

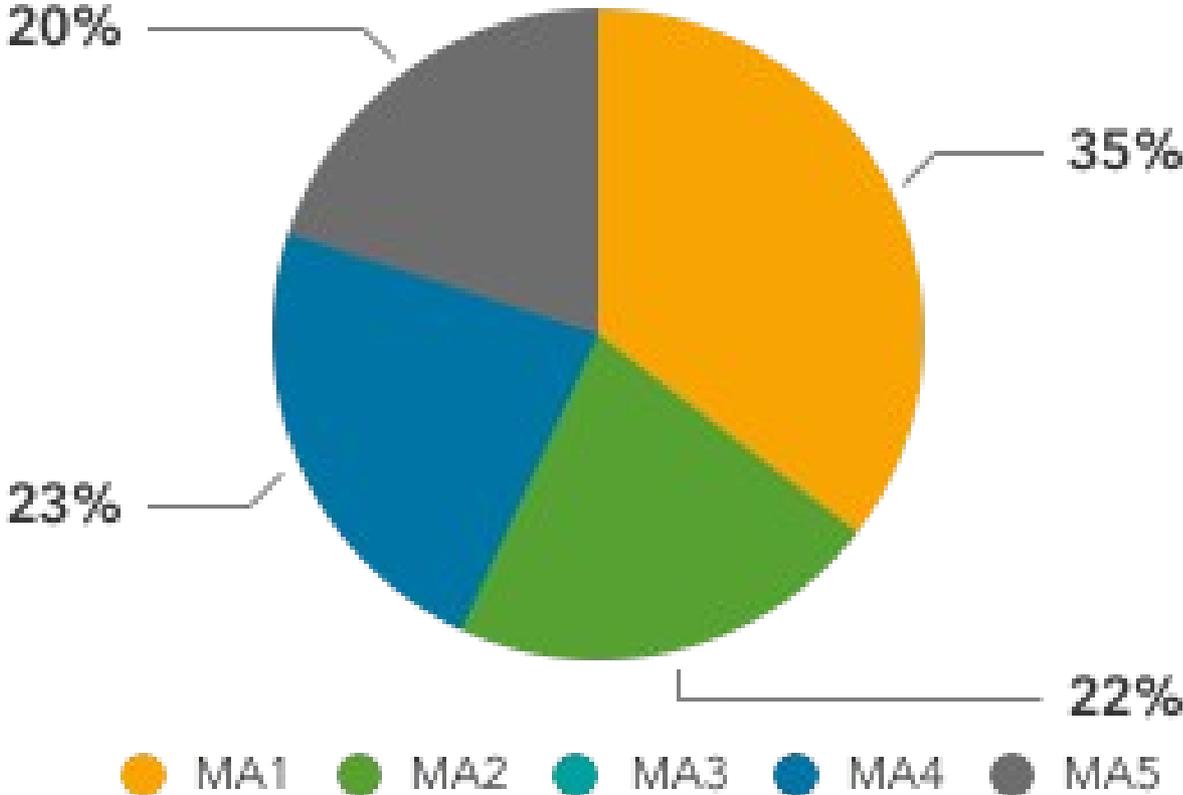
Roberto Decarli

INAF – Osservatorio di Astrofisica e Scienza dello Spazio di Bologna



MacroArea1 @ OAS-Bologna

PERSONALE DI RICERCA
OAS-BOLOGNA



Galaxies, AGN, and their evolution (15)

Clusters, large-scale structures, IGM (3)

Theoretical and observational cosmology (5)

Staff (23):

Sandro Bardelli, Micol Bolzonella, Alberto Cappi, Andrea Comastri, Olga Cucciati, Roberto Decarli, **Stefano Ettori**, **Fabio Finelli**, Roberto Gilli, Carlotta Gruppioni, **Alessandro Gruppuso**, Giorgio Lanzuisi, **Massimo Meneghetti**, Marco Mignoli, **Daniela Paoletti**, Lucia Pozzetti, **Mauro Sereno**, Giovanna Maria Stirpe, **Luca Valenziano**, Eros Vanzella, Daniela Vergani, **Fabrizio Villa**,
Elena Zucca

Post-docs, Students (11):

Jose Ramon Bermejo-Climent, **Matteo Billi**, **Matteo Braglia**, **Vittorio Ghirardini**, Giacomo Girelli, Federica Loiacono, **Julien Merten**, Riccardo Nanni, Alessandro Peca, **Antonio Pensabene**, **Mauro Roncarelli**

Optical / IR / mm / radio surveys of galaxies
(=> Lucia's, Olga's, Elena's, and my talks)

AGN search and multi-wavelength characterization
(=> my talk)

X-ray to radio studies of galaxy clusters
(=> Stefano's talk)

Gravitational lensing: models and observations
(=> Eros' talk)

Study of the cosmic microwave background
(=> Daniela's talk)

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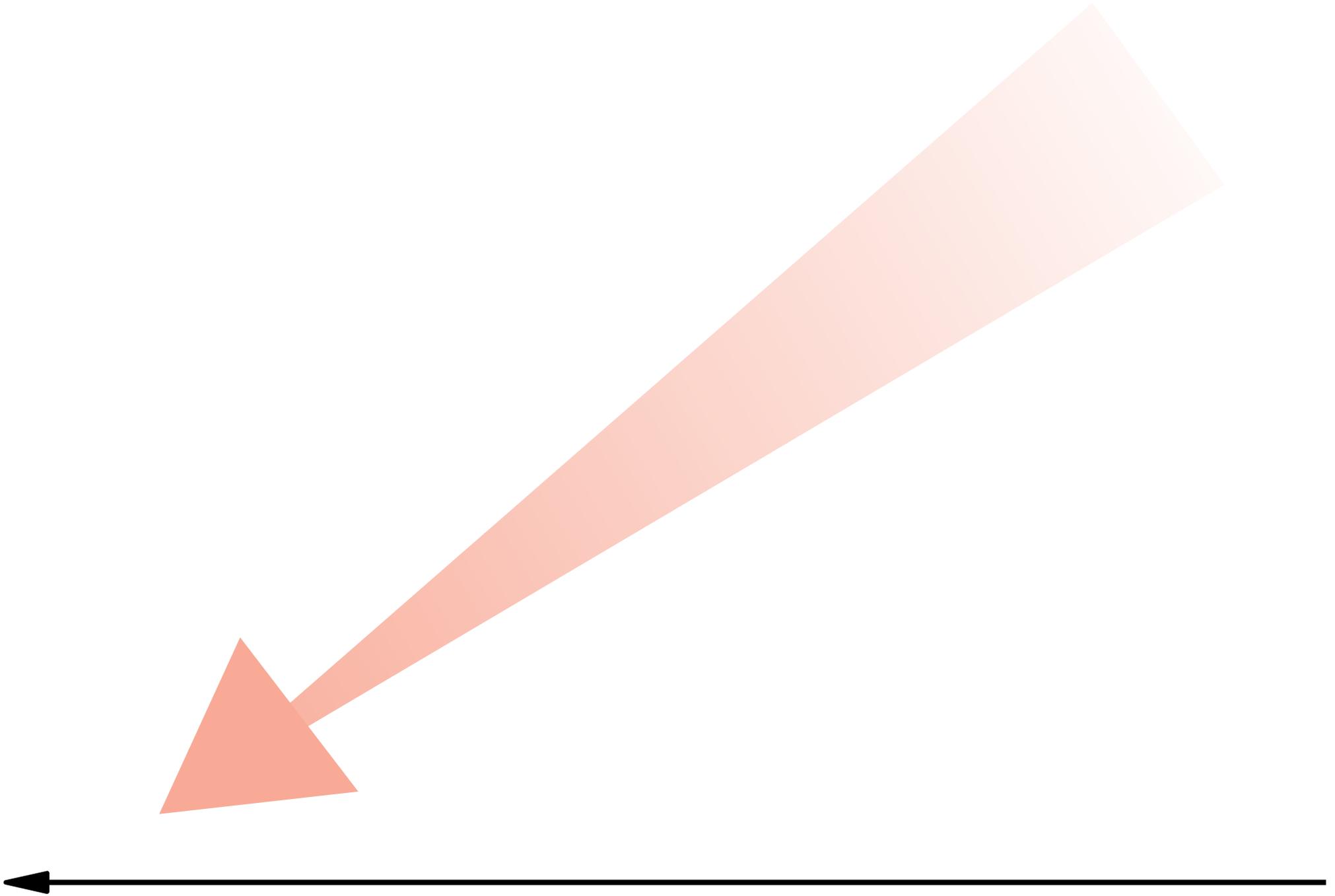


