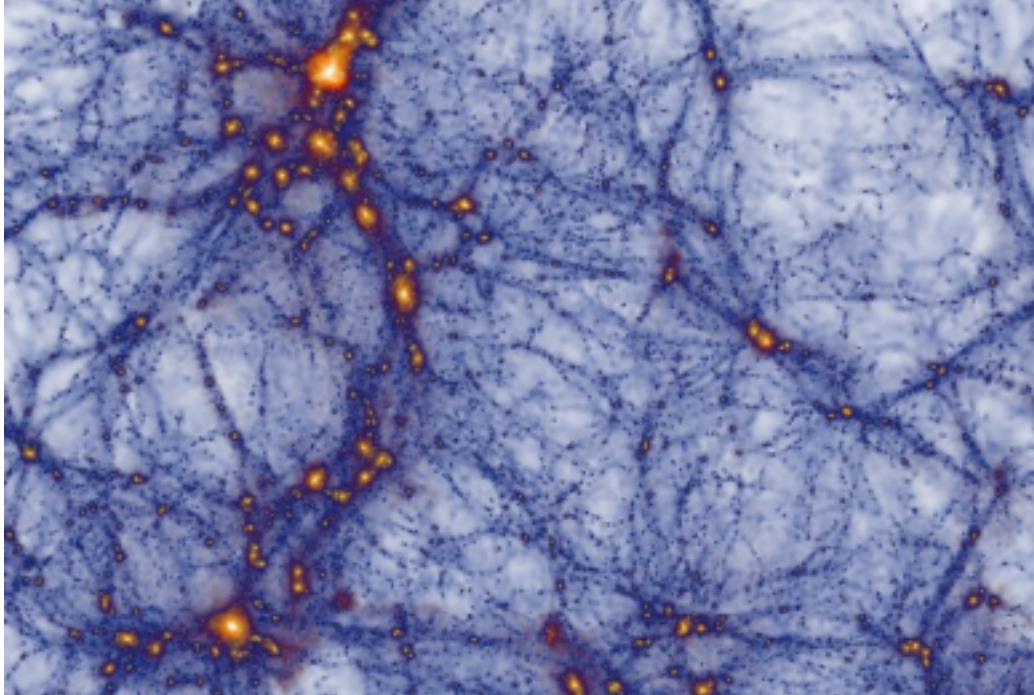


An Excess of Dusty Starbursts at $z=2.2$

Helmut Dannerbauer (Vienna)

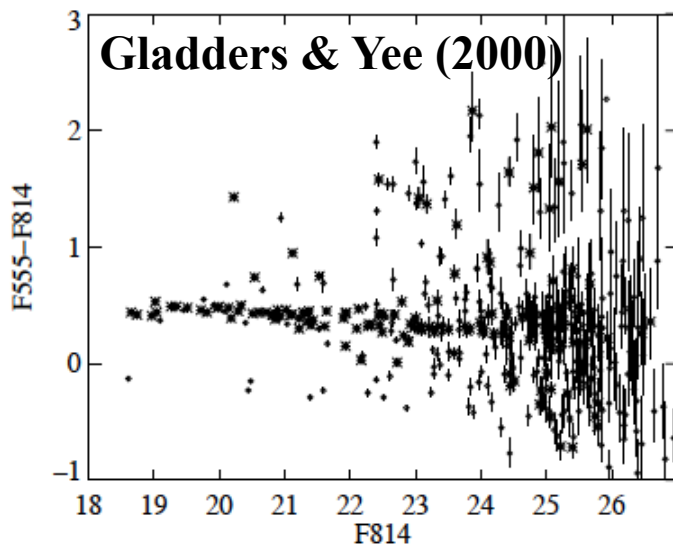


Kurk, De Breuck, Altieri, Coia, Emonts, Galametz, Hatch, Kodama, Koyama, Miley, Röttgering, Seymour, Tanaka, Sanchez-Portal, Santos, Valtchanov, Venemans, Ziegler

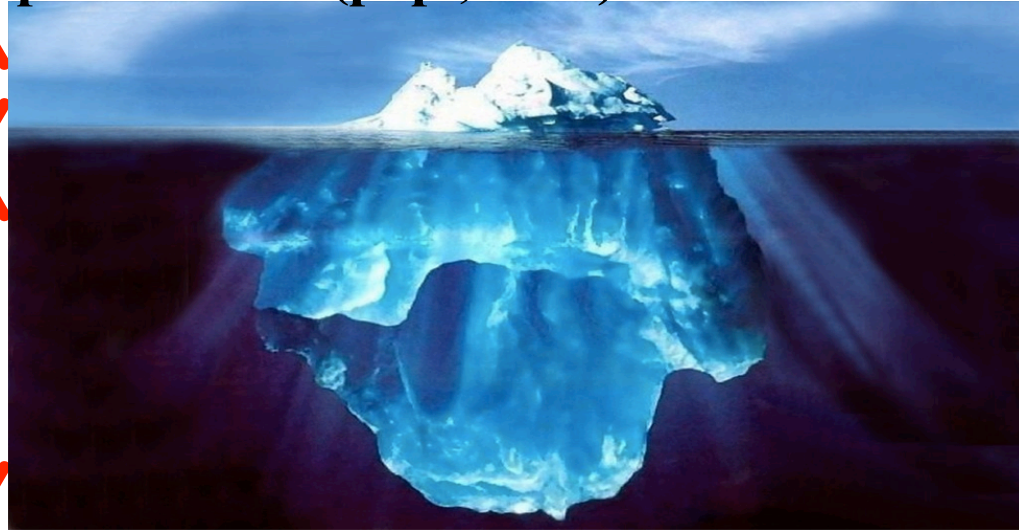
→ *Dannerbauer, Kurk, De Breuck et al., A&A, submitted*

Motivation

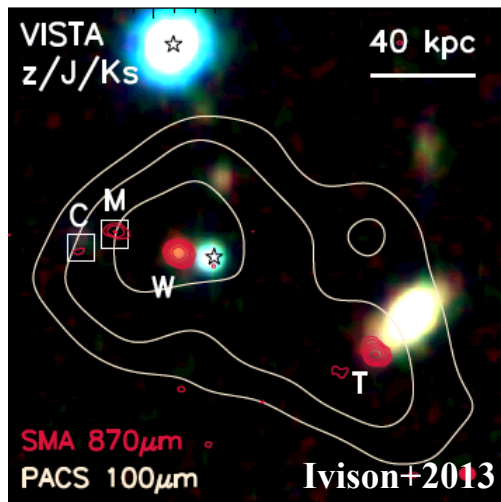
formation red sequence



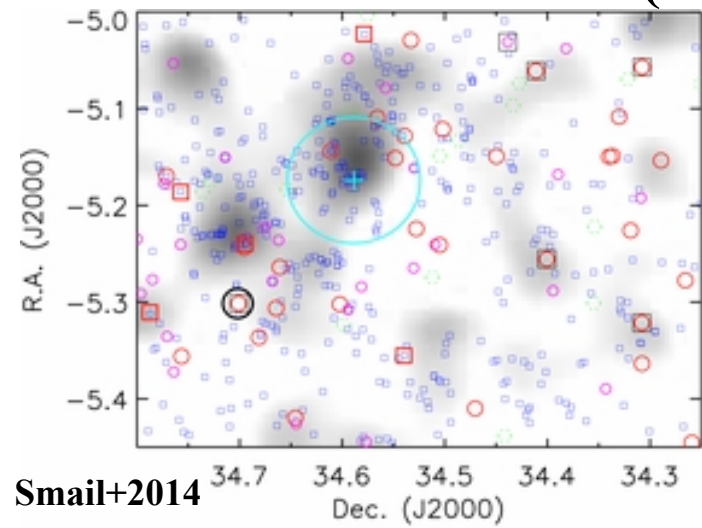
complete census (pop., SFR) of overdensities



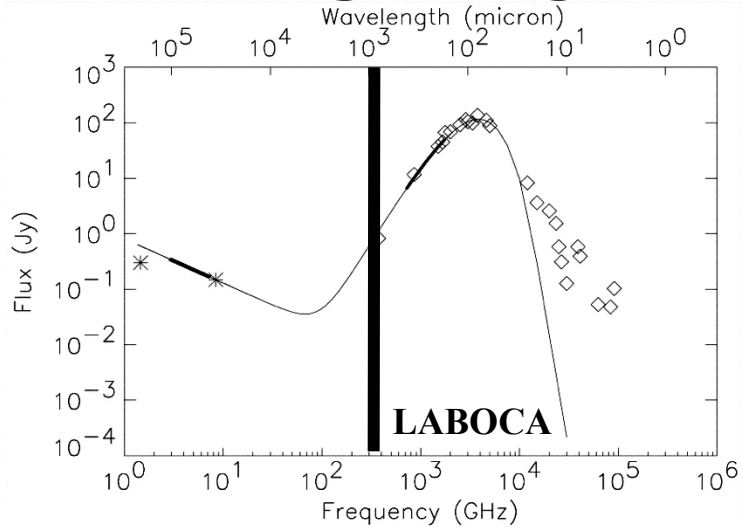
SMGs within overdensities



search for overdensities in the (sub)mm



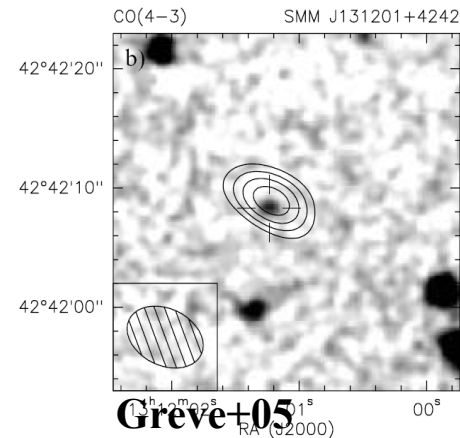
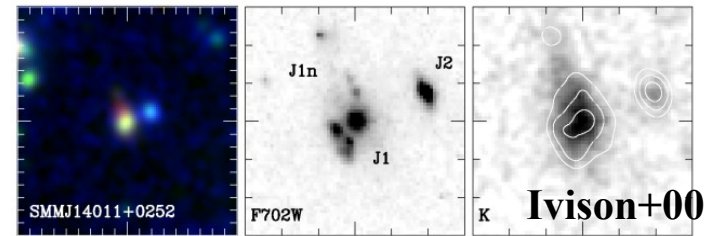
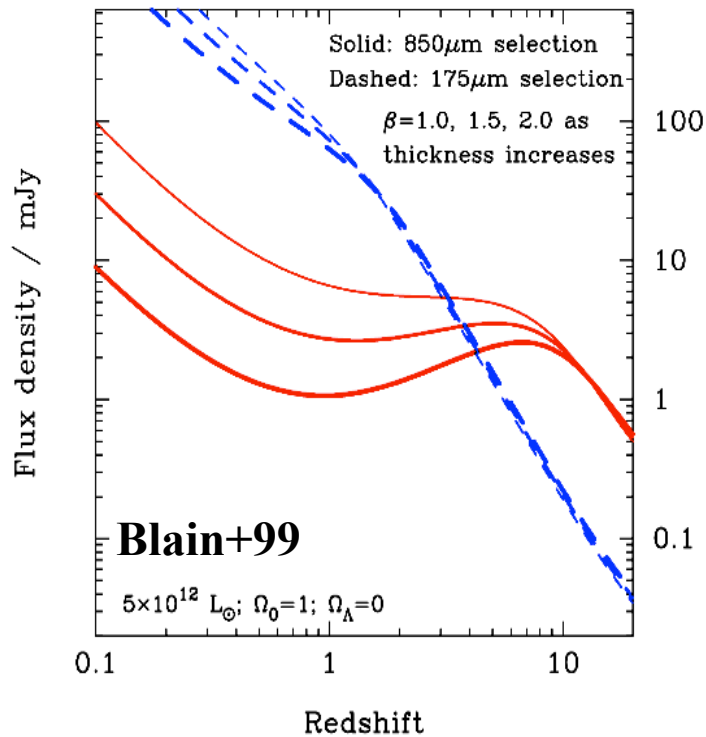
Detecting Large Scale Structure in the (Sub)mm



Submm-selected galaxies (SMGs):

