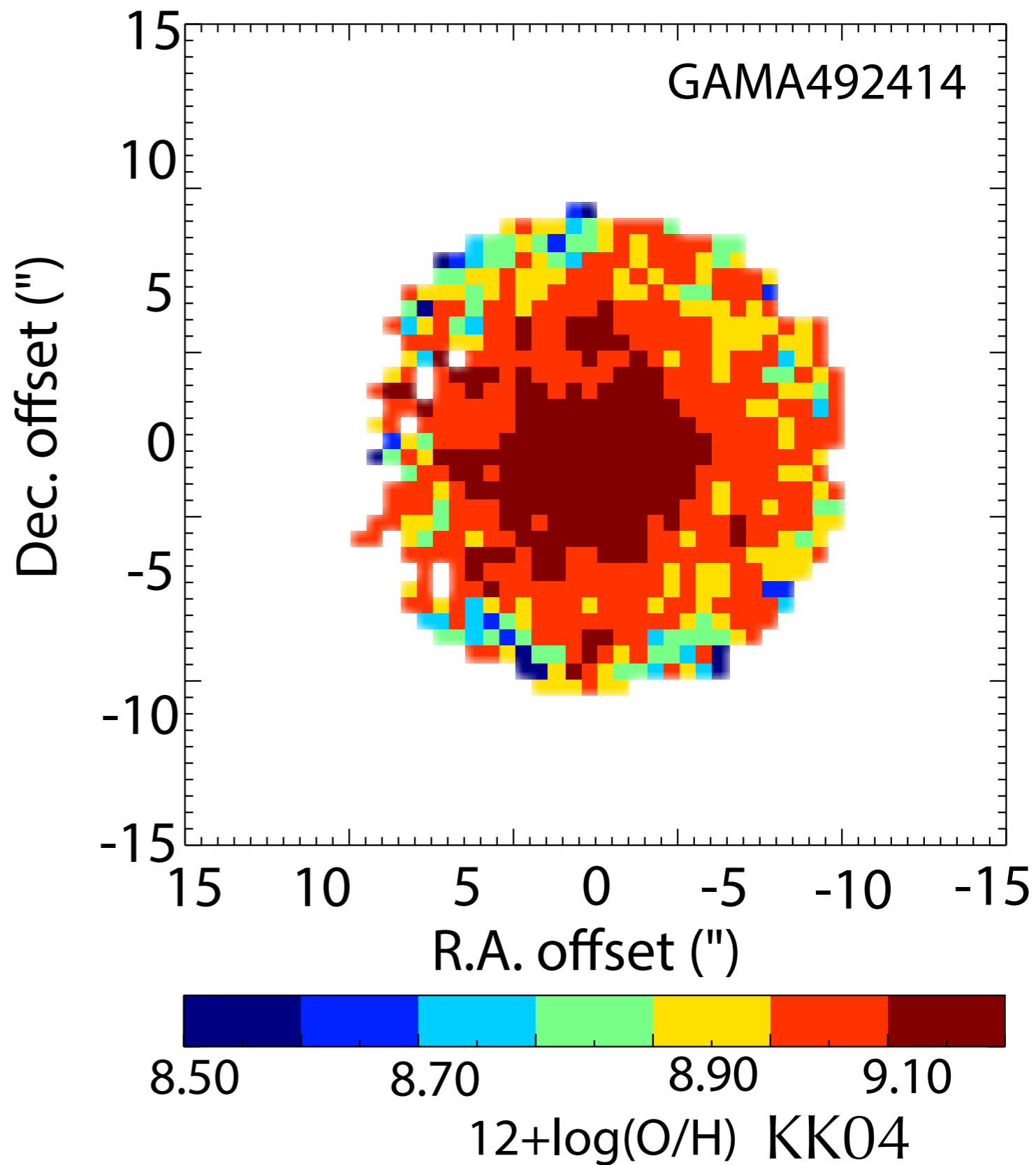
GAMA492414



5"