The birth of the giants: A multi-wavelength look at AGN

OAS Team: Francesco Calura, Andrea Comastri, Roberto Gilli,
Carlotta Gruppioni, Federica Loiacono, Marco Mignoli,
Riccardo Nanni, Alessandro Peca, Antonio Pensabene

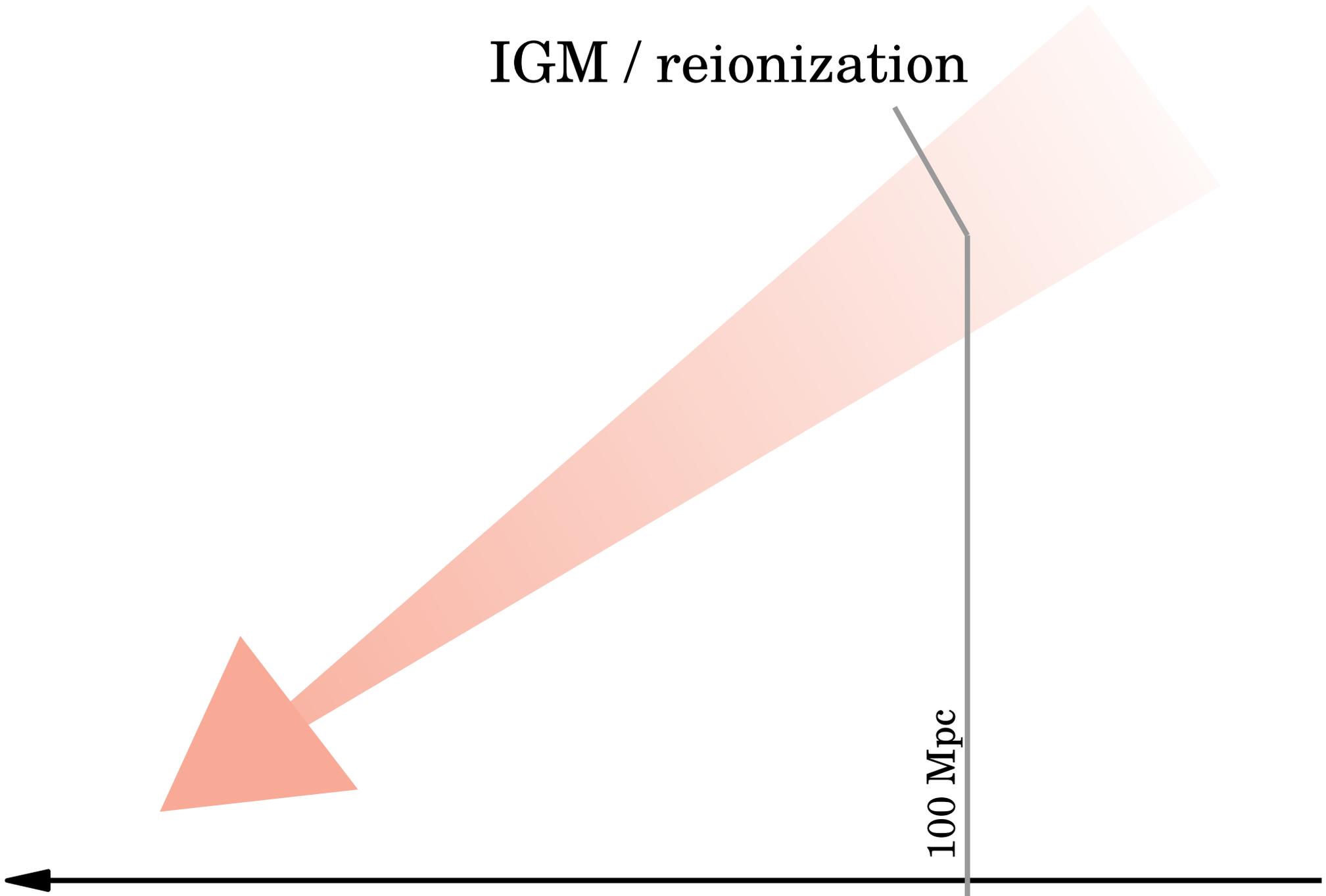
DIFA: Marcella Brusa, Andrea Cimatti, Francesca Pozzi,
Margherita Talia, Cristian Vignali