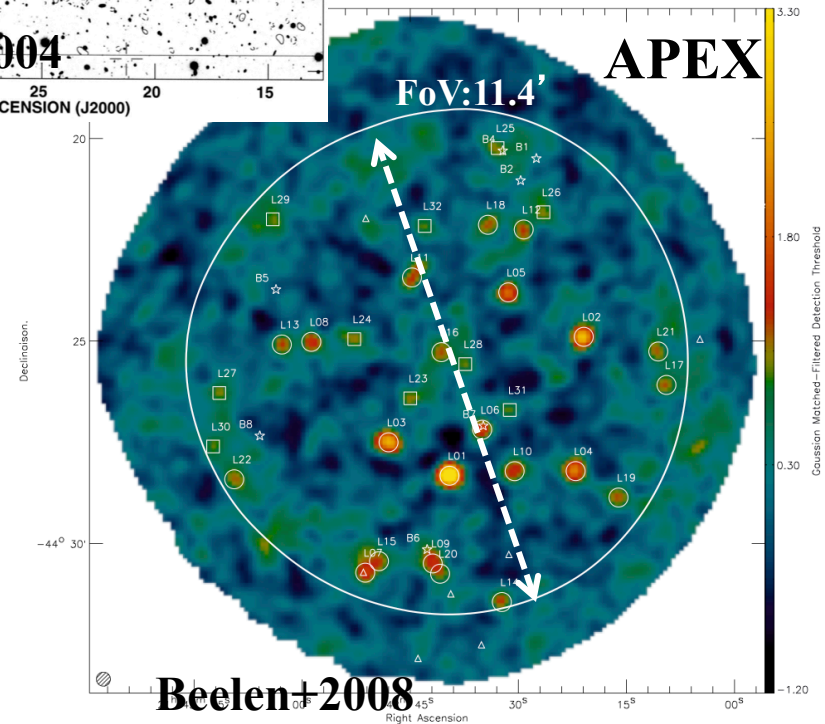
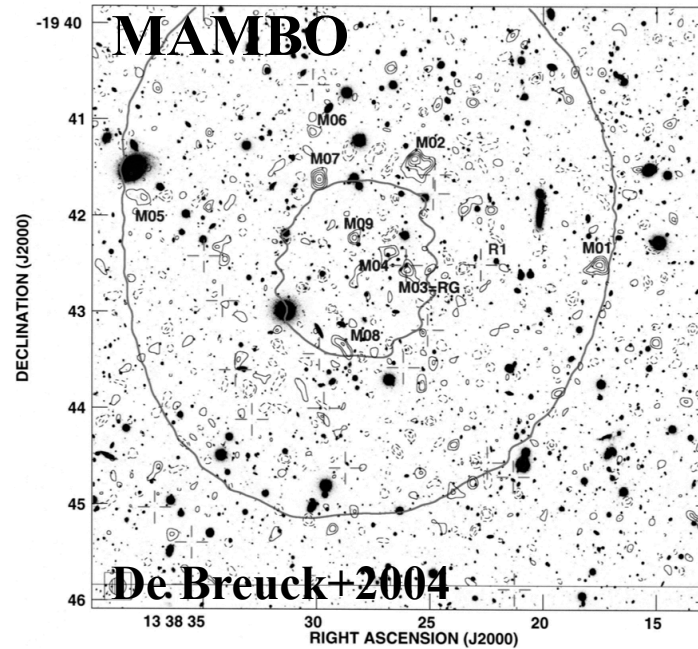
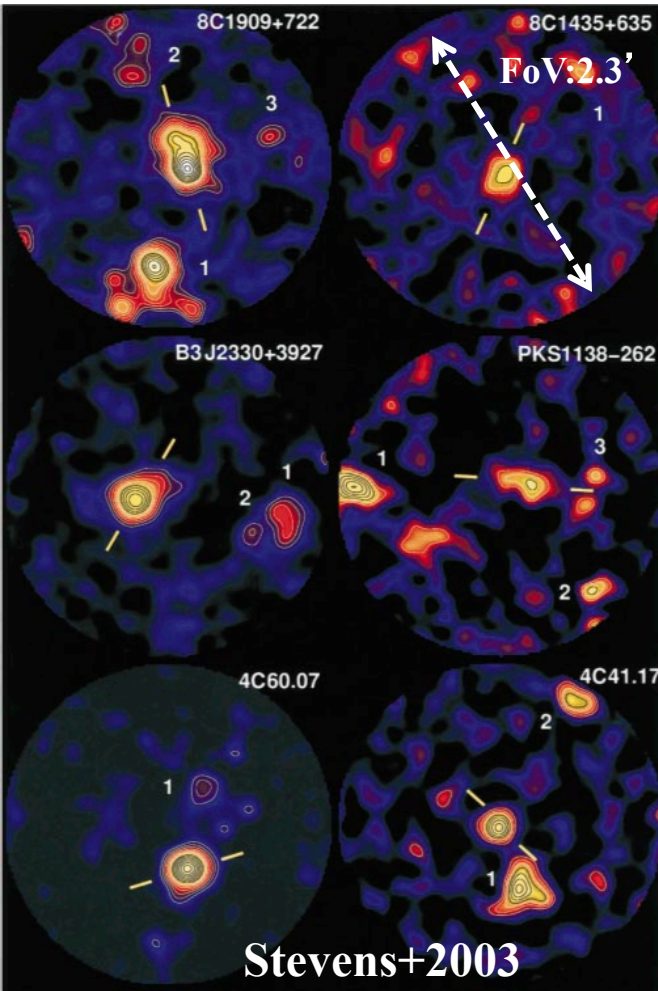
- very massive up to $10^{11} M_{\odot}$
- gas-rich
- high SFR: several $1000 M_{\odot}/\text{yr}$
- merger-like morphology
- ellipticals in formation
- average redshift $z=2.2$

➔ *excellent tracers of mass-density peaks*



Previous Work

SCUBA

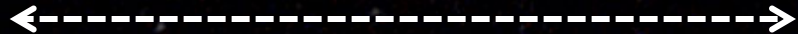


Protocluster MRC1138 @ $z=2.16$

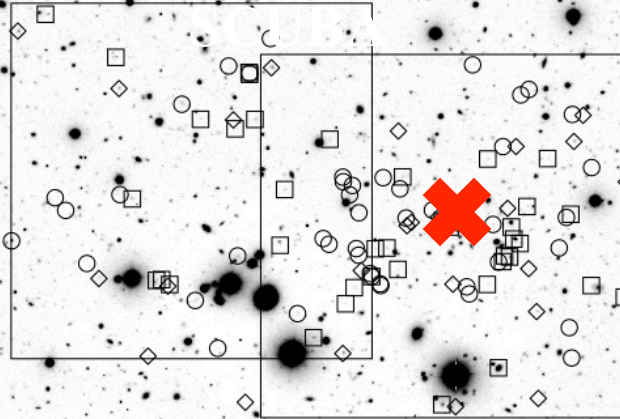
Miley+2006



13arcsec

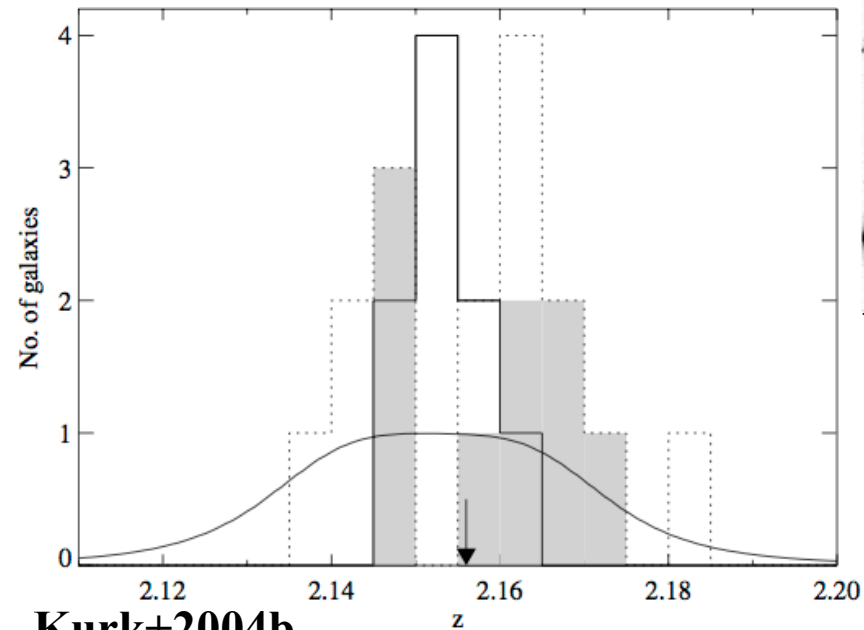
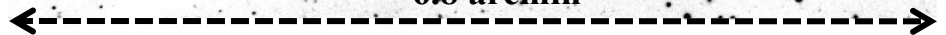


Kurk+2004a



◇ LAE
□ HAE

6.8 arcmin



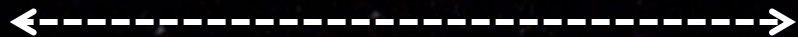
Kurk+2004b

Protocluster MRC1138 @ $z=2.16$

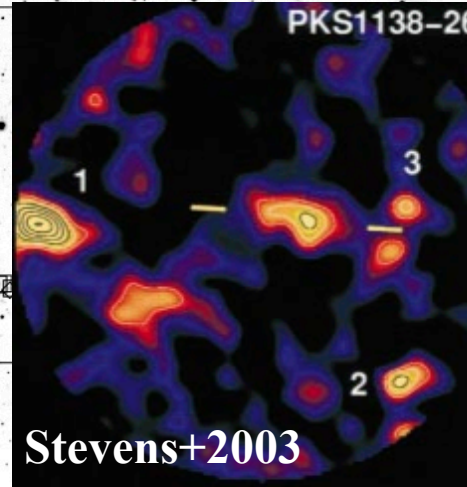
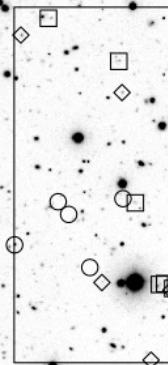
Miley+2006



13arcsec



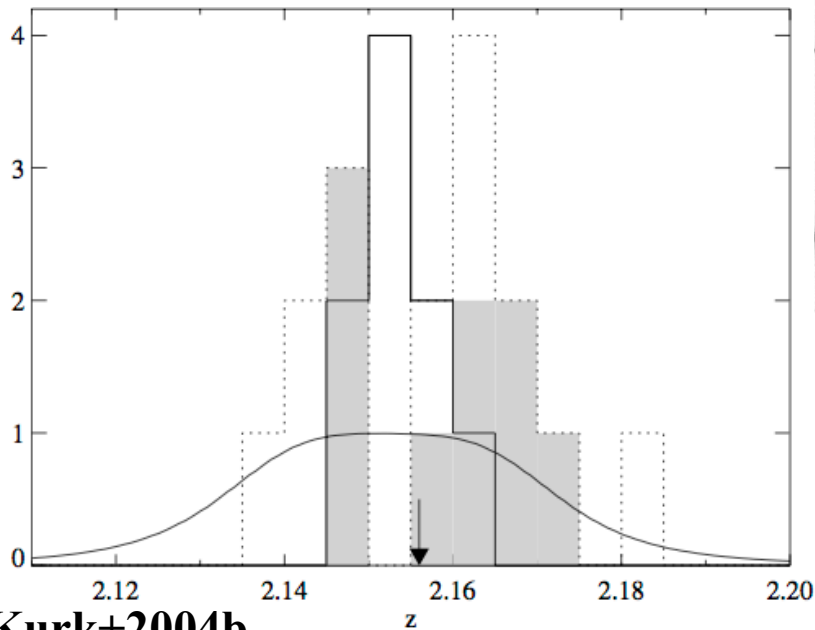
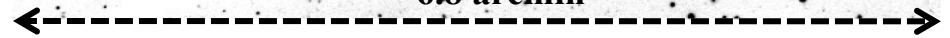
Kurk+2004a