Henry
Poetrodjojo

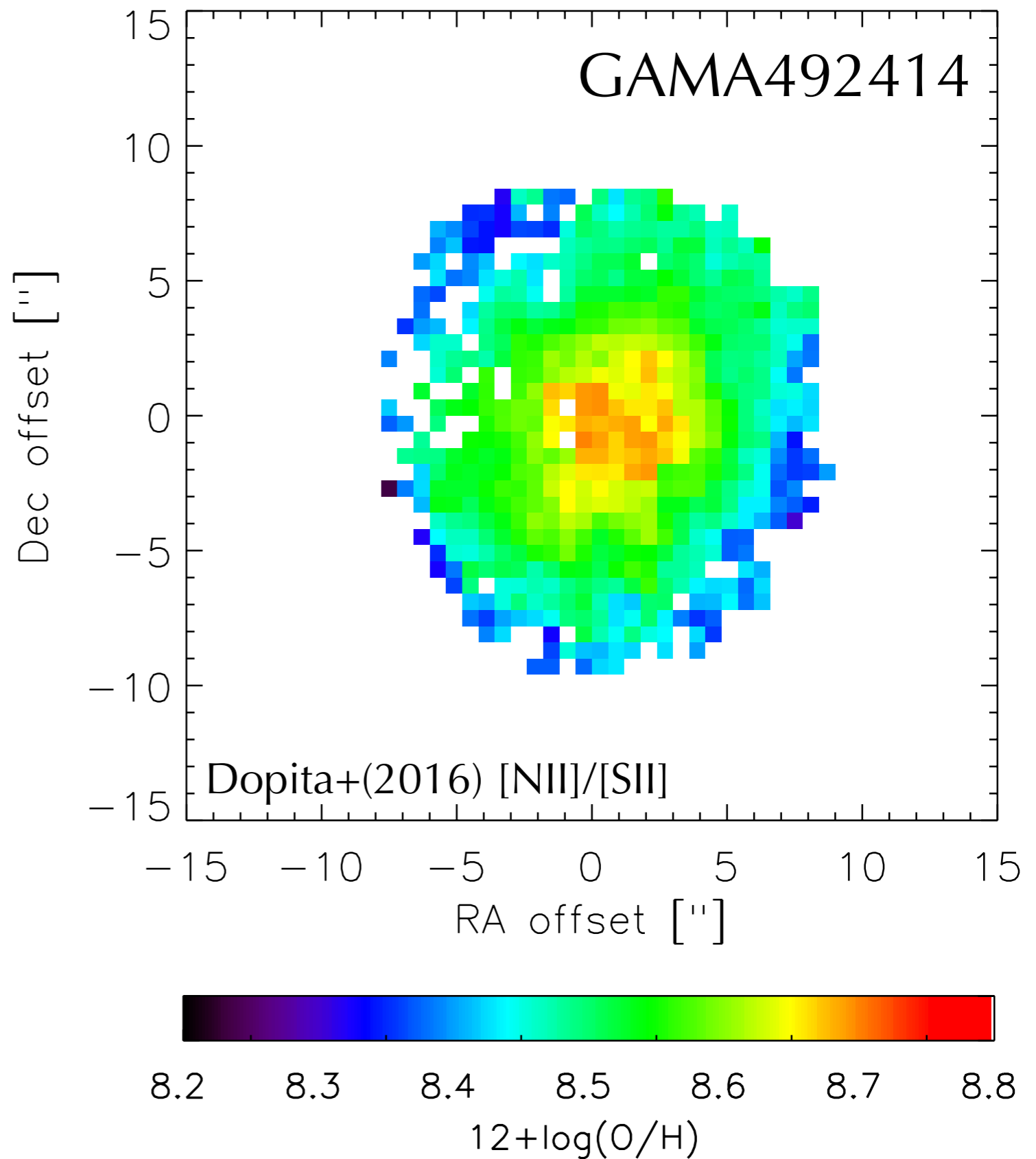


Metallicity

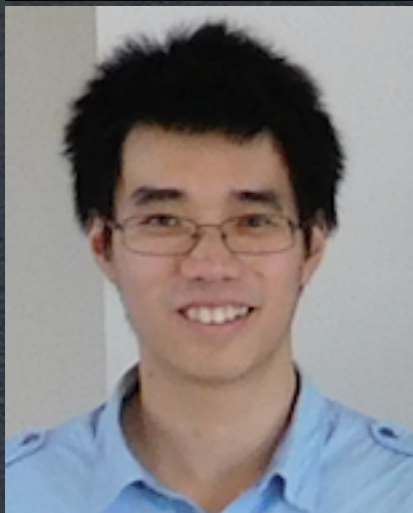
GAMA492414



5''