High-redshift AGN



High-redshift AGN

IGM / reionization



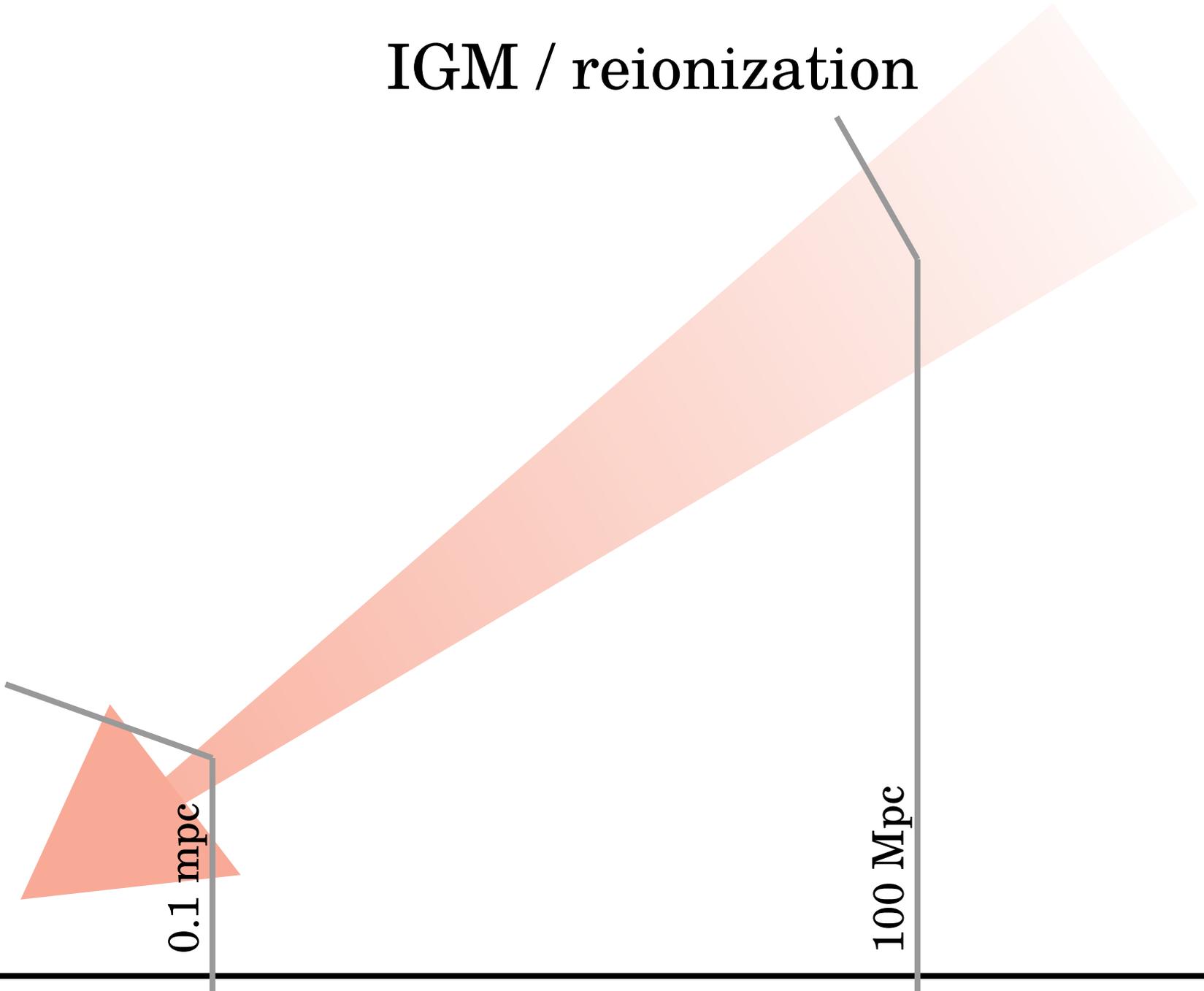
High-redshift AGN

IGM / reionization

Black
hole

0.1 mpc

100 Mpc



High-redshift AGN

IGM / reionization

Black
hole

0.1 mpc

12 dex!!!