Stevens+2003

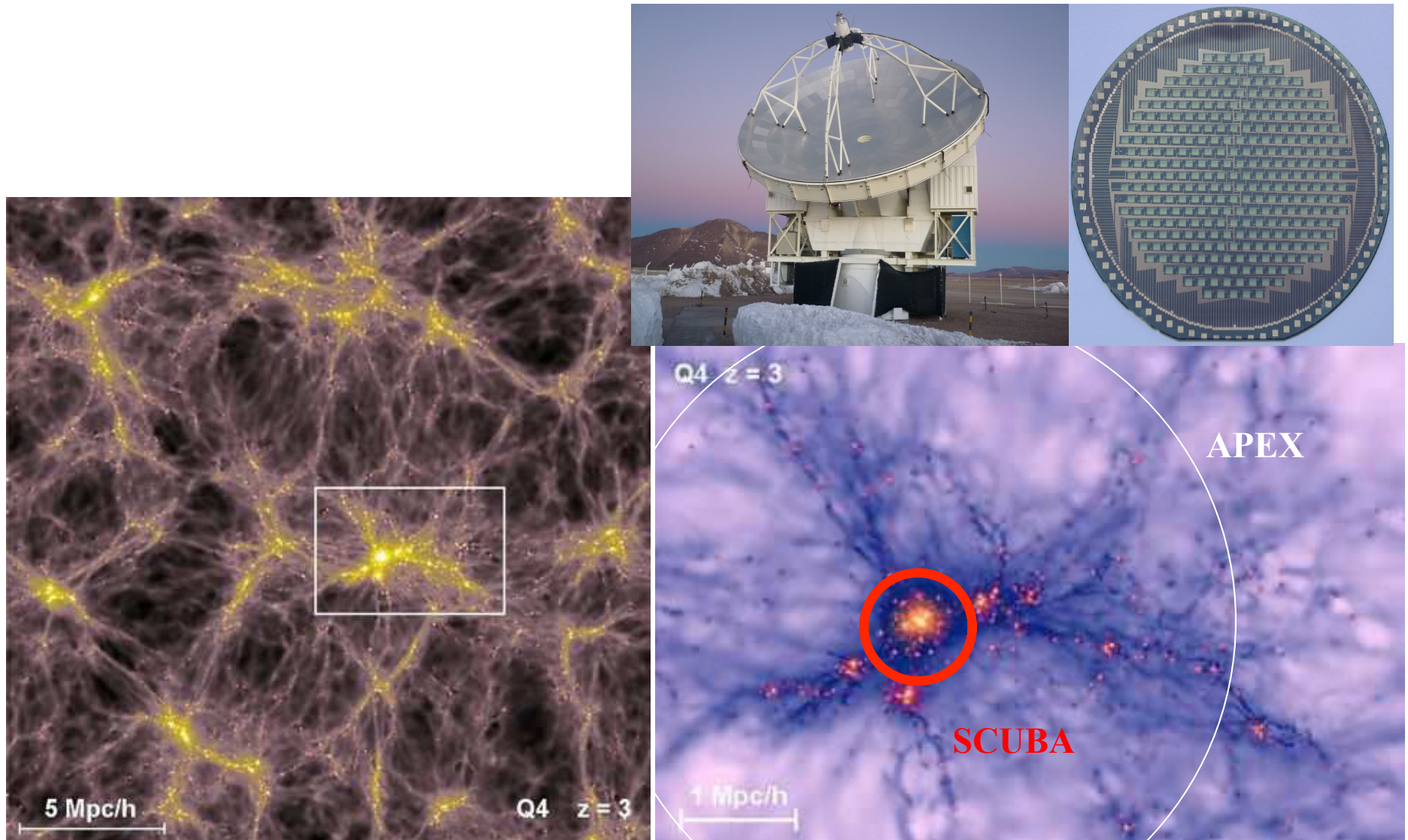
◇ LAE
□ HAE

6.8 arcmin



Kurk+2004b

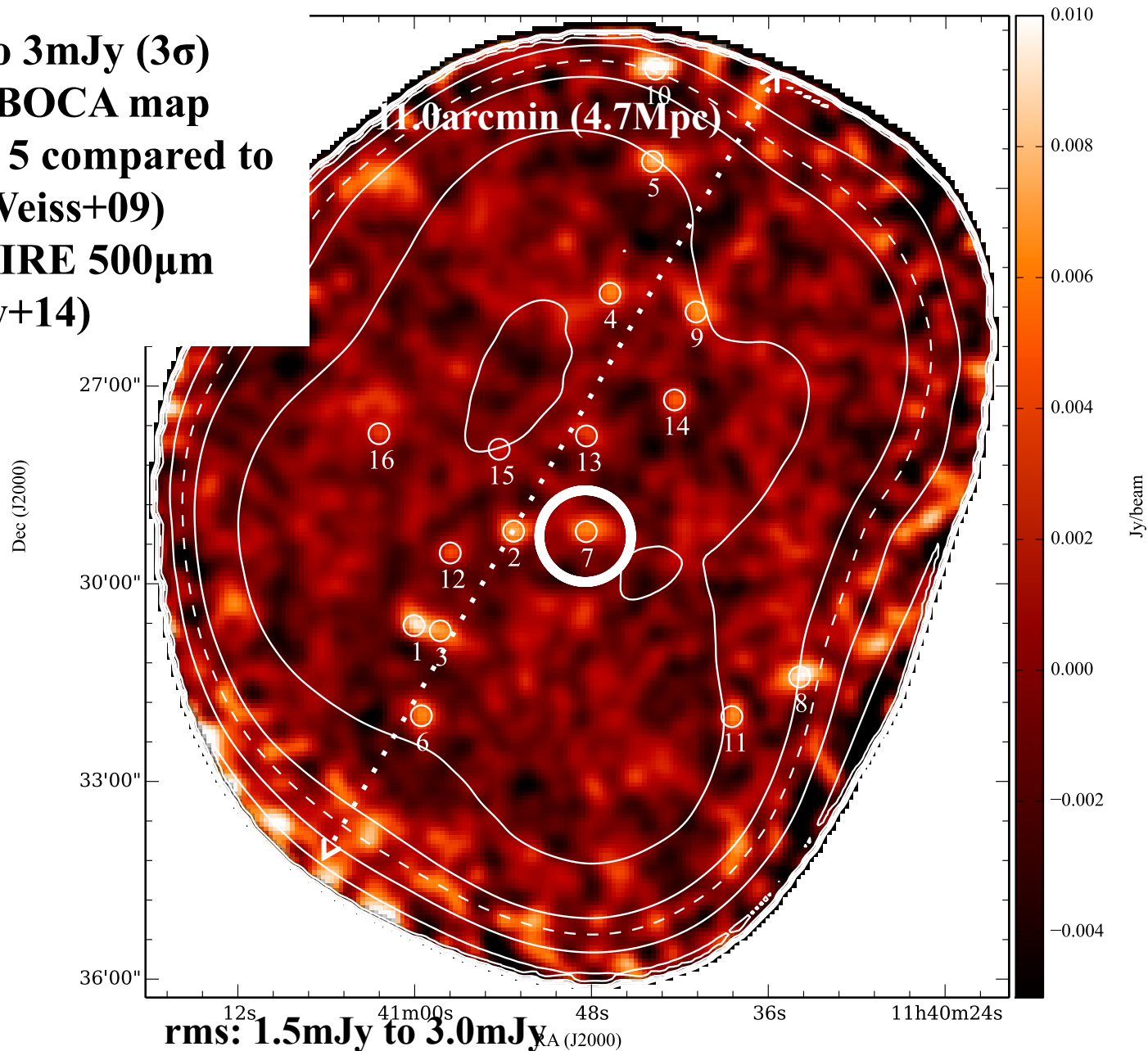
APEX LABOCA Observations



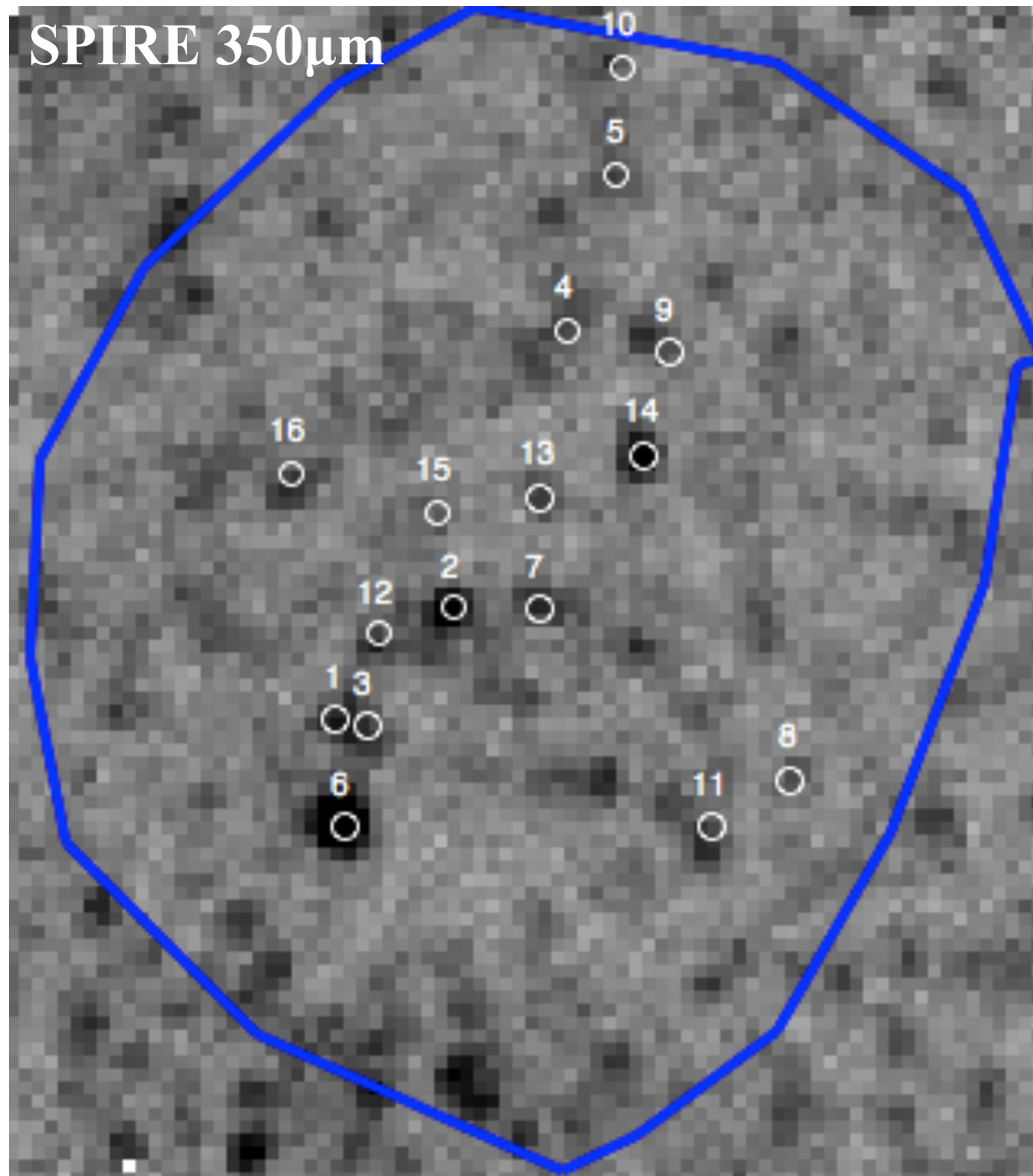
Springel & Hernquist (2003)

APEX LABOCA Observations

- 16 sources down to 3mJy (3σ)
- one of deepest LABOCA map
- overdensity factor 5 compared to blank fields (e.g. Weiss+09)
- consistent with SPIRE 500 μ m overdensity (Rigby+14)



Source Reliability - Herschel Counterparts



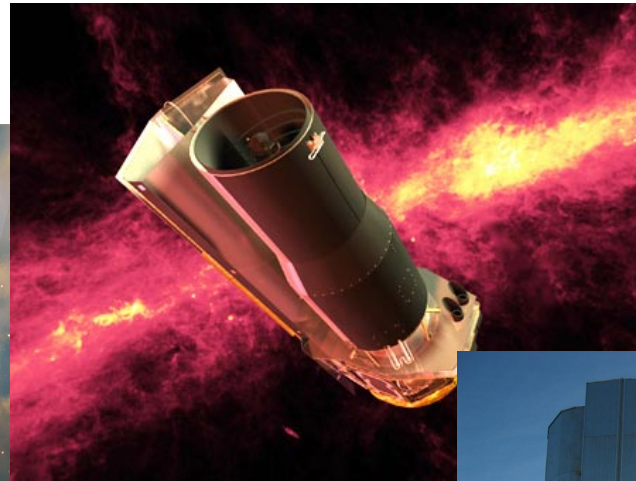
Vatlchanov+2013; Rigby+2014

Identification Work

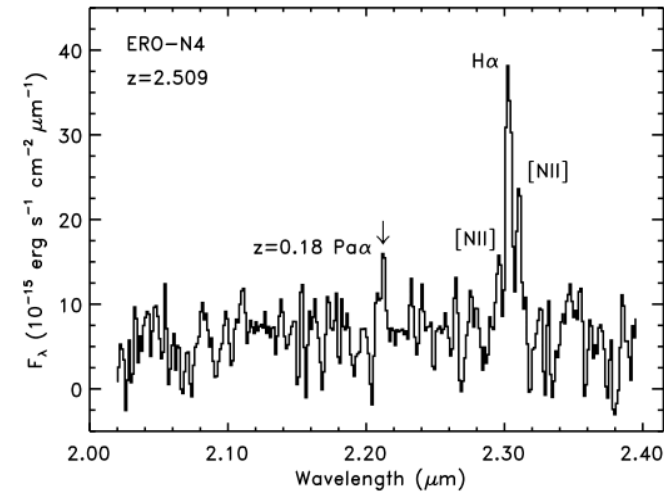
- best approach would be mm-interferometry



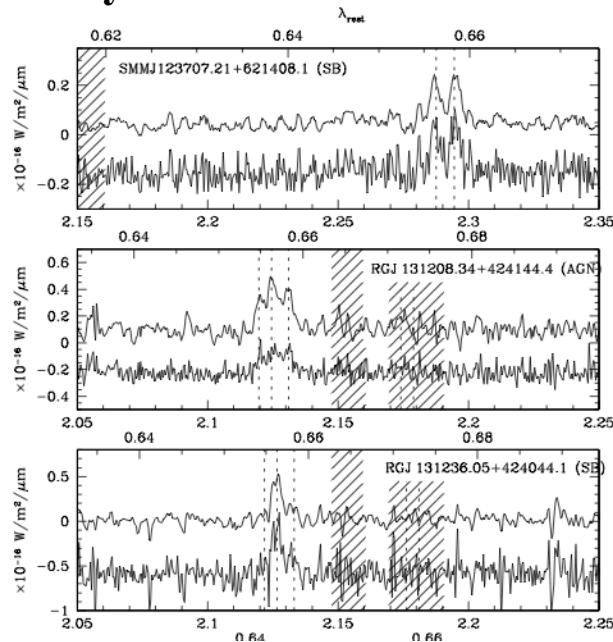
- counterpart identification could be done based on probabilistic statistic
→corrected Poissonian Probability (Downes+86)