Poetrodjojo, BG, LK et al. (sub



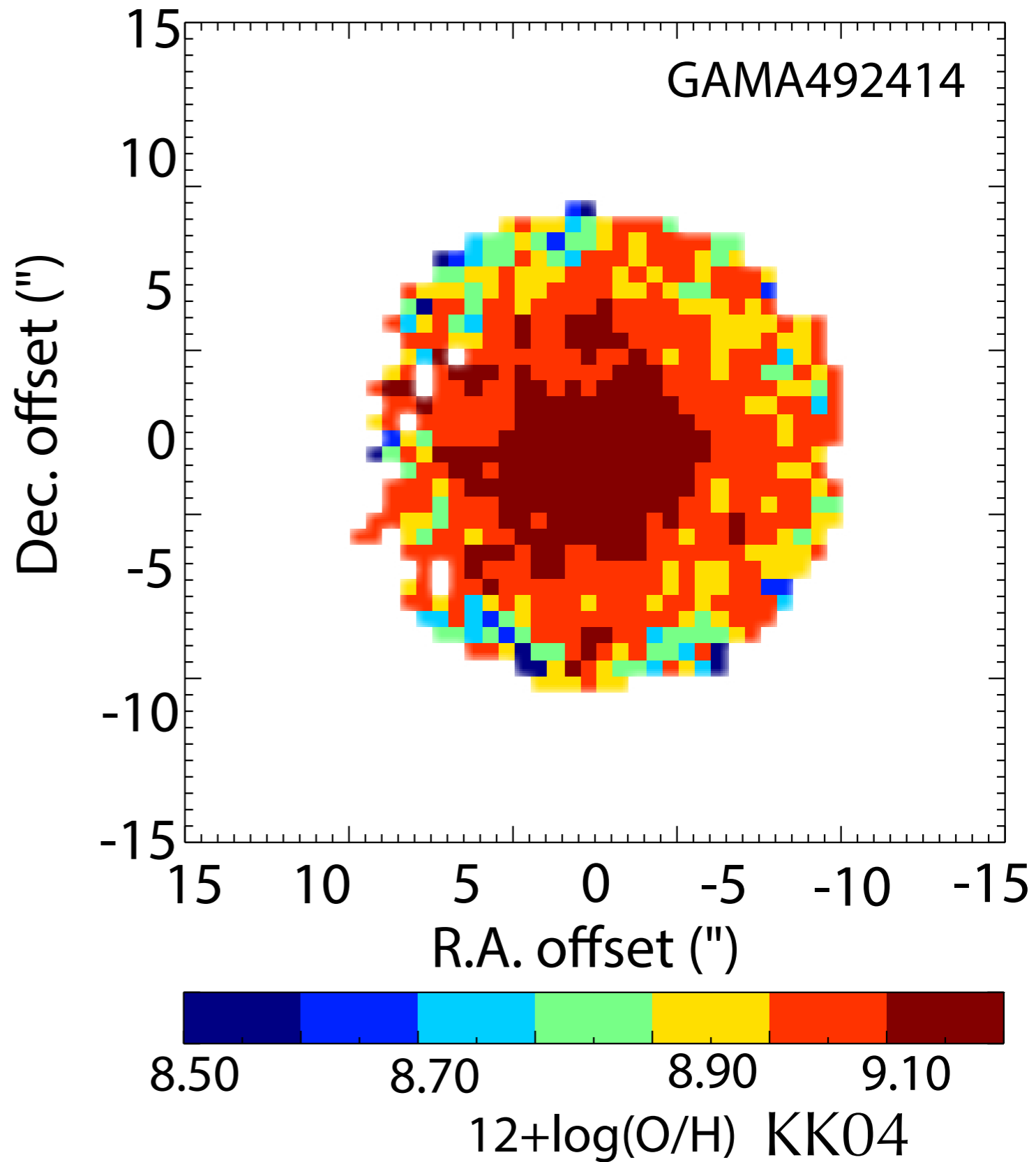
Henry
Poetrodjojo

Metallicity

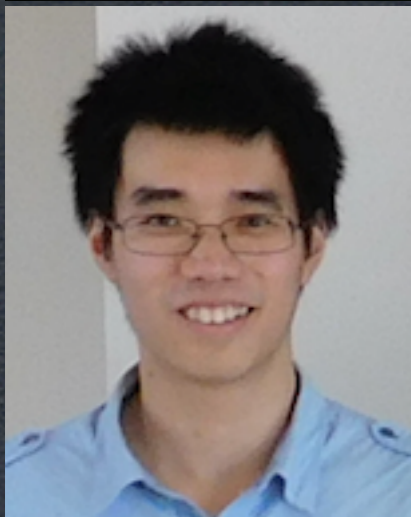
GAMA492414



5"