100 Mpc



High-redshift AGN

IGM / reionization

Large-scale clustering

Small-scale structures

Black
hole

0.1 mpc

100 kpc

1 Mpc

100 Mpc



High-redshift AGN

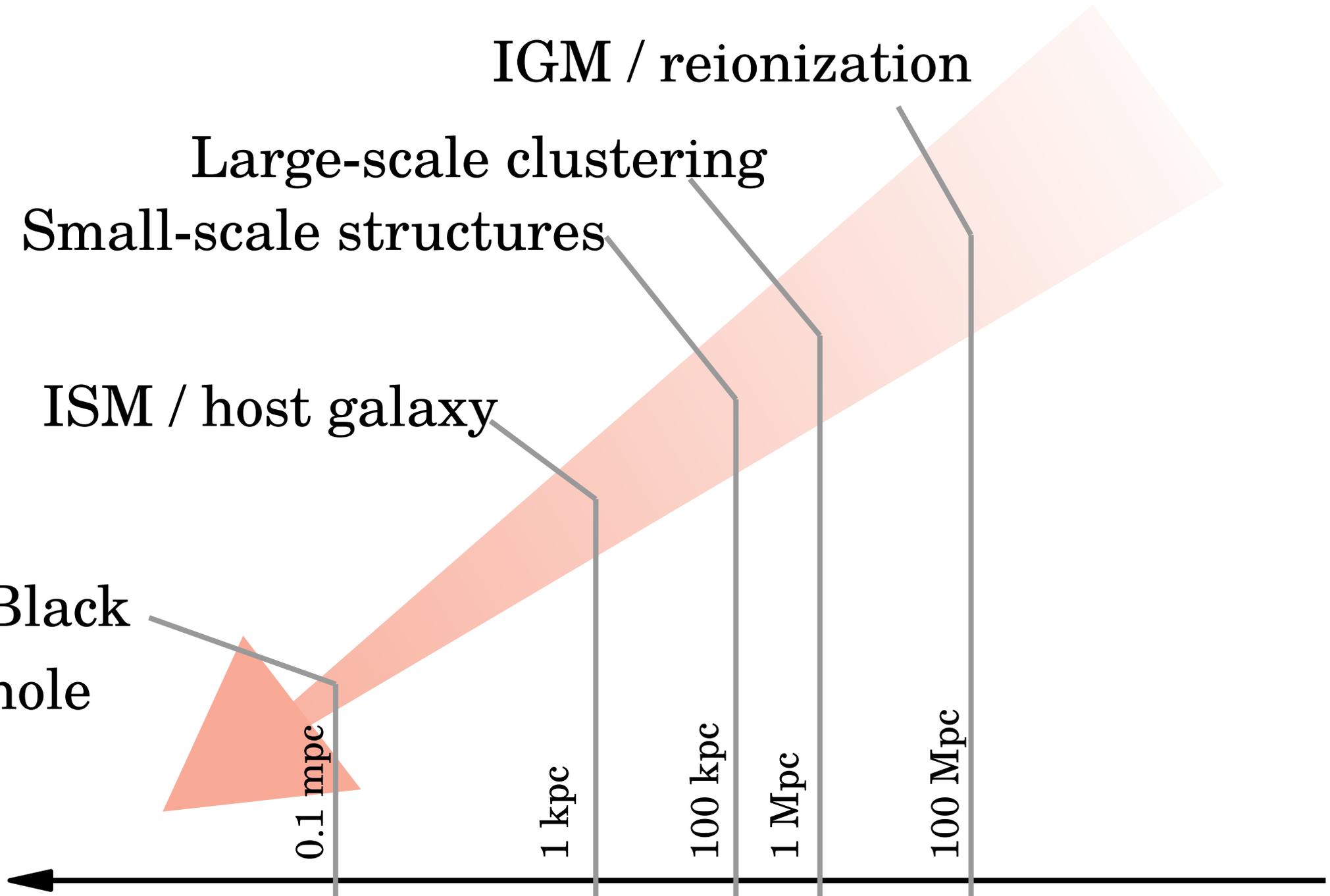
IGM / reionization

Large-scale clustering

Small-scale structures

ISM / host galaxy

Black
hole



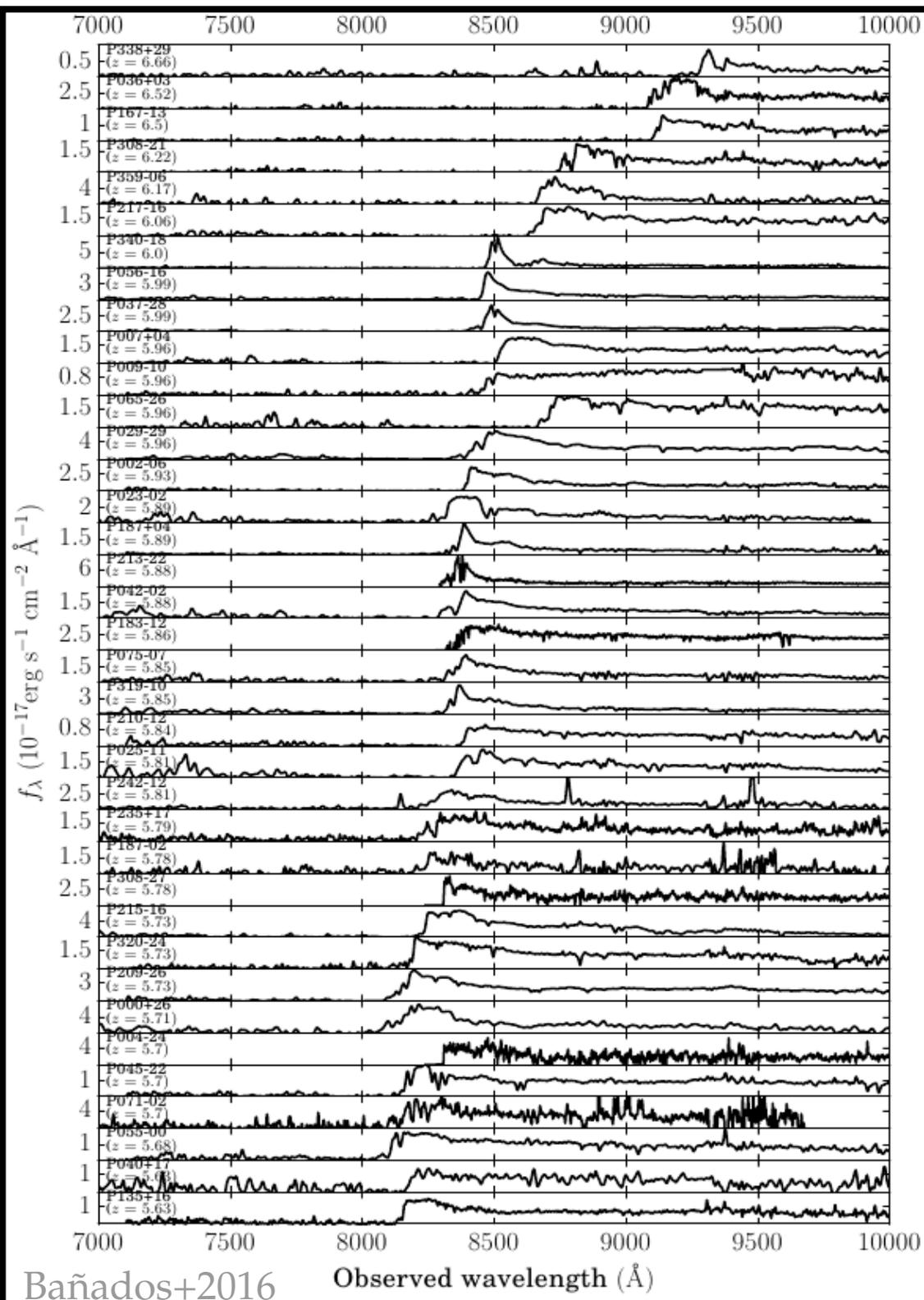
Discovery of

~320 quasars at $z > 5.5$

~180 at $z > 6.0$

28 at $z > 6.5$

4 at $z > 7.0$



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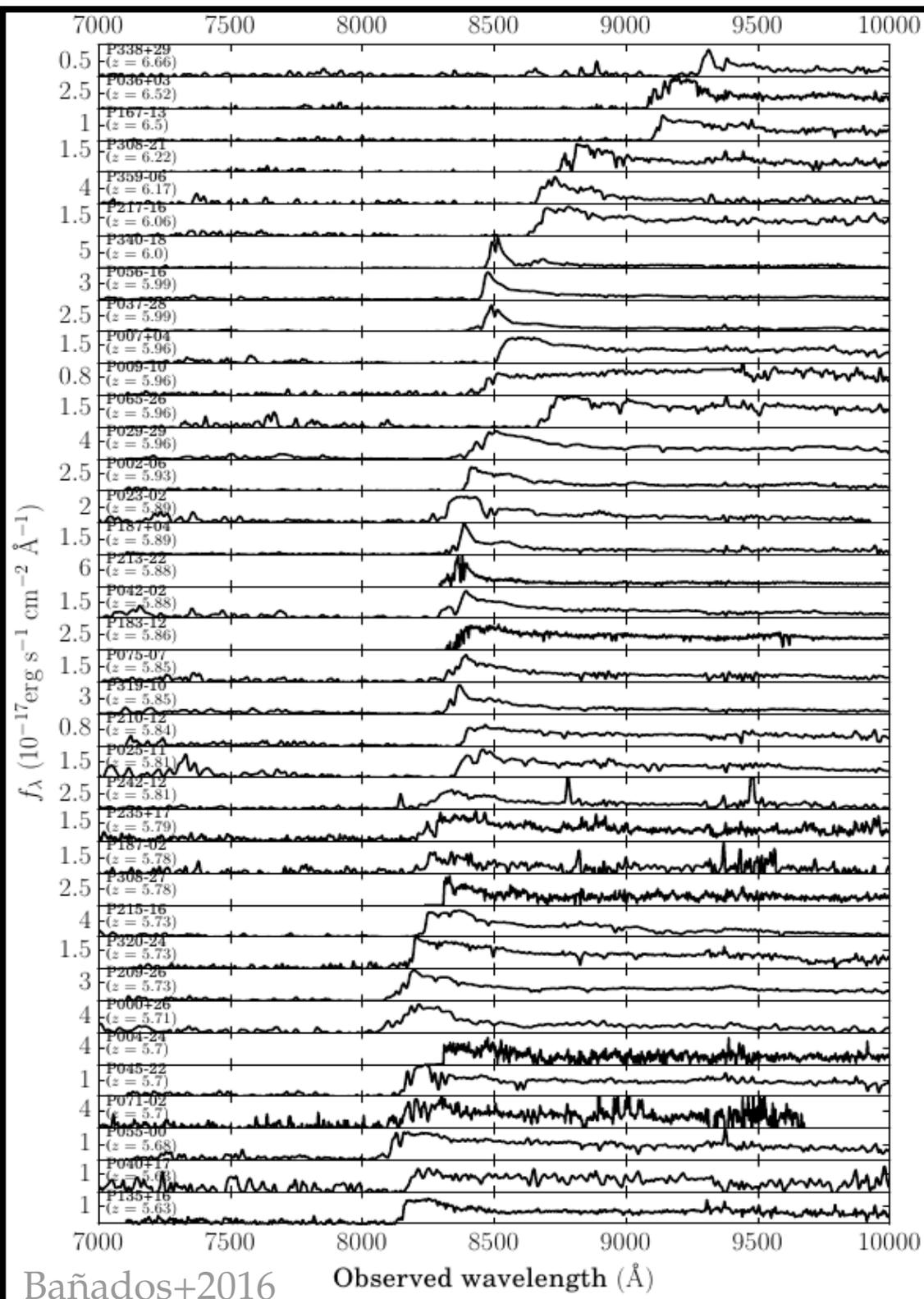
28 at $z > 6.5$