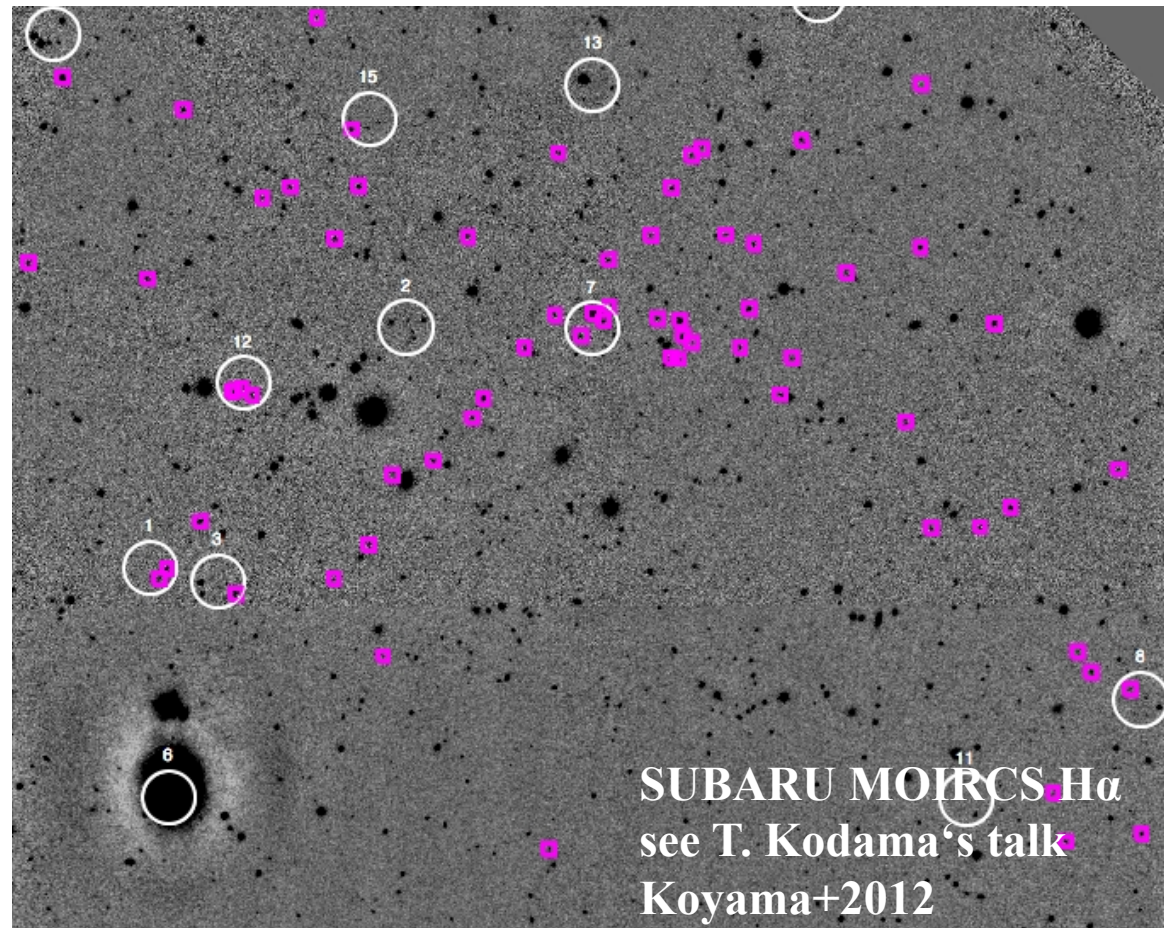
HAEs associated with SMGs



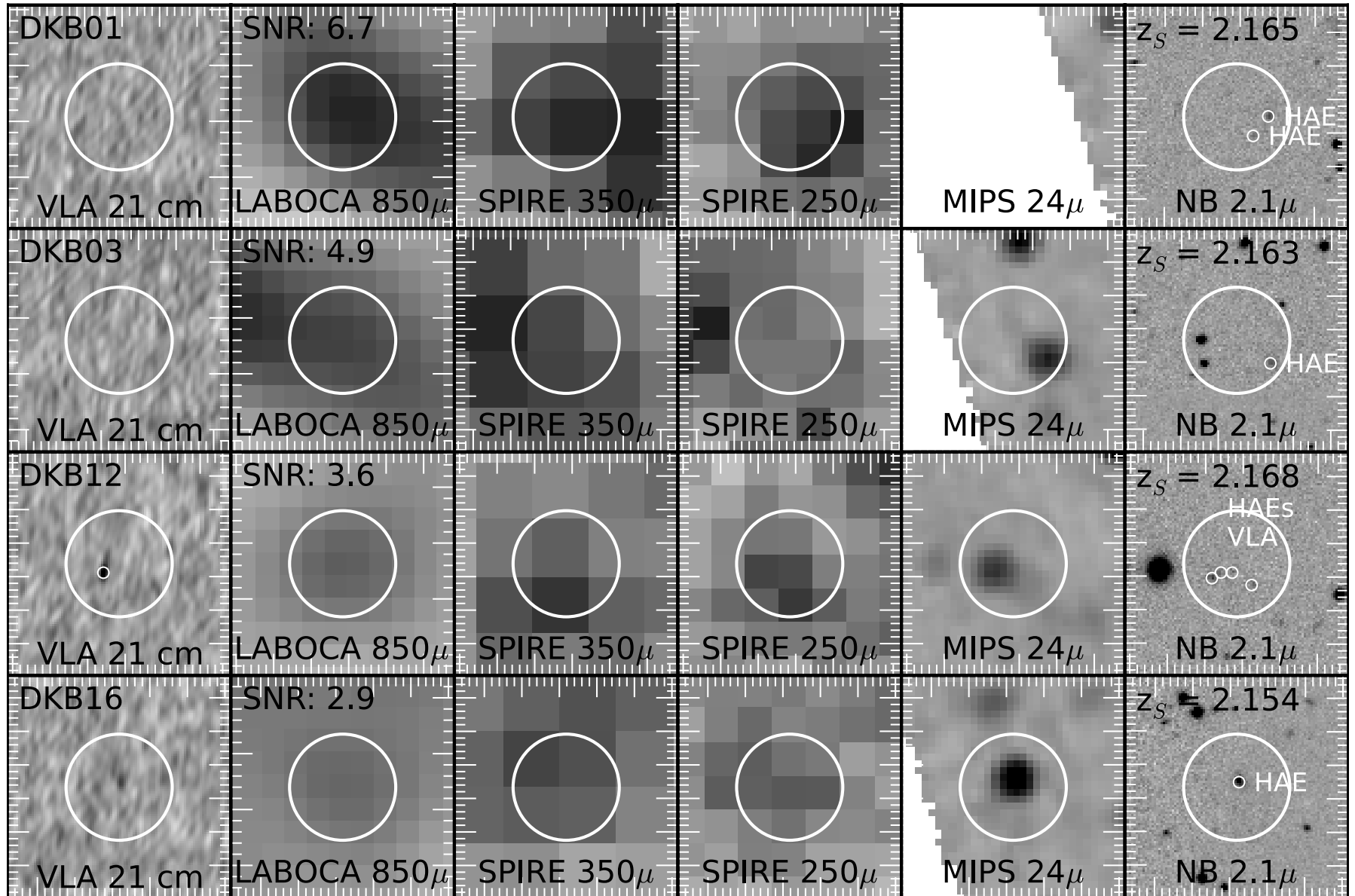
Frayer+2004



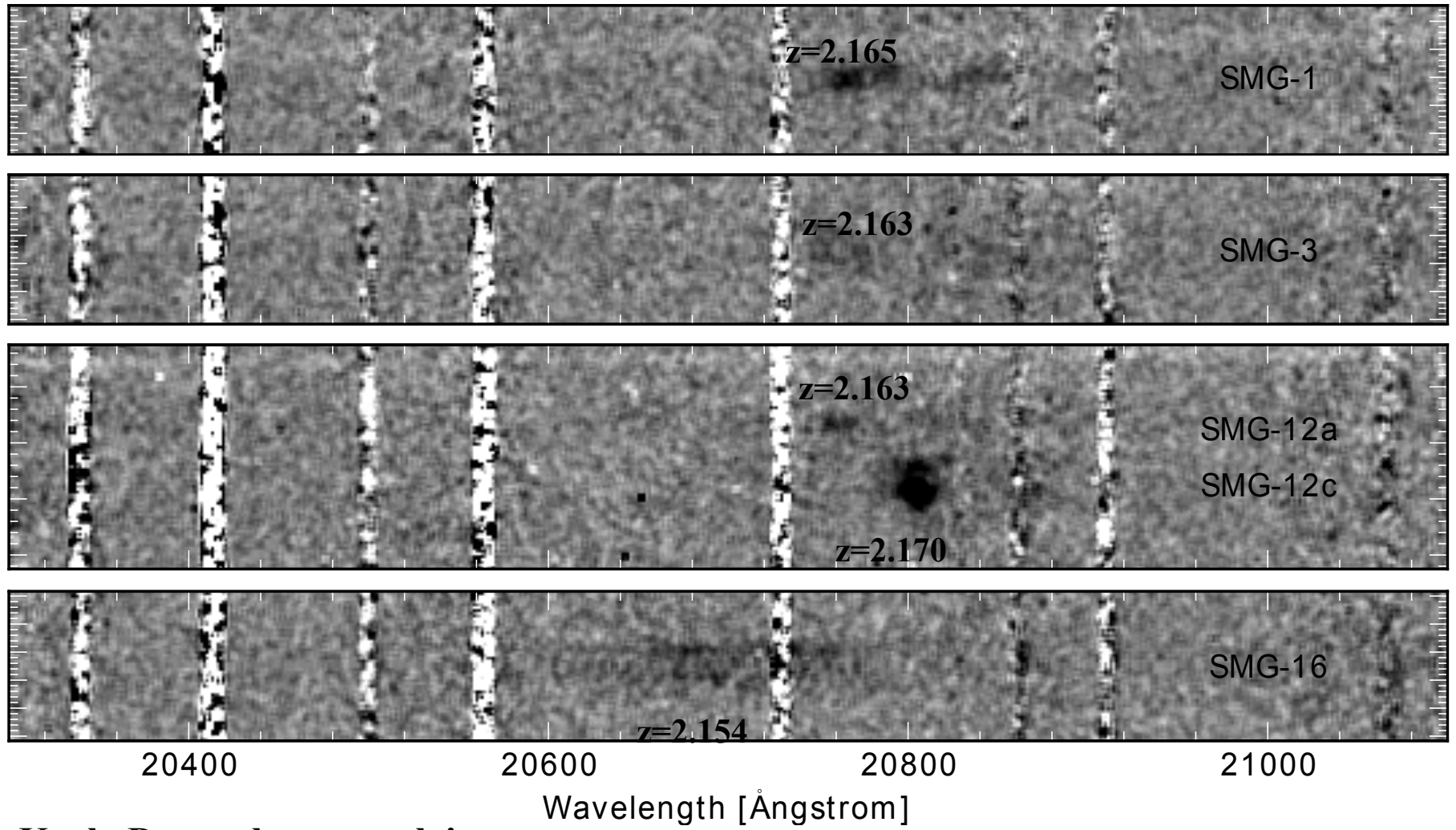
Swinbank+2003



Counterparts

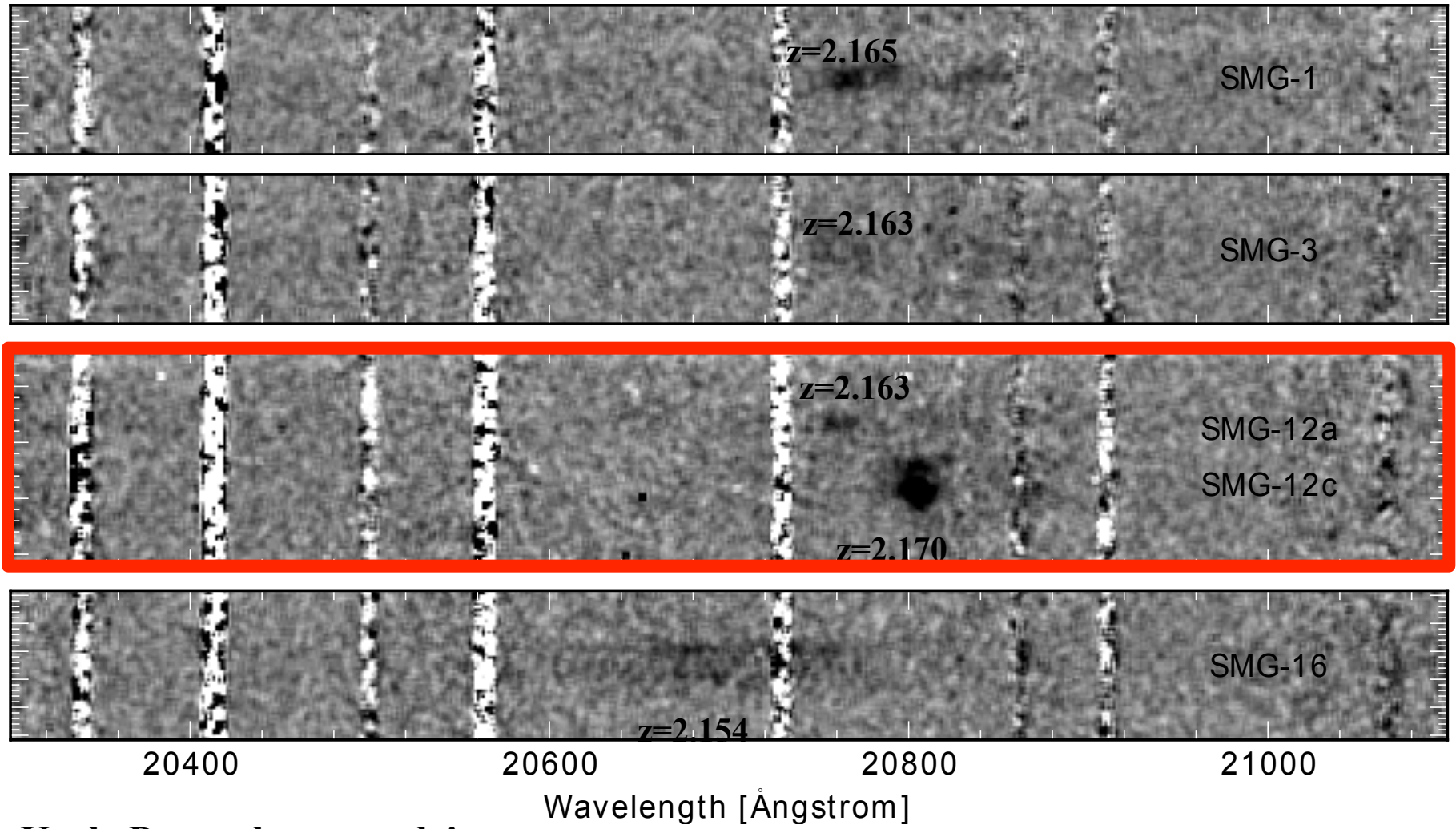


ISAAC Spectroscopy



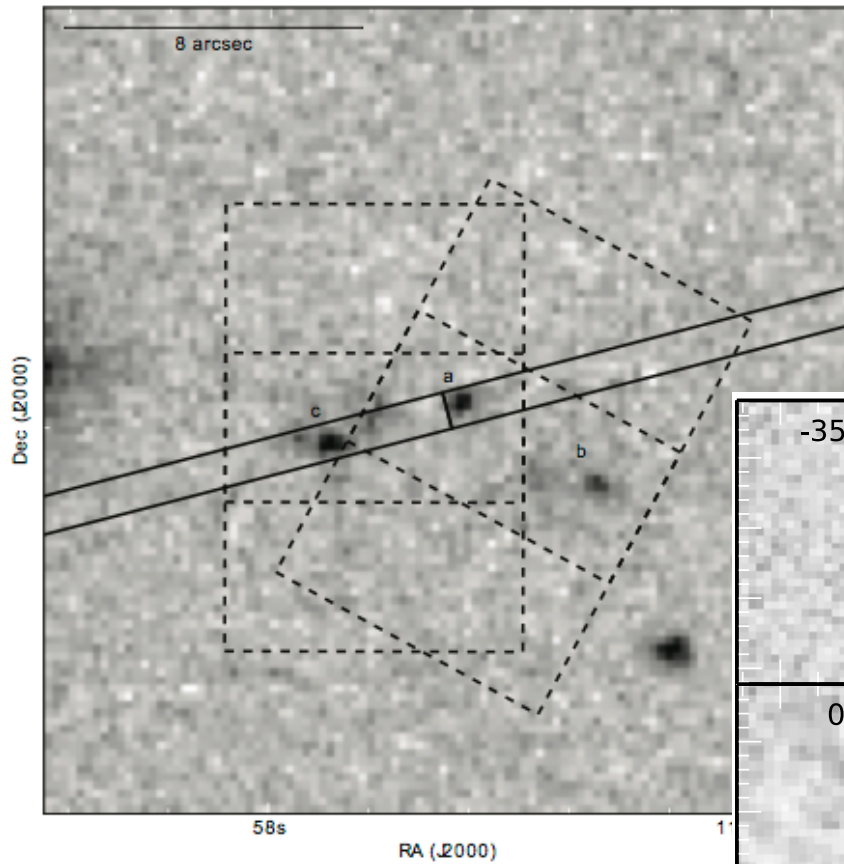
Kurk, Dannerbauer et al. in prep