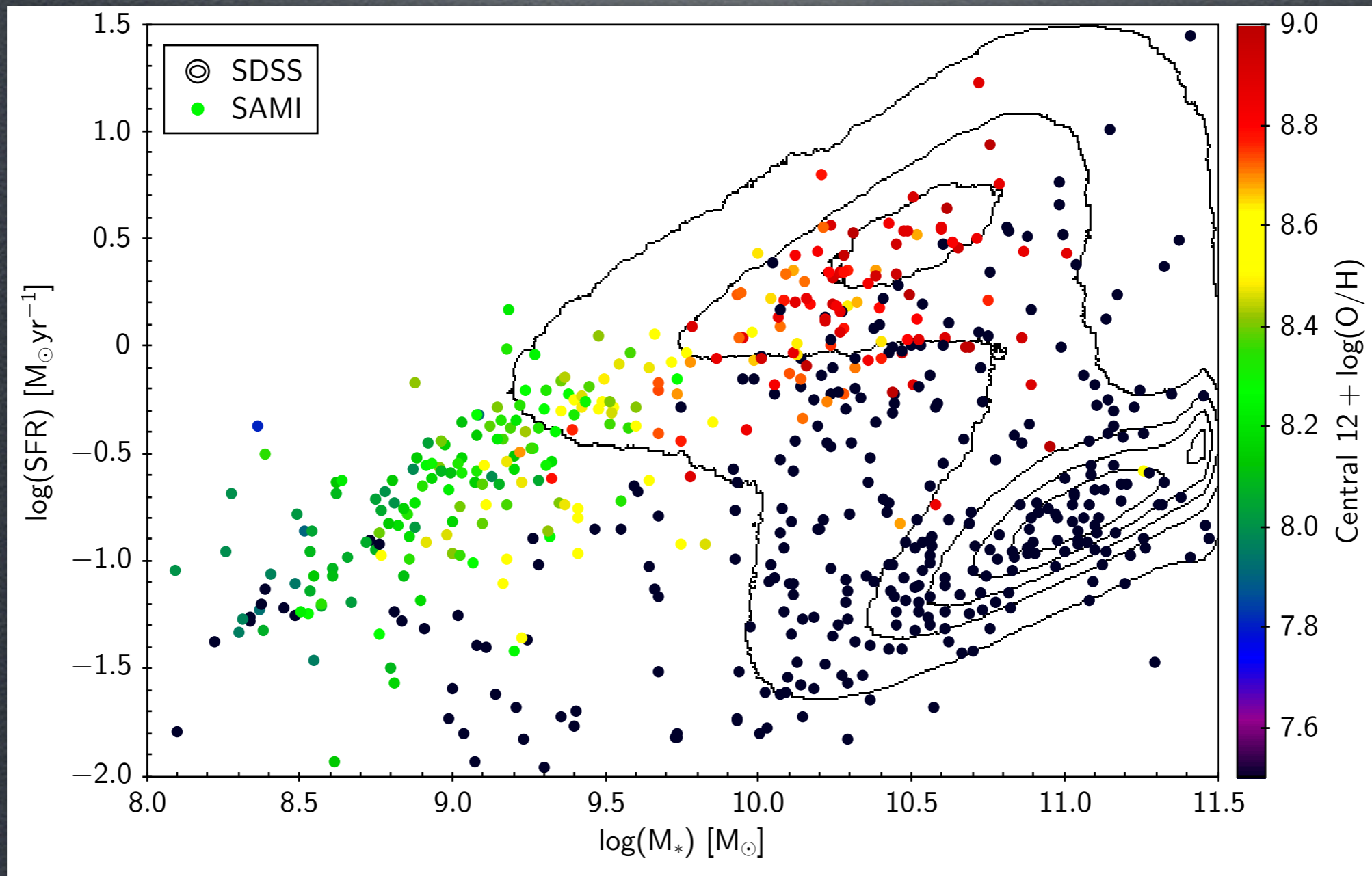


Poetrodjojo, BG, LK et al. (sub

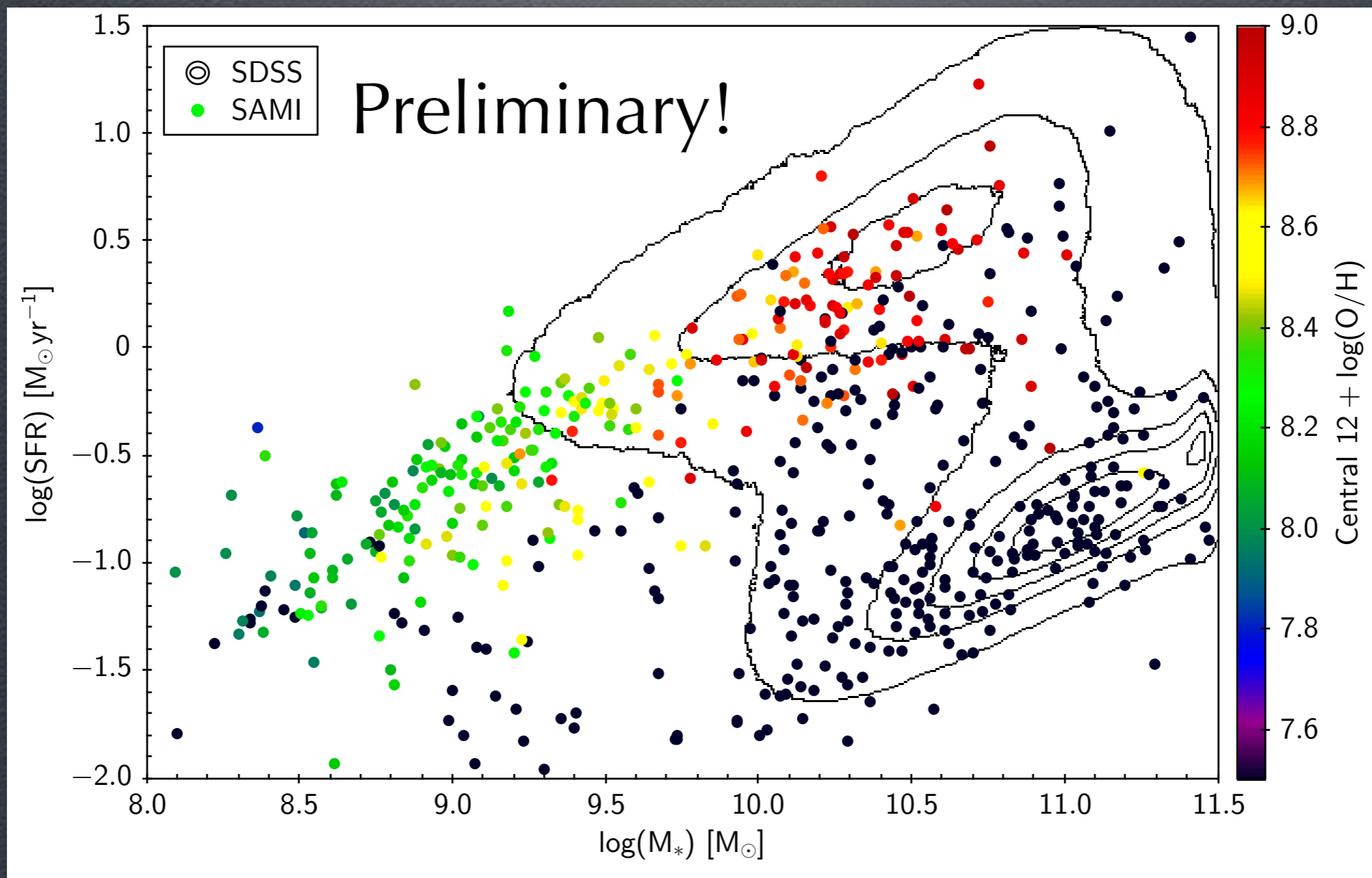


Henry
Poetrodjojo

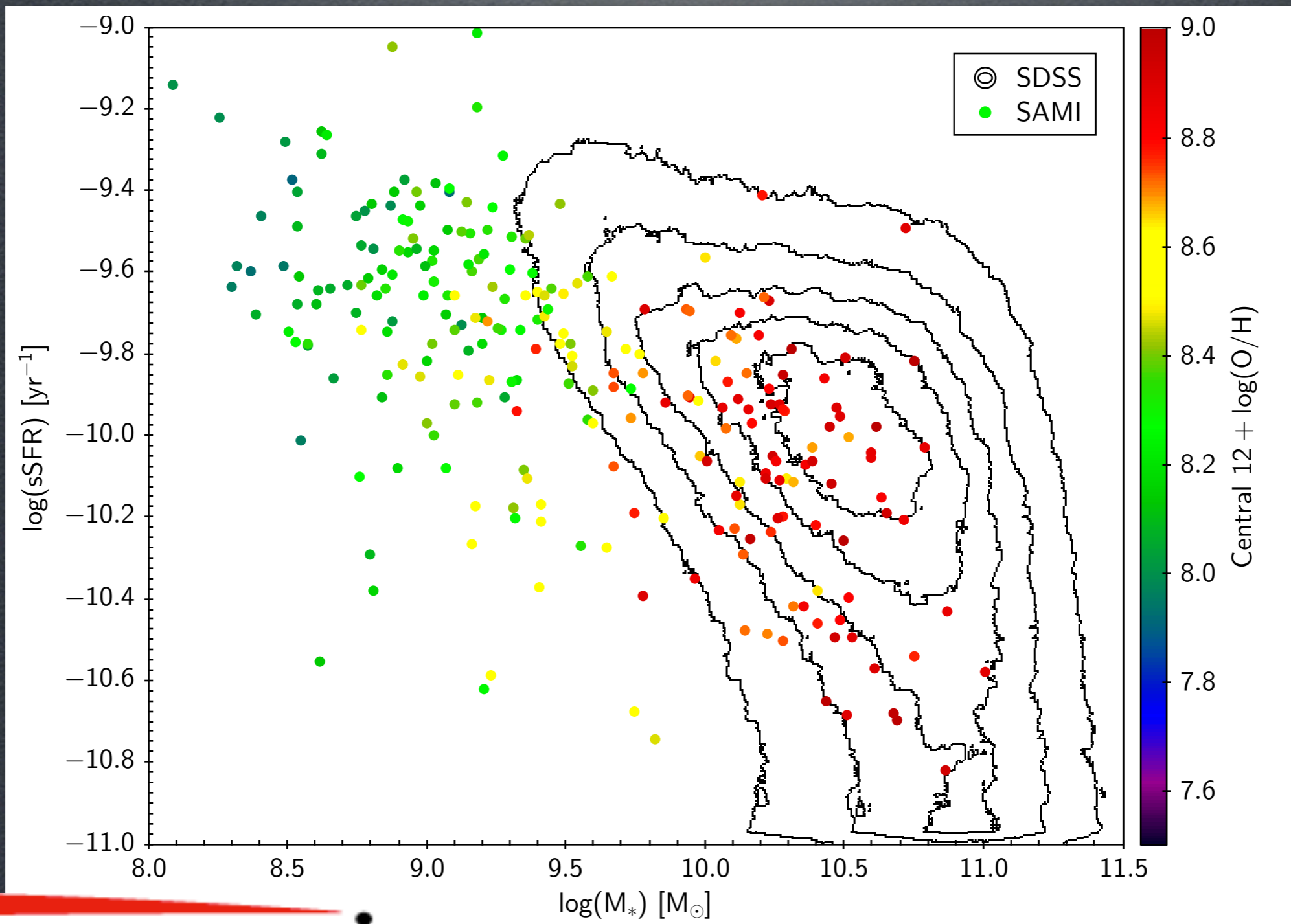