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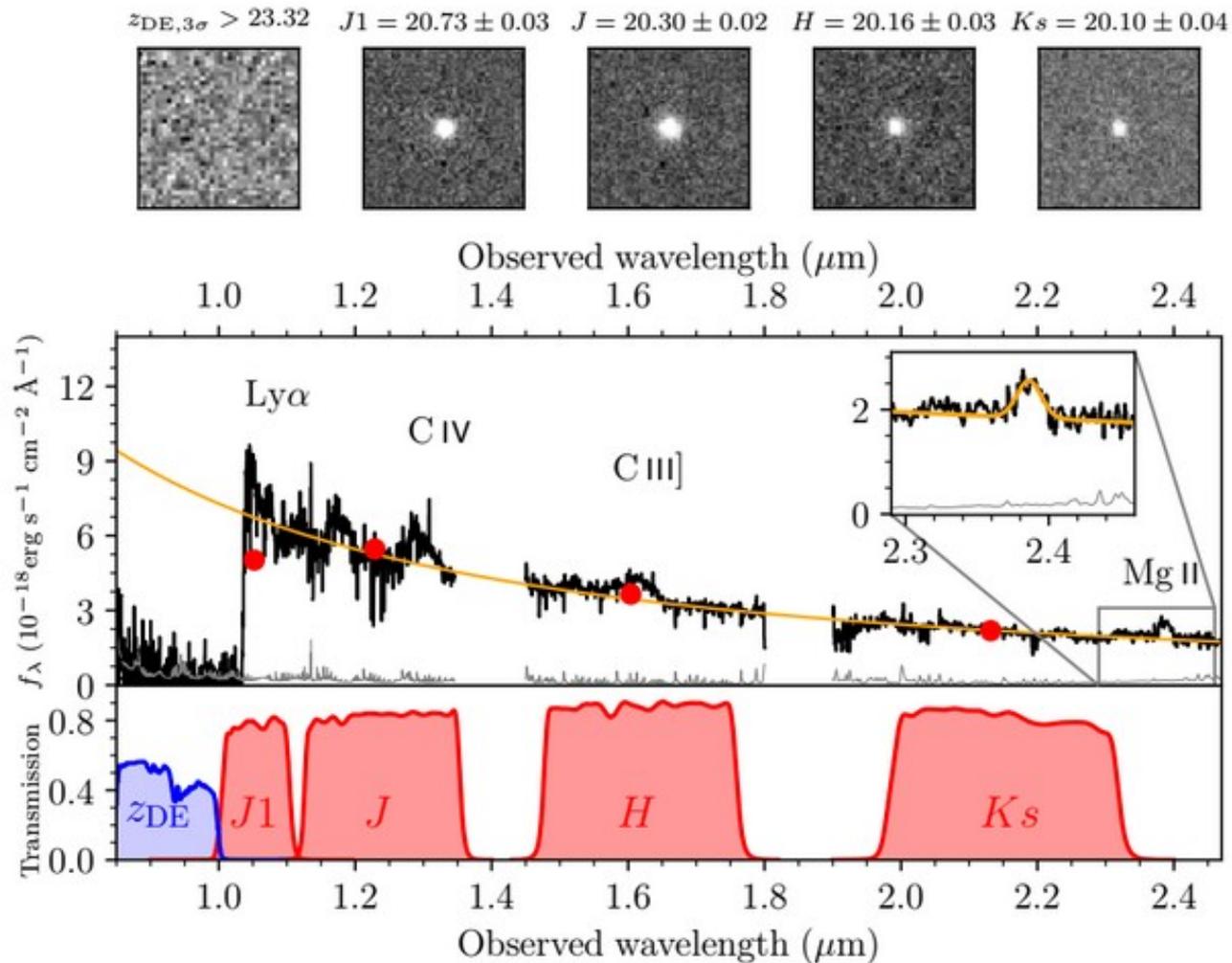
Antonio
Pensabene
(PhD)

Riccardo Nanni
(PhD, Marco Polo)



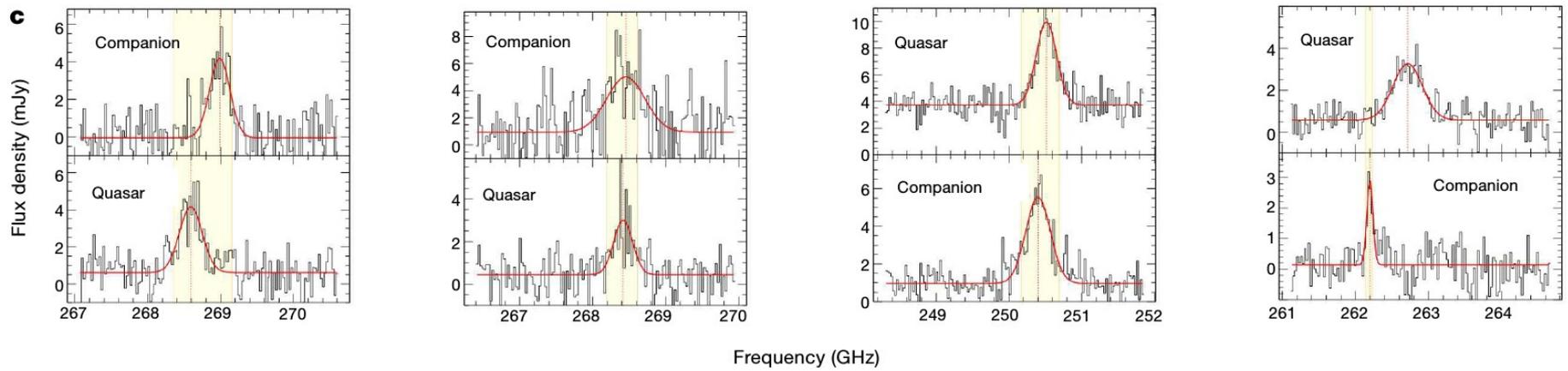
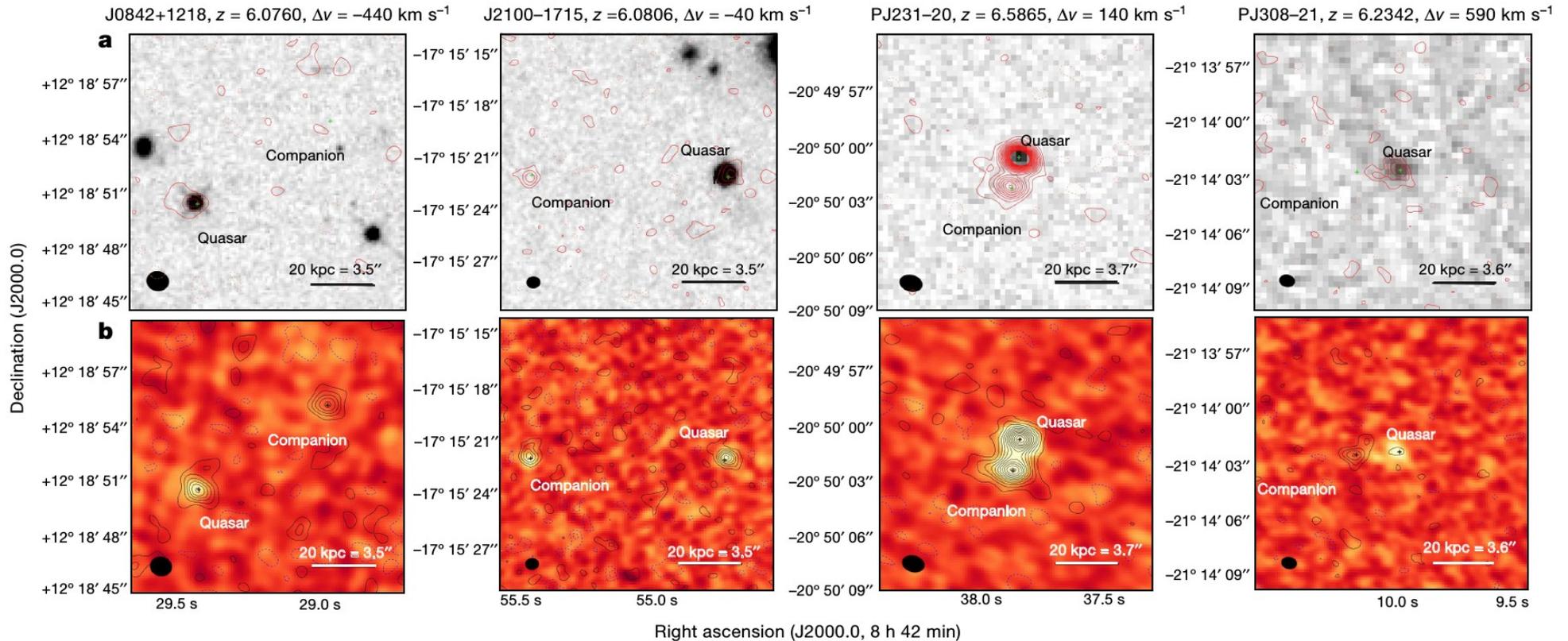
The most distant quasar

“Pisco” @ $z=7.54$



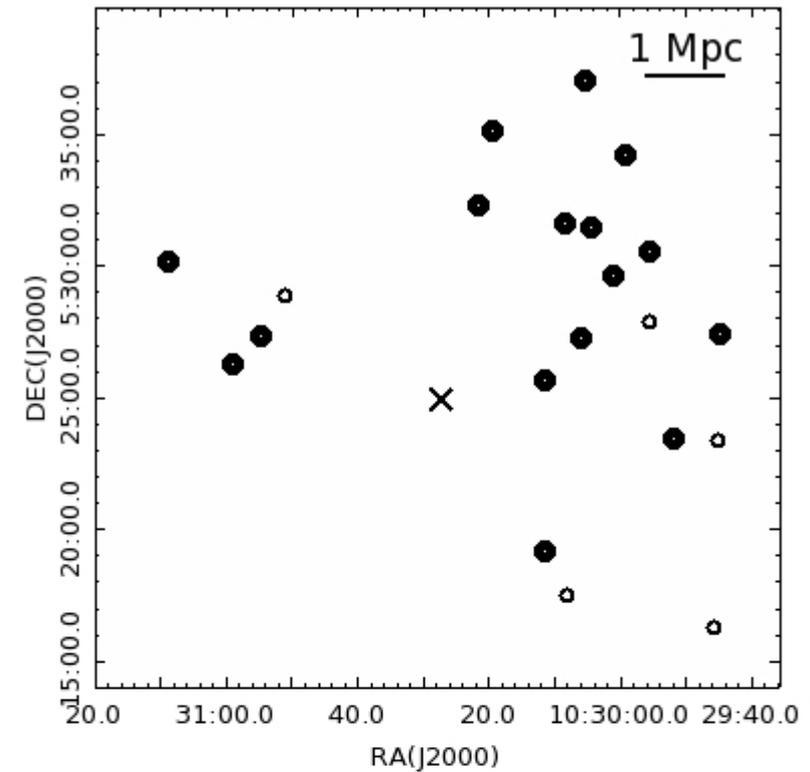
Companions of quasars at $z > 6$

Decarli et al. (2017) Nature

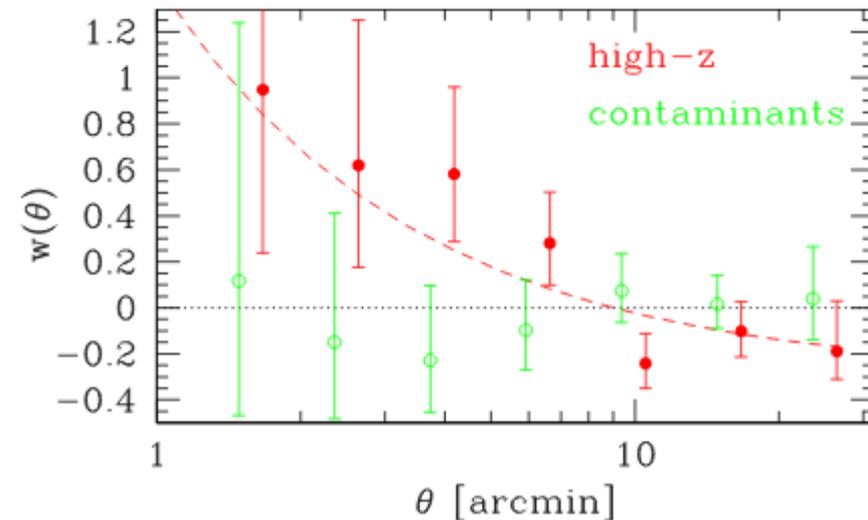


Large-scale environment

Companion galaxies
selected via dropout techniques
+ follow-up campaigns



Balmaverde et al. (2017)