ISAAC Spectroscopy

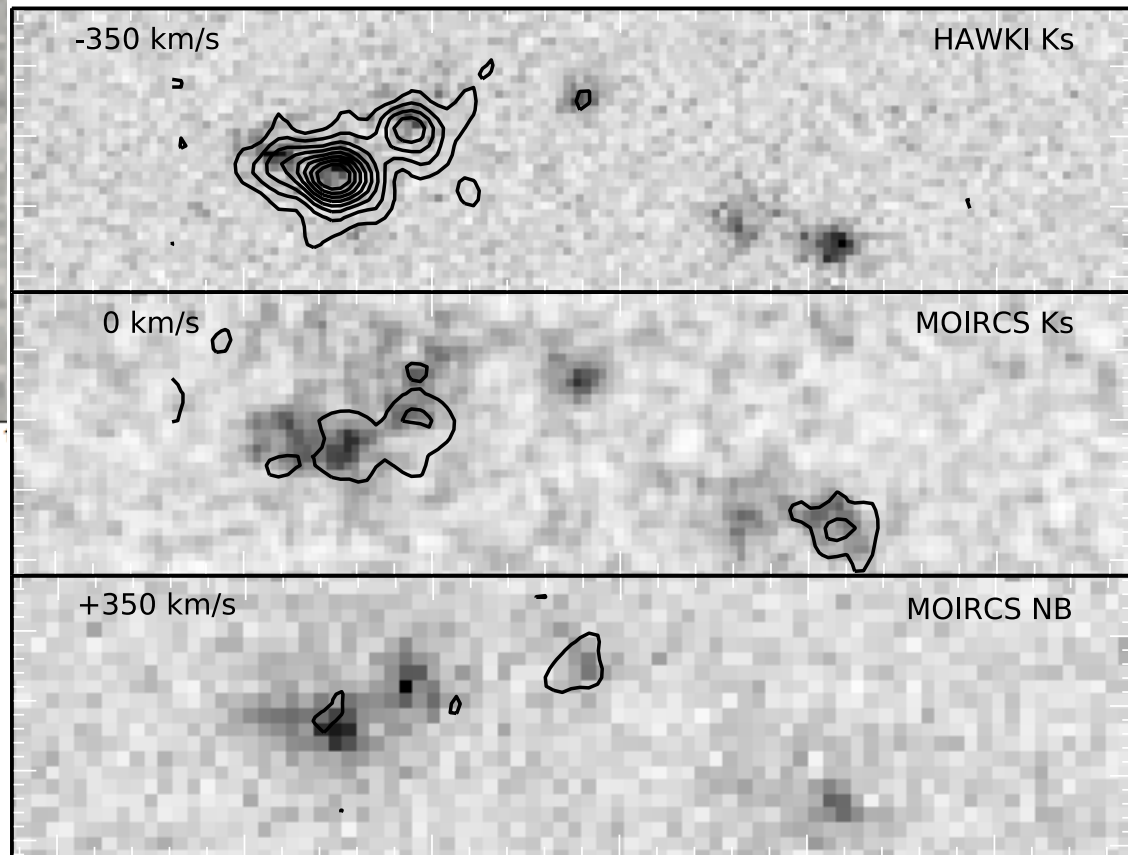


Kurk, Dannerbauer et al. in prep

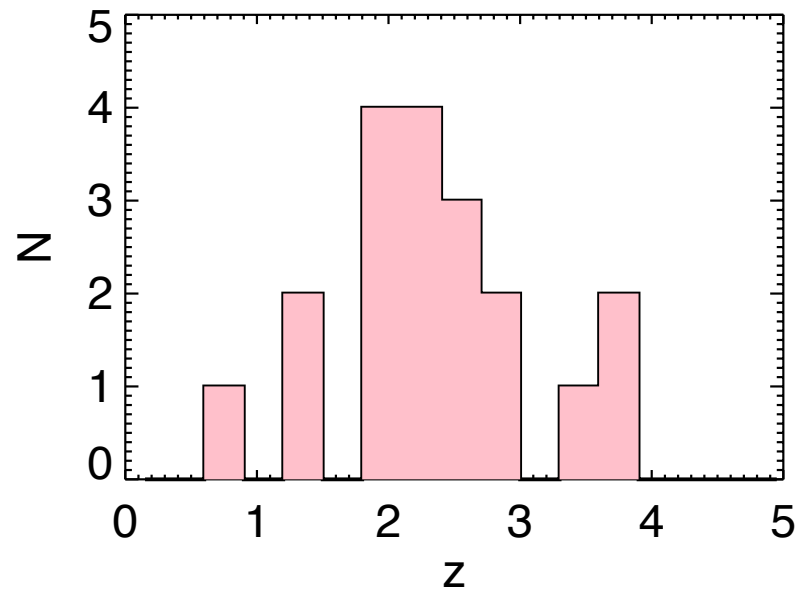
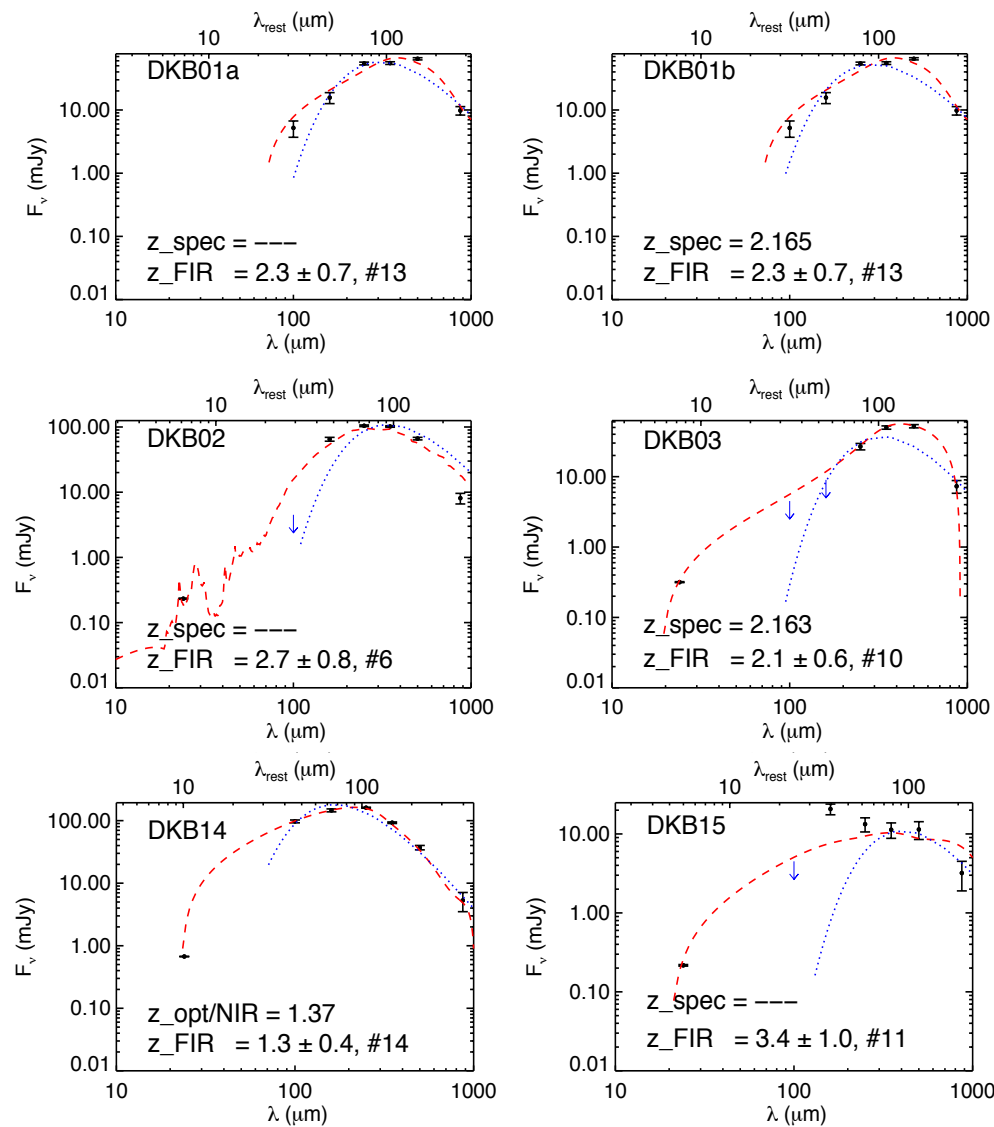
H α -Spectroscopy



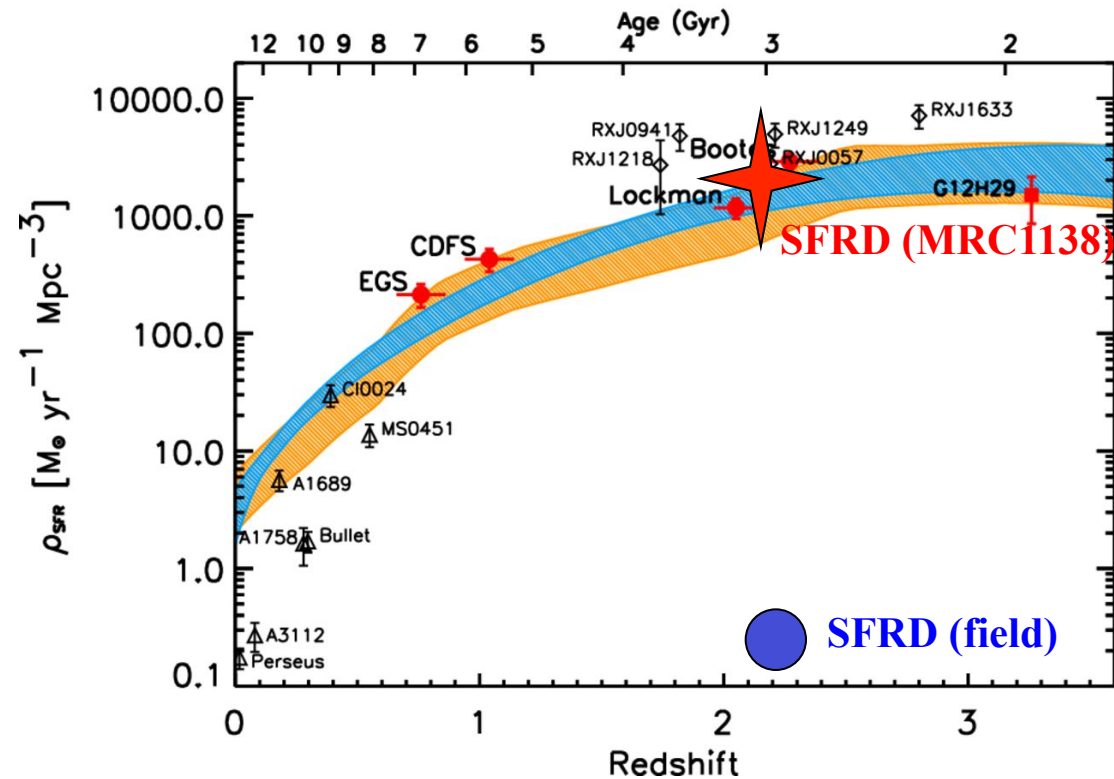
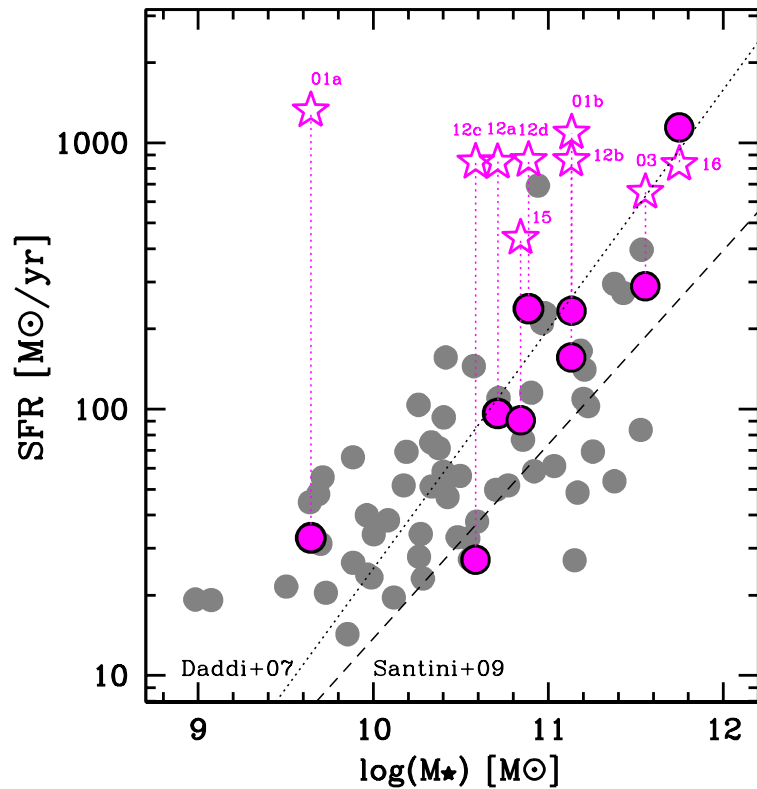
VLT SINFONI spectroscopy