SAMI Mass-Metallicity



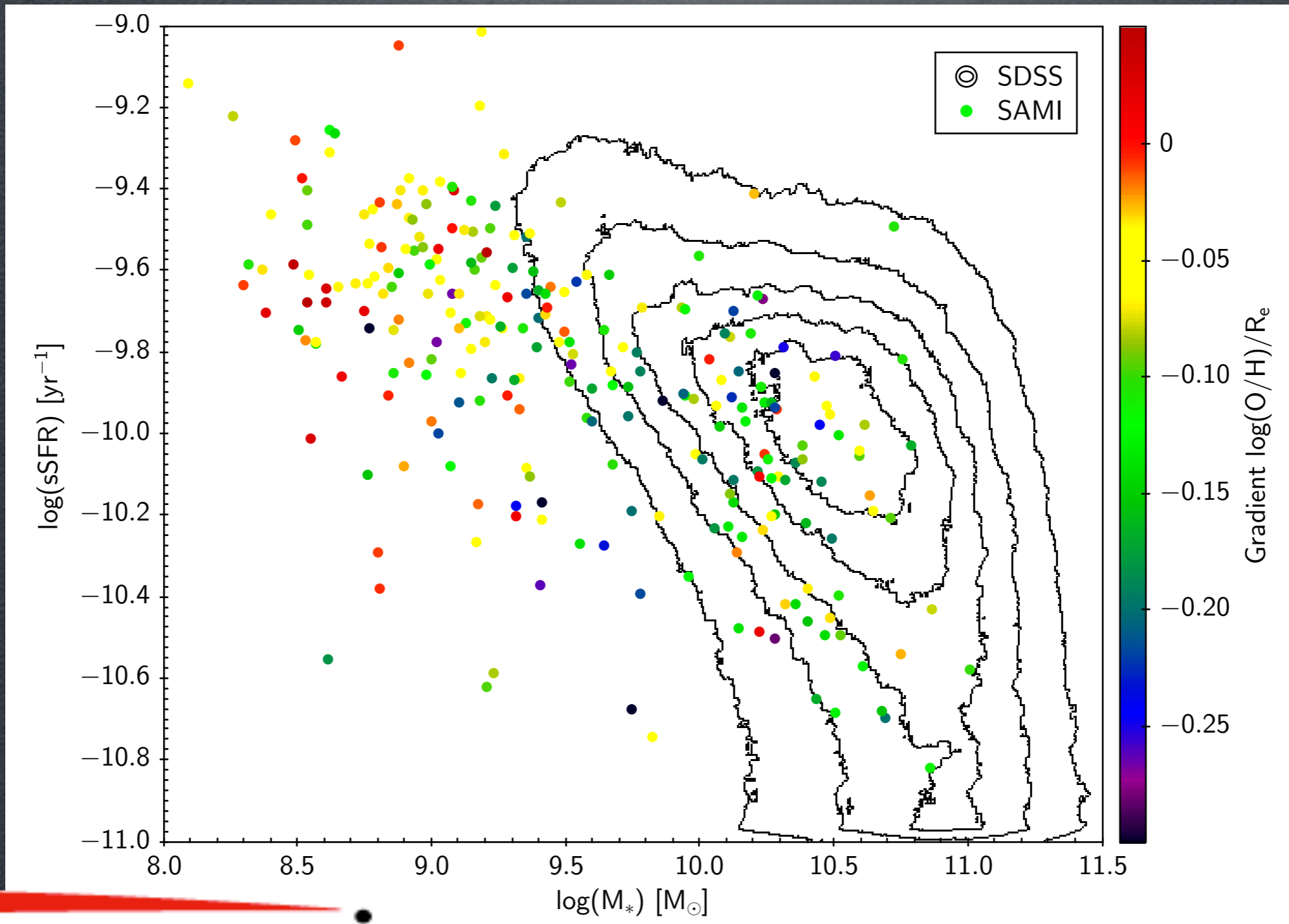
SAMI Mass-Metallicity



SAMI Mass-Metallicity



SAMI Mass-Metallicity





Those Devilish Metals

- Gas-phase metallicity follows the stellar mass of the galaxies
- Internally we see a consistent gradient of (O/H) with R_e independent of galaxy
- Yet we see no variations of (O/H) or gradient with specific Star Formation Rates

- BUT beware of internal and systematic effects
 - Density does vary with SFR
 - Metallicity depends on diagnostics and systematics