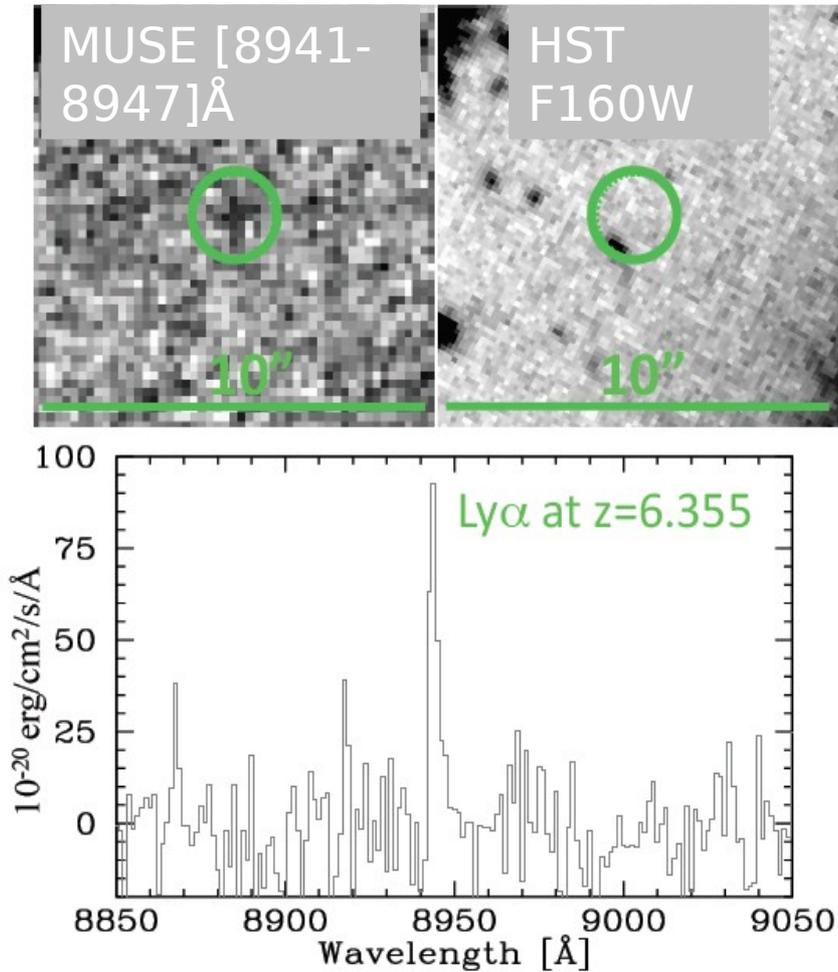


Marco Mignoli

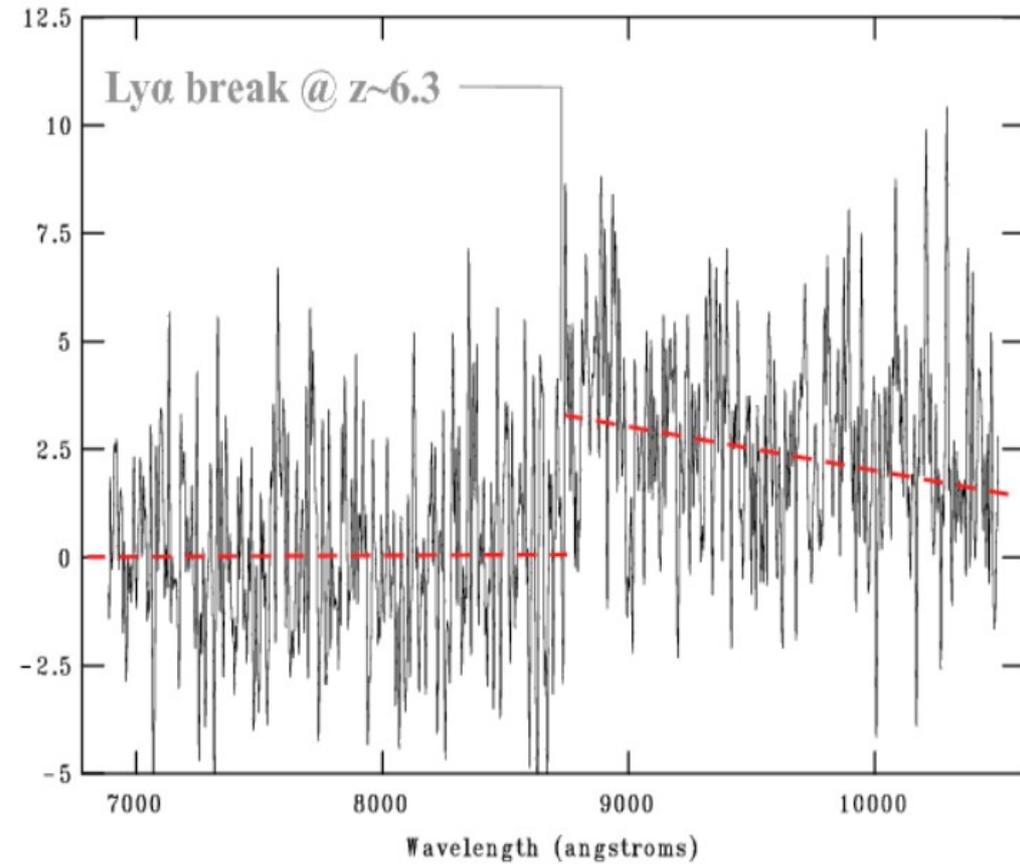


Roberto Gilli

MUSE Ly α emitter



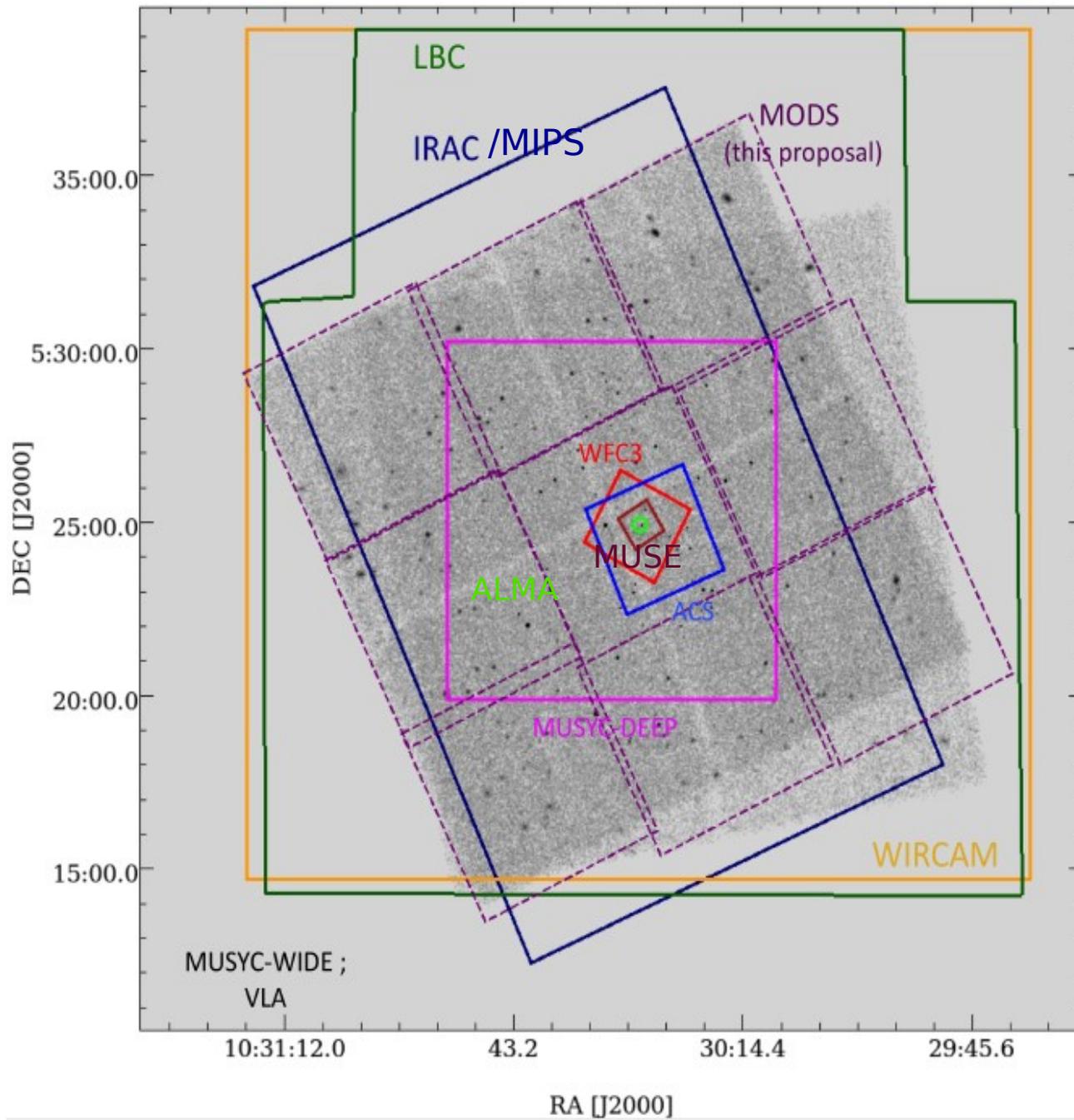
Keck Lyman Break Galaxy



Marco Mignoli



Roberto Gilli

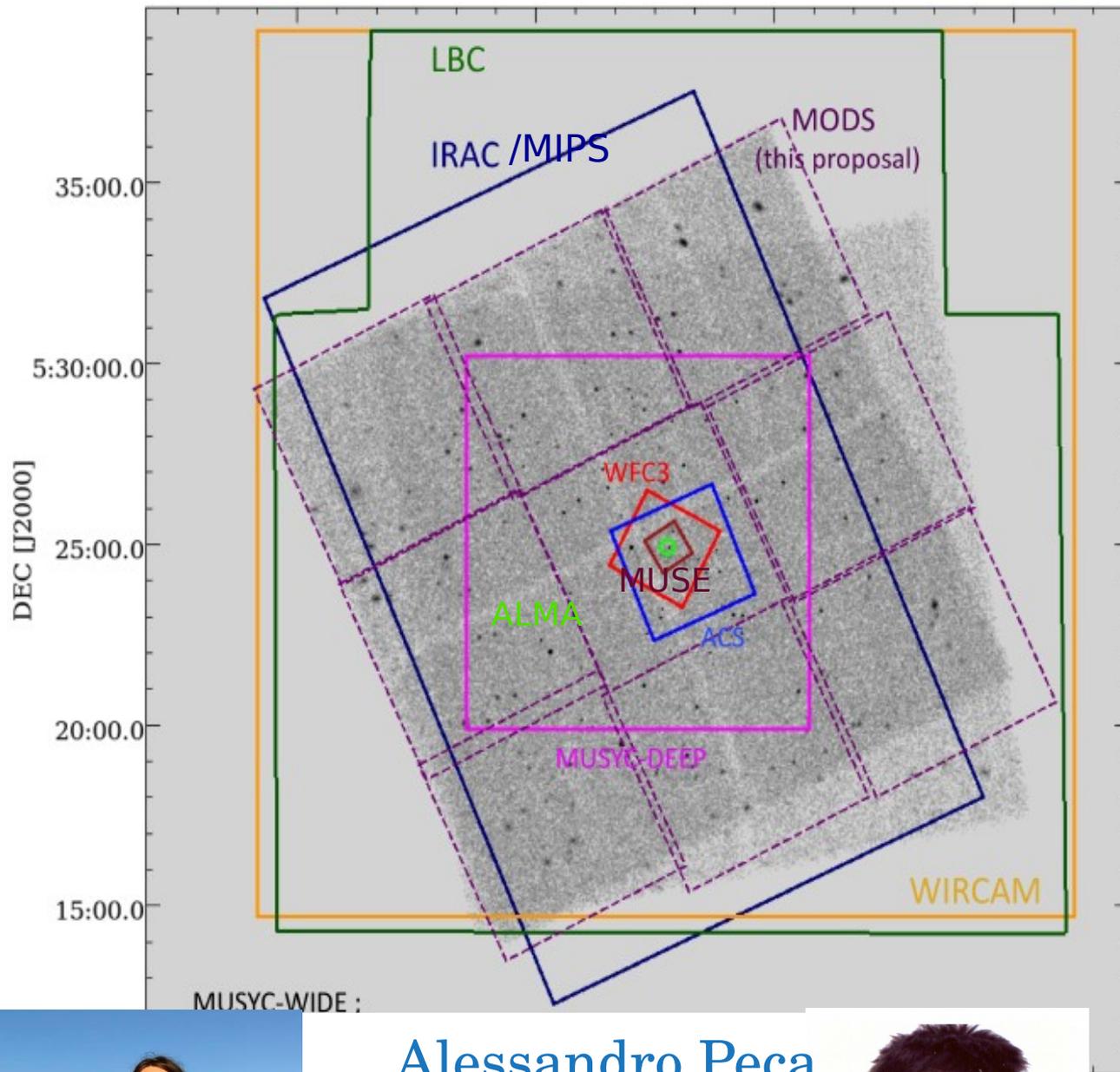


>200 X-ray sources

Opt/NIR spectra of
X-ray sources and