FIR-photo-z

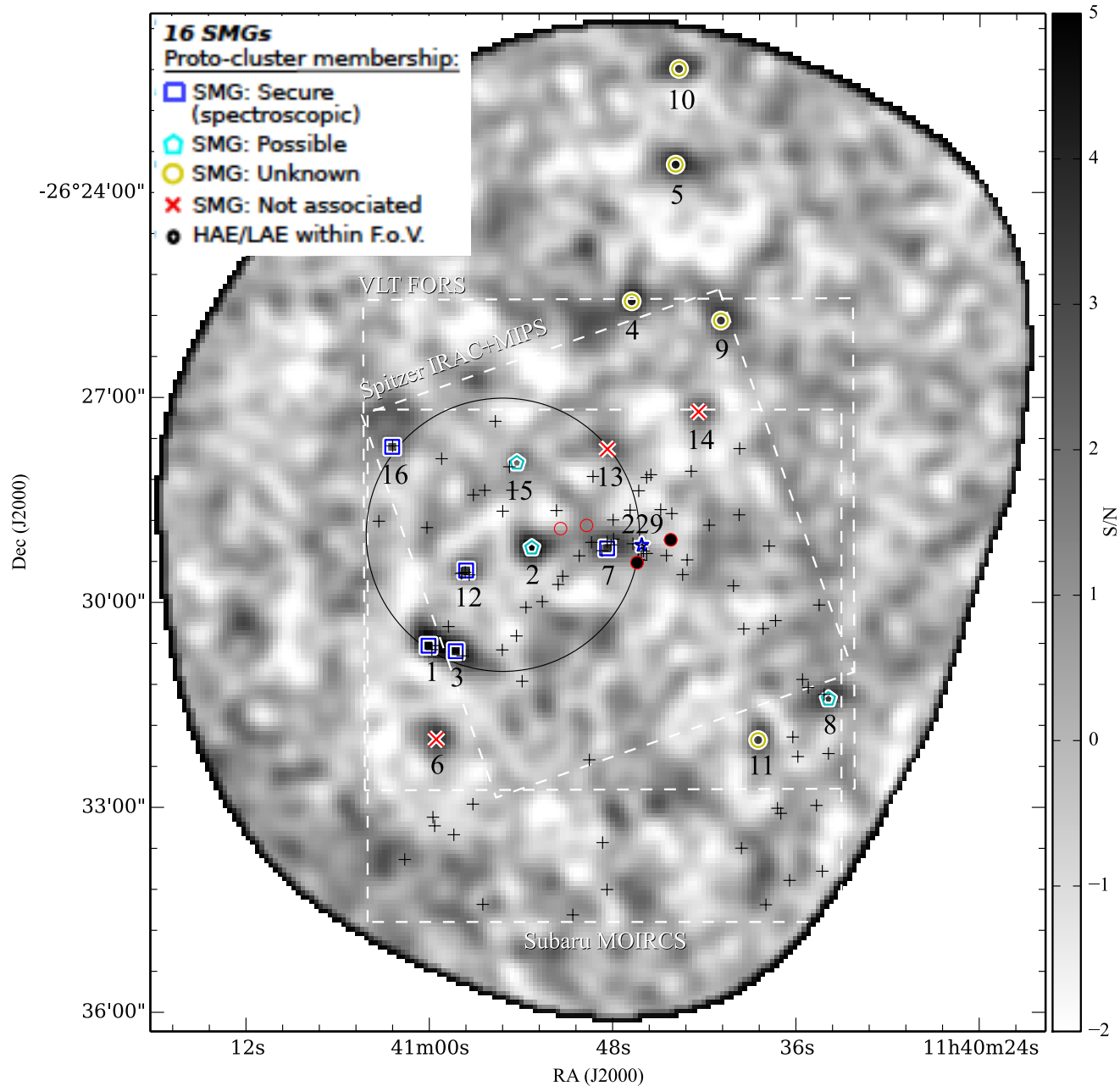


Dust Obscuration and Star Formation

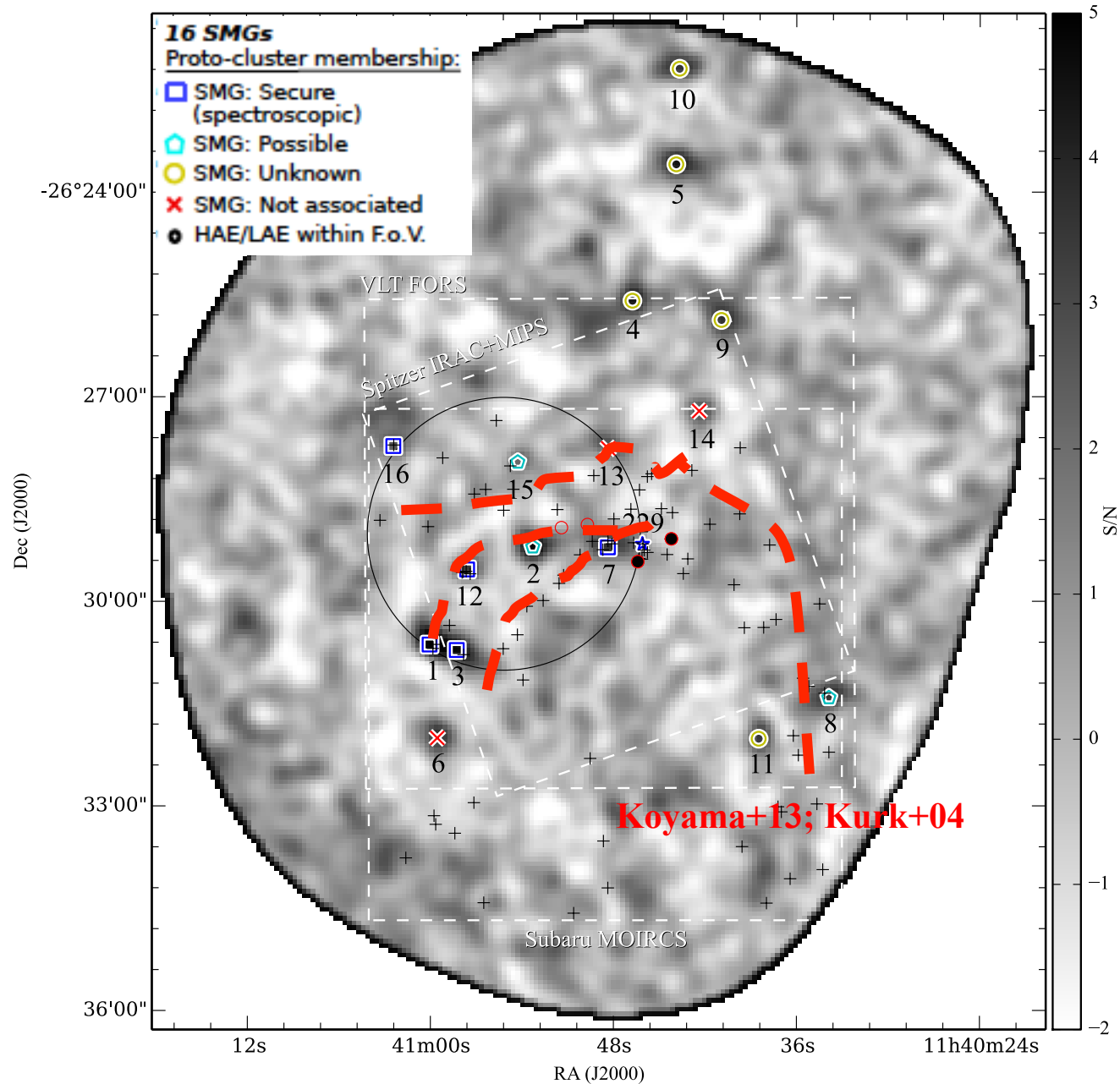


Clements+2014

Proto-Cluster Membership



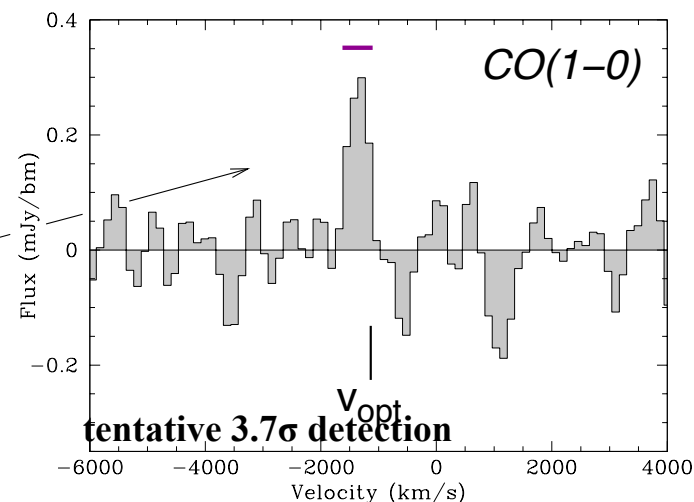
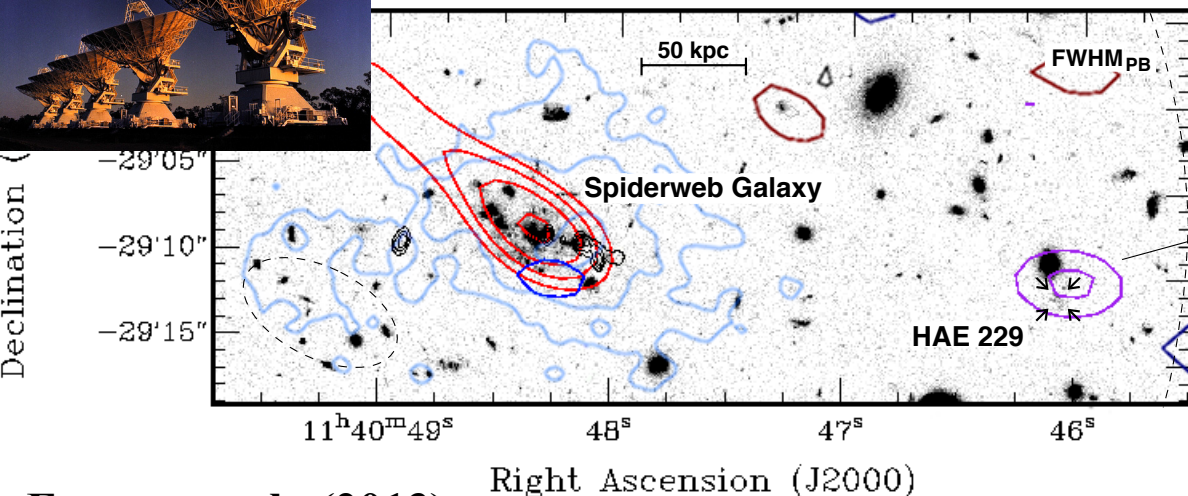
Proto-Cluster Membership



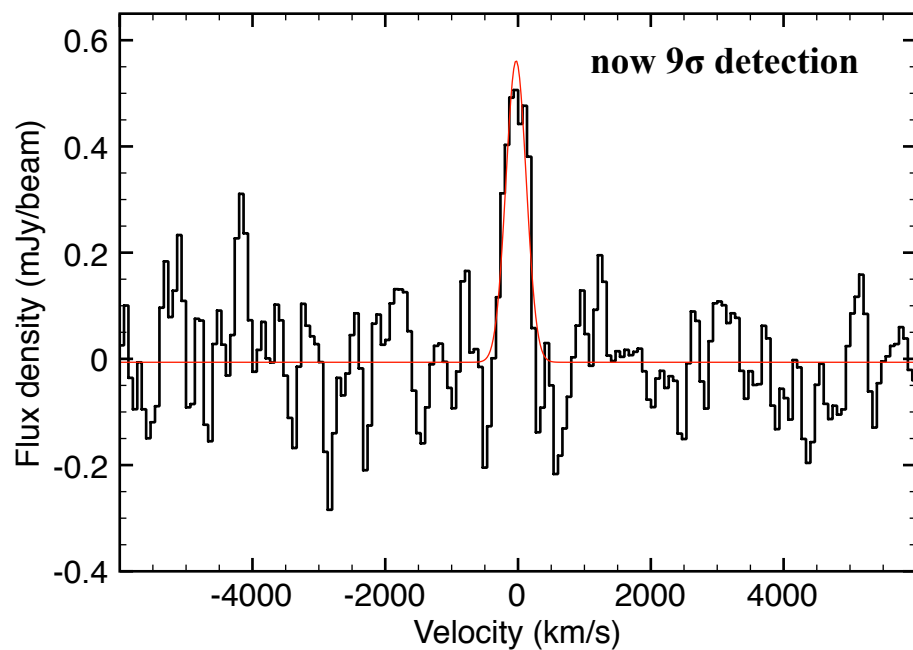
ATCA



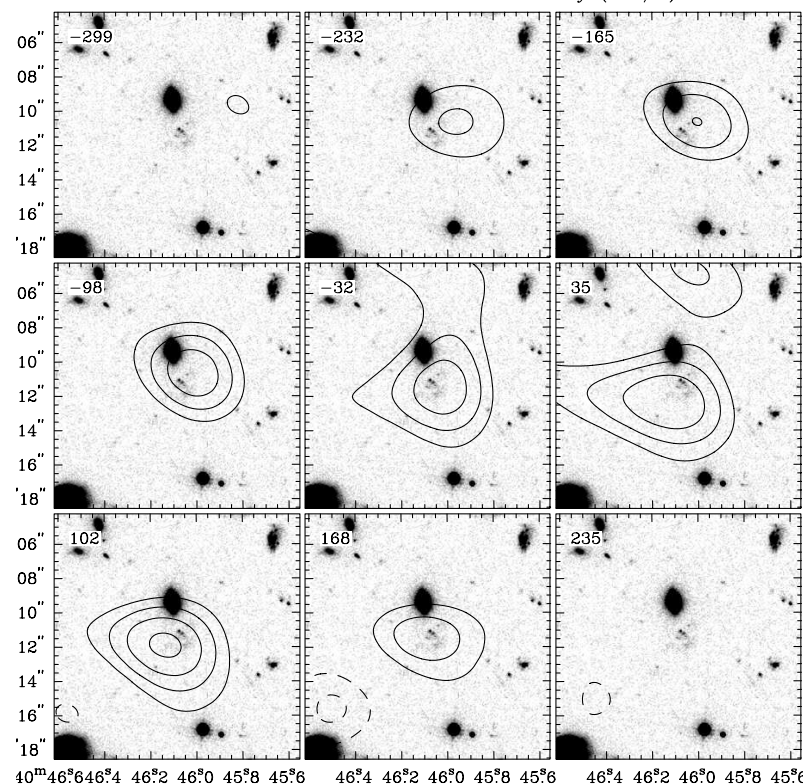
HAE229 alias SCUBA SMG#3



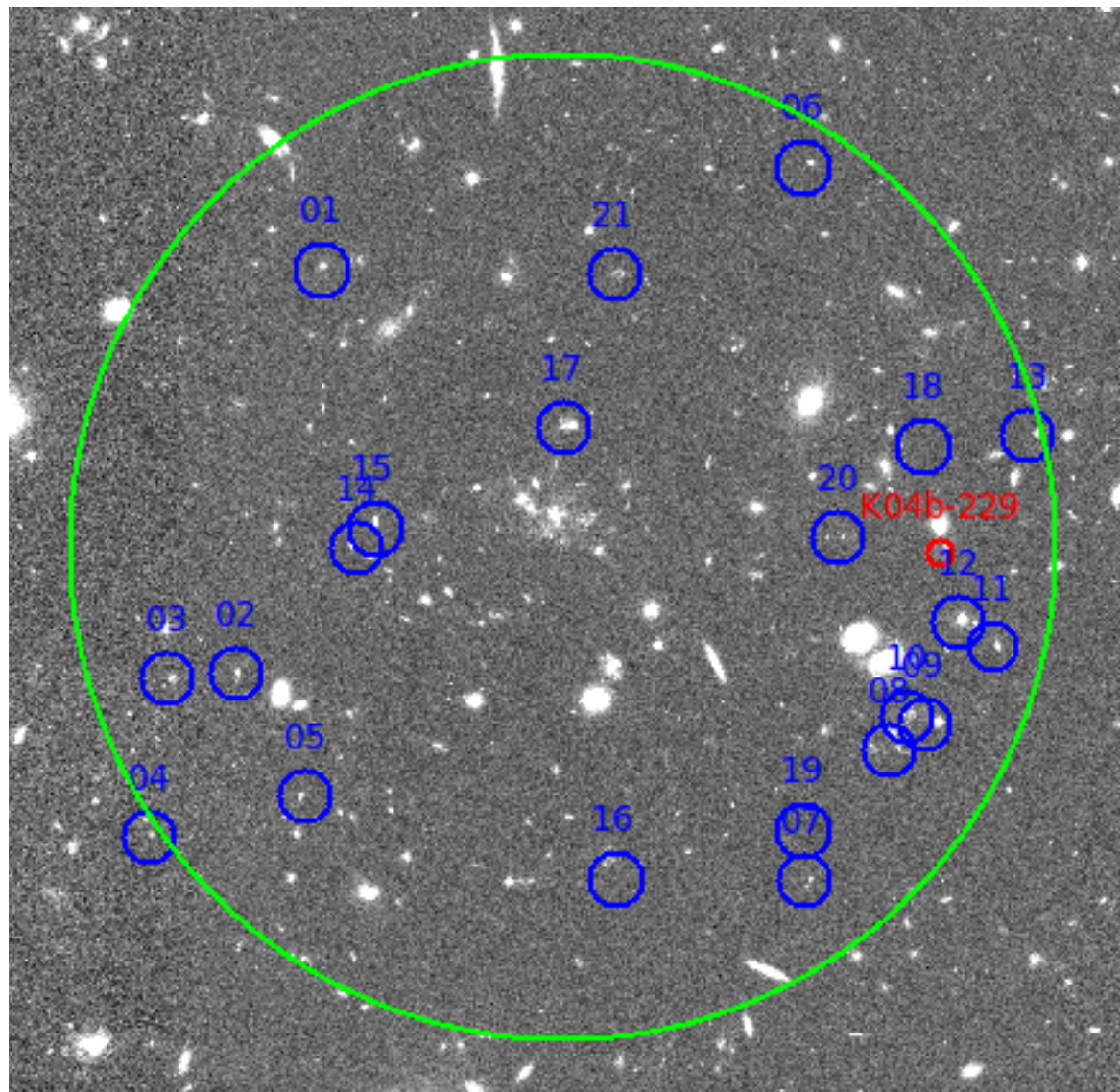
Emonts et al. (2013)



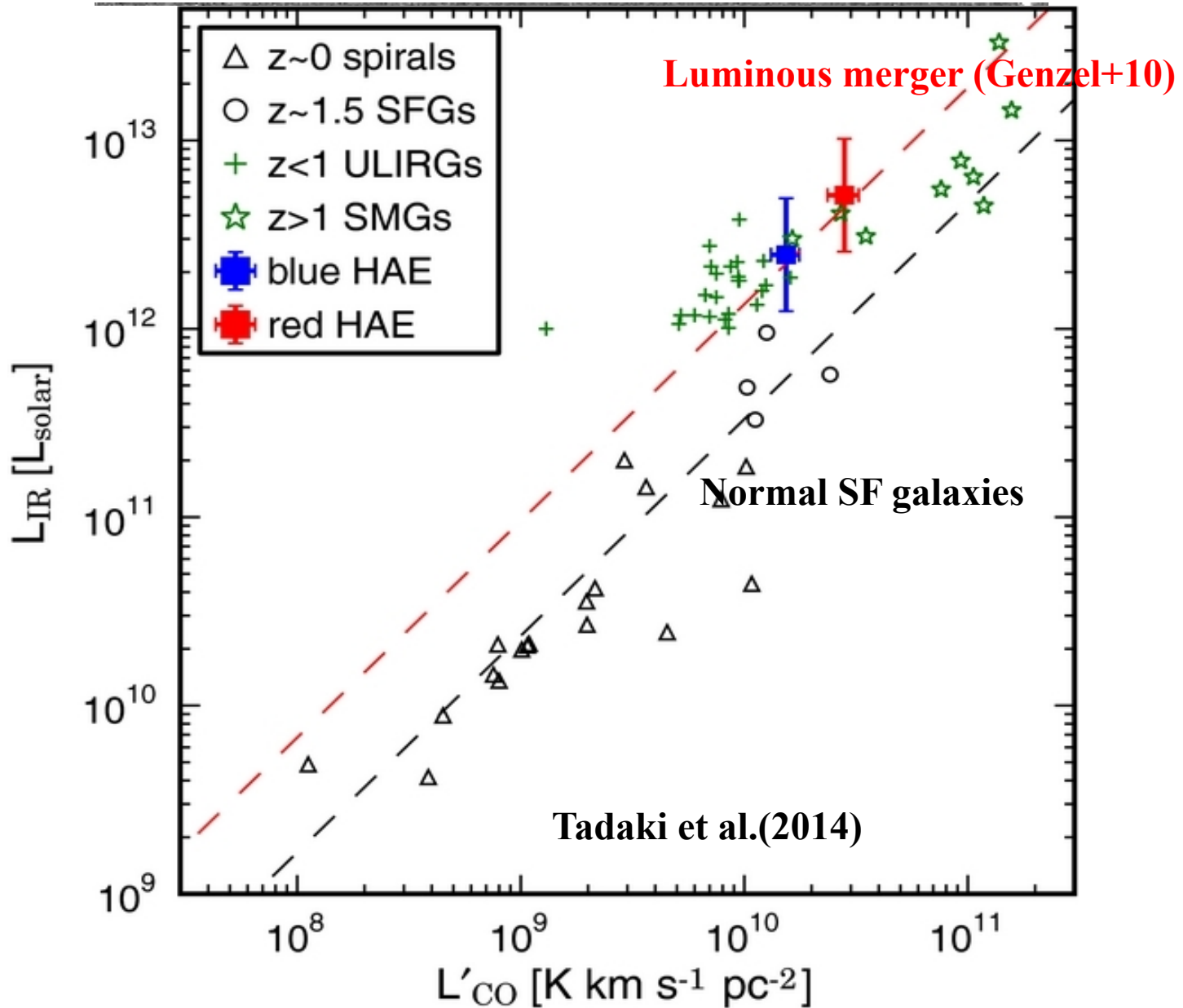
Dannerbauer, Emonts et al. in prep.