z~6 galaxy
candidates (Keck,
MUSE, LBT)

LBT strategic
program (52hr)

~180 redshifts exp.:
AGN demography
and evolution



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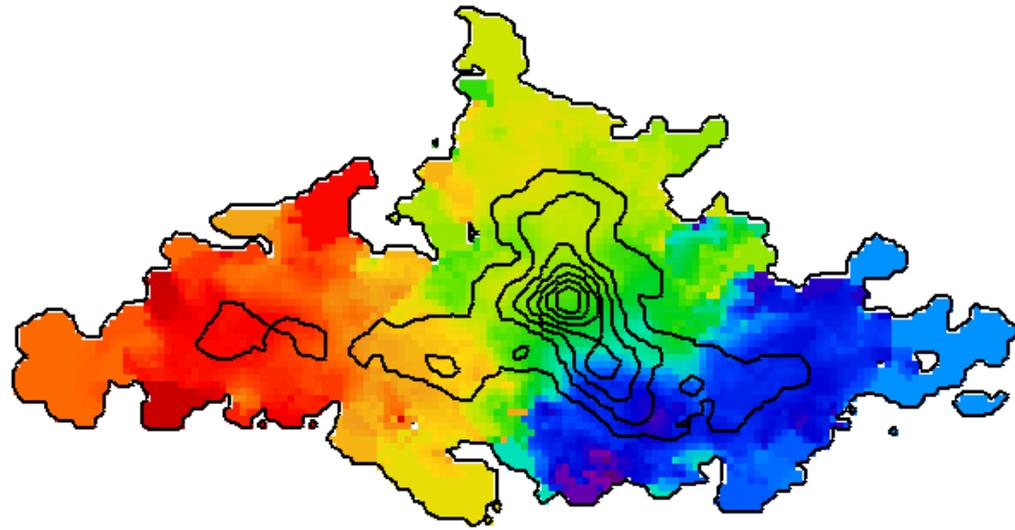


Alessandro Peca



Riccardo Nanni

Build up of a quasar host at $z > 6$

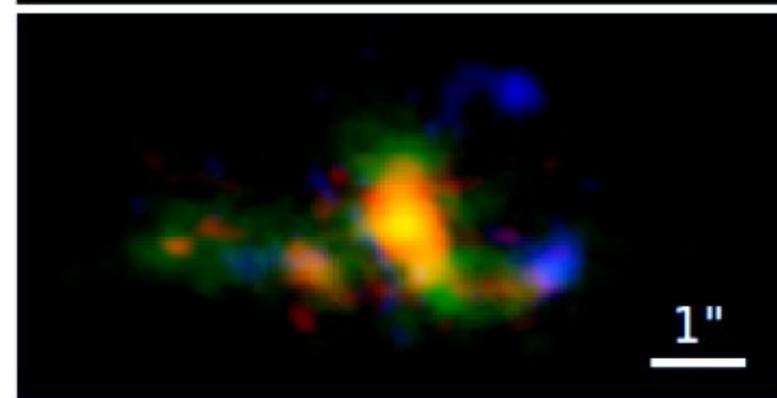