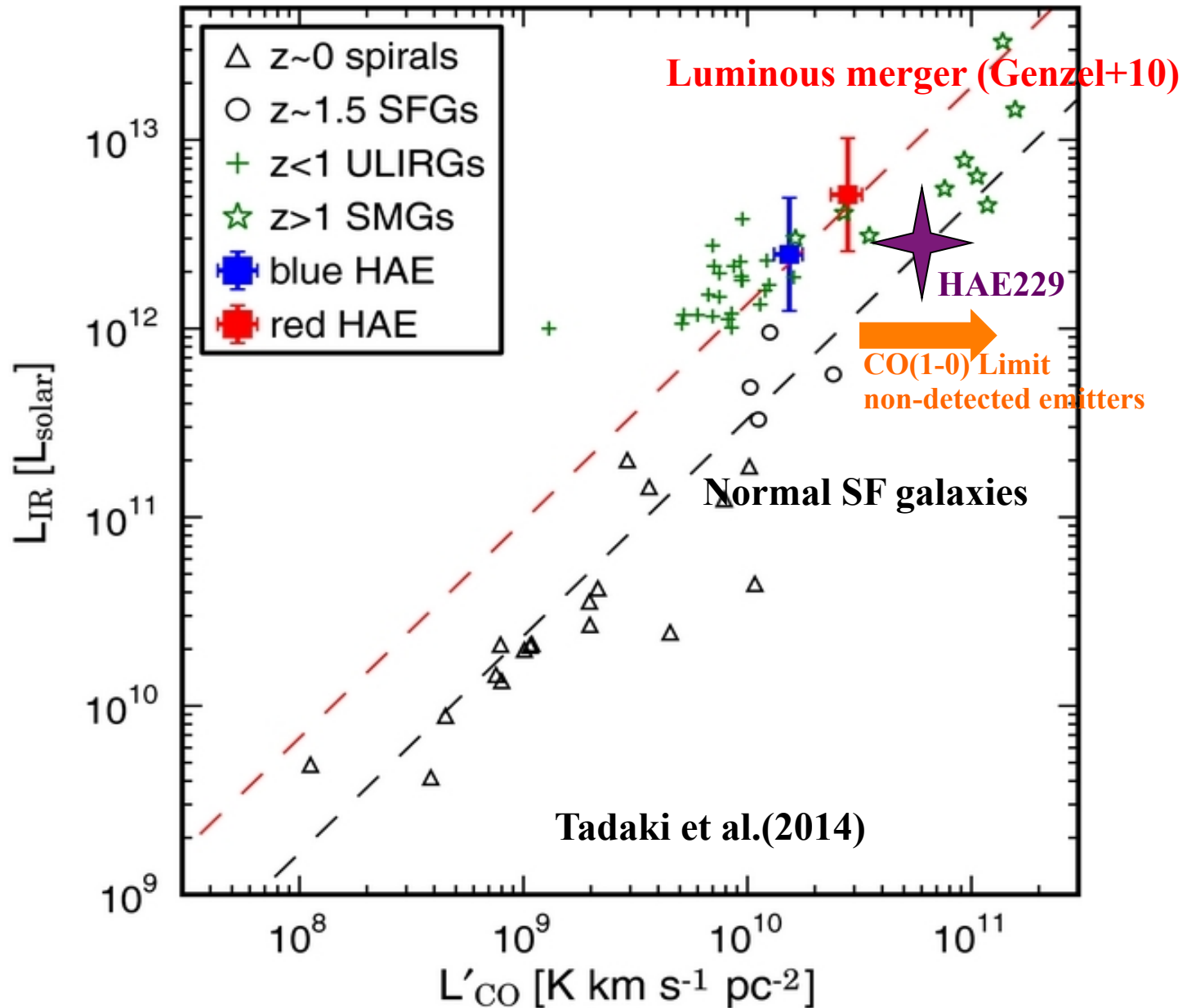
Line Emitters



Line Emitters



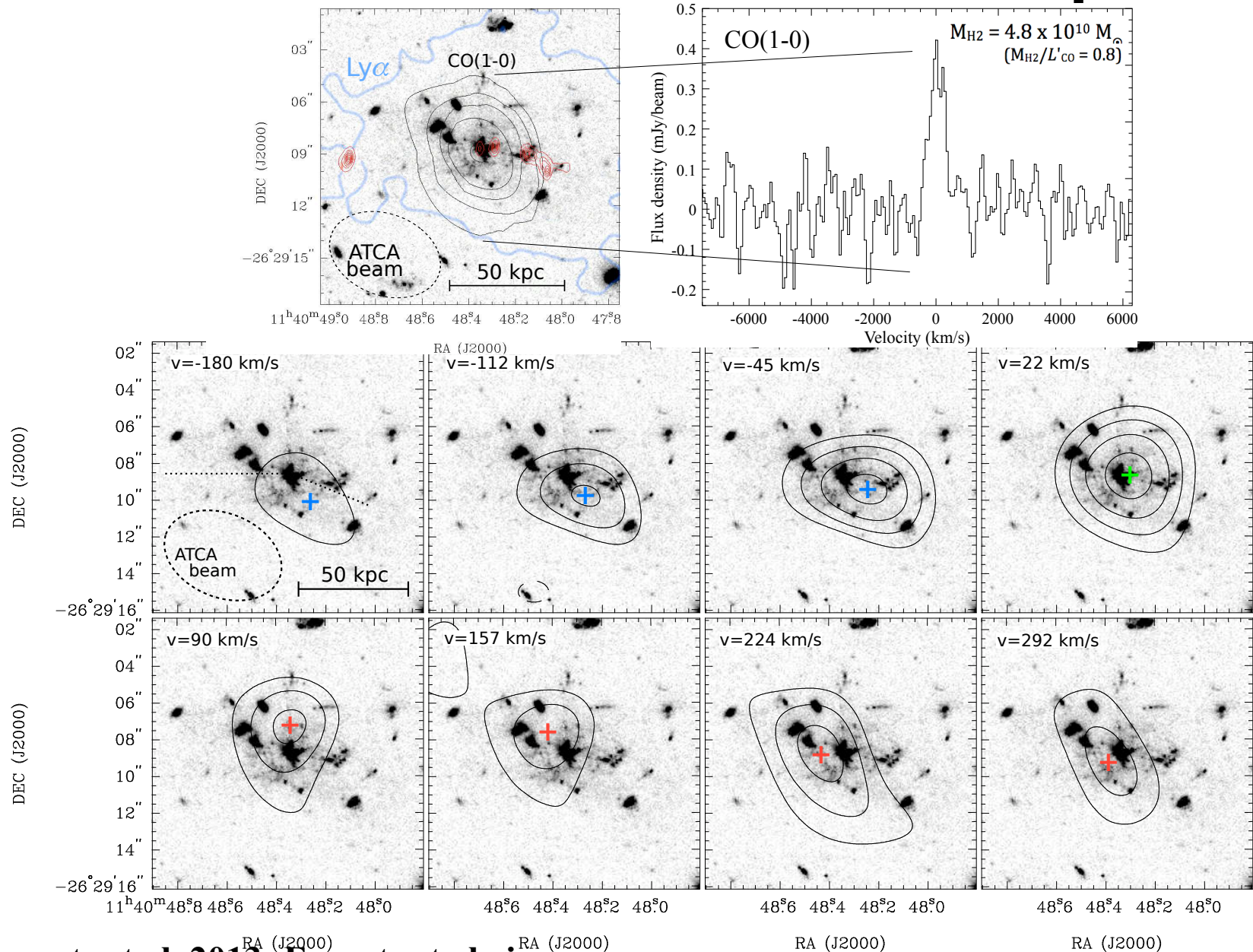
Line Emitters



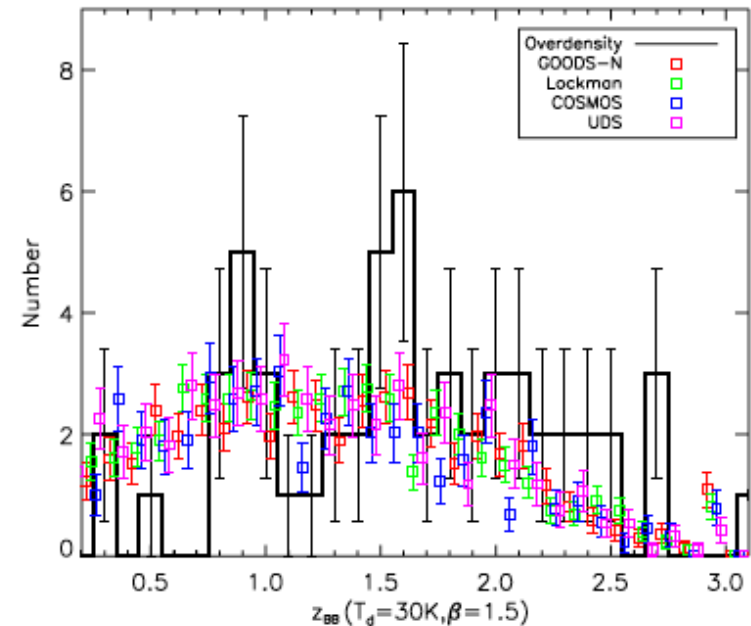
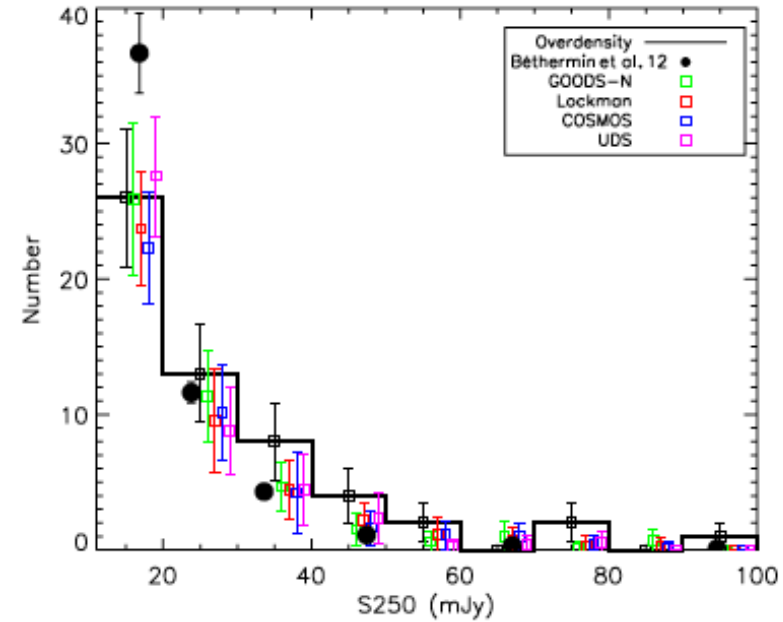
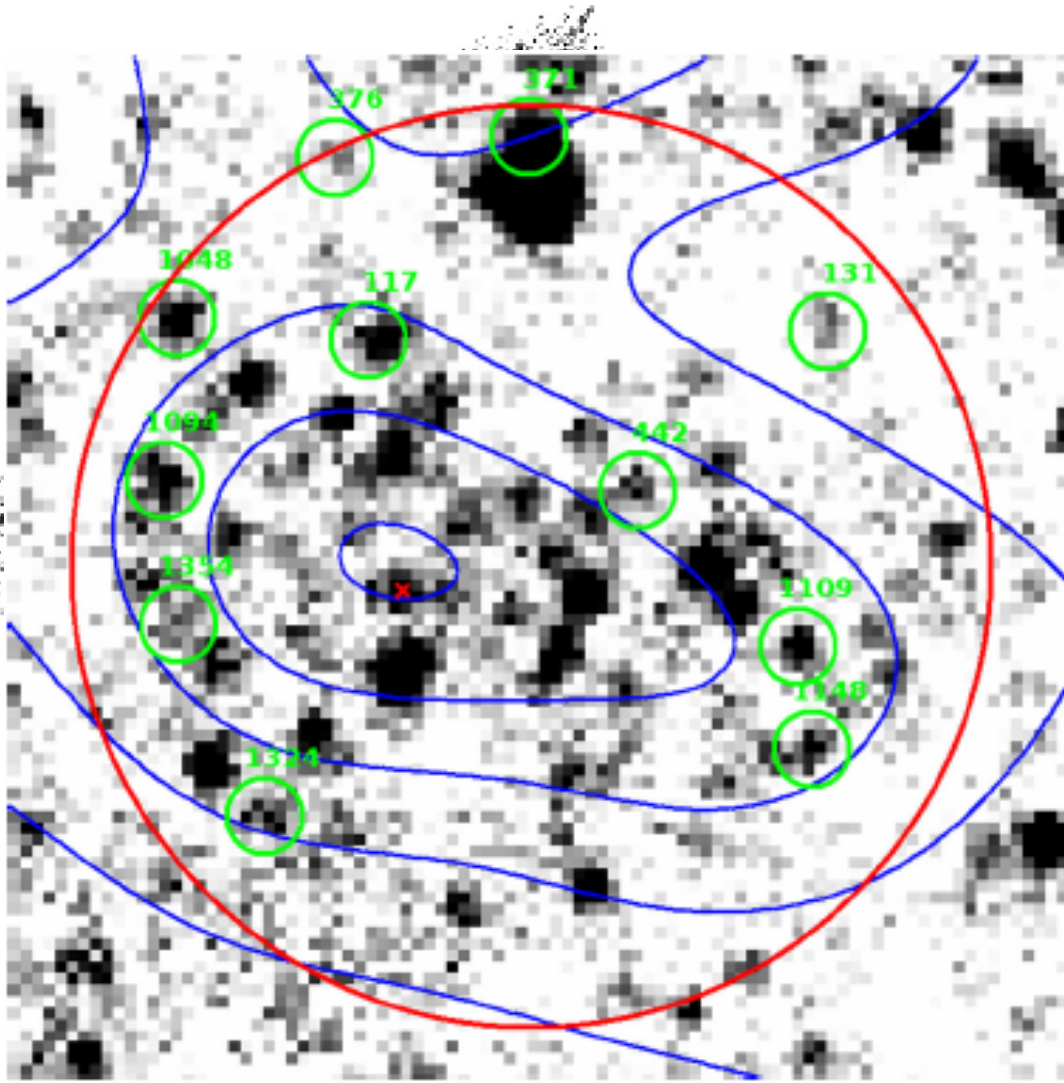
Conclusion

- **overdensity of dusty starbursts associated to MRC1138**
- **at least 7 SMGs are members of the proto-cluster**
- **HAEs promising approach to trace (part of) the SMG (system)**
- **LABOCA imaging seems to be a good way to search for overdensities/large scale structures**

In-situ birth of a Giant Cluster Elliptical?

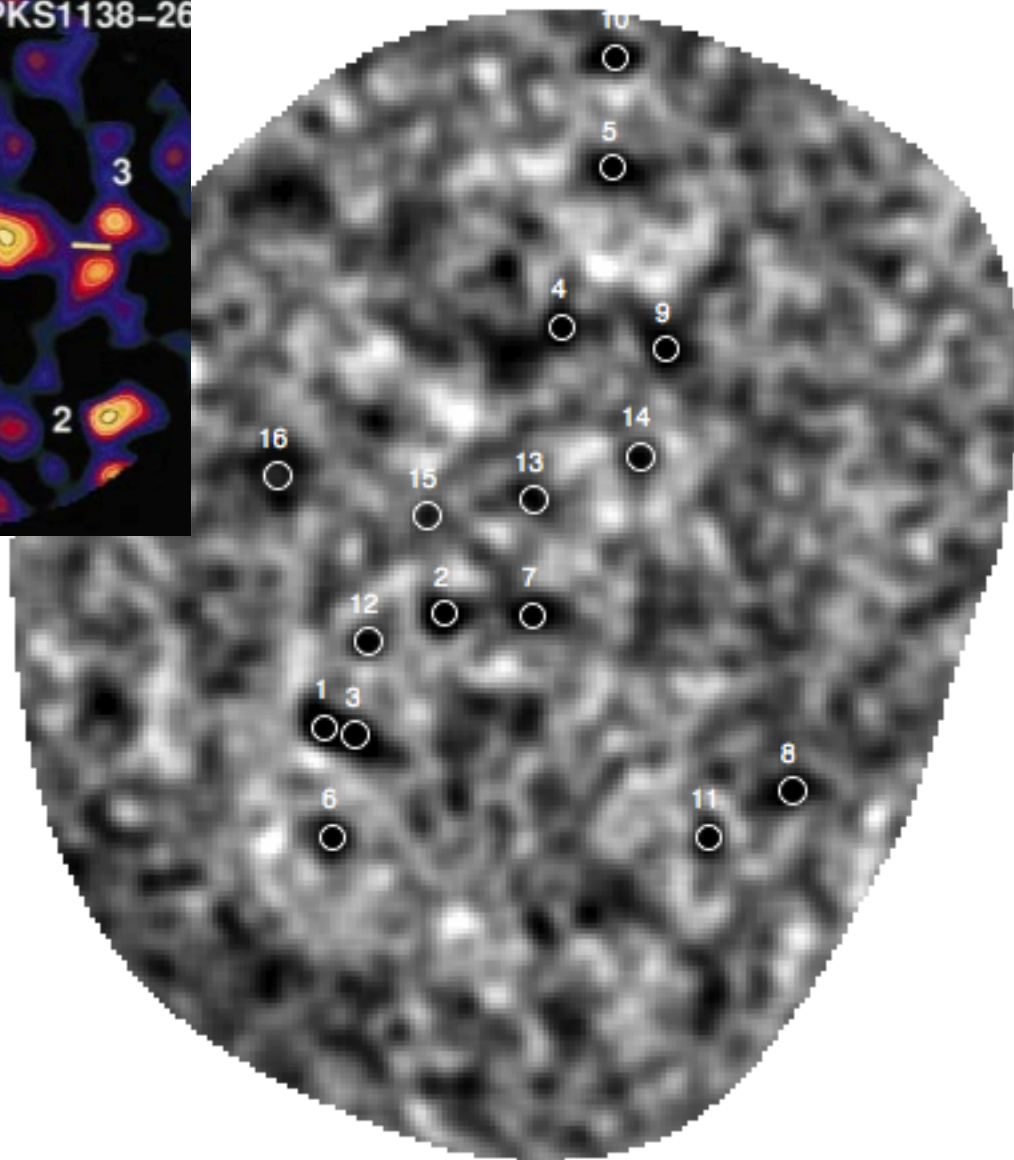
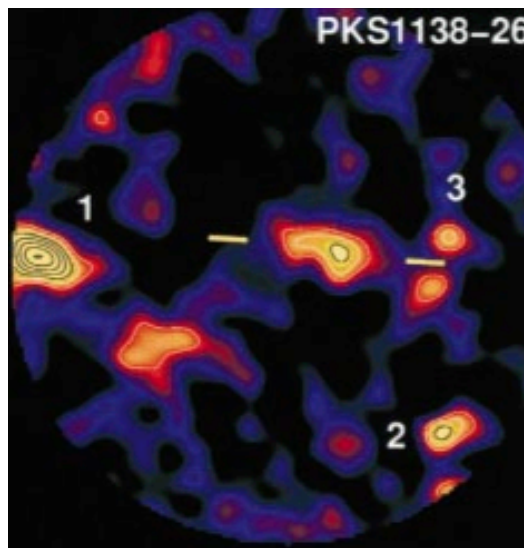


Herschel-SPIRE 250 μ m Overdensity



Valtchanov et al. (2013)

Previous SCUBA Observations



Previous SCUBA Observations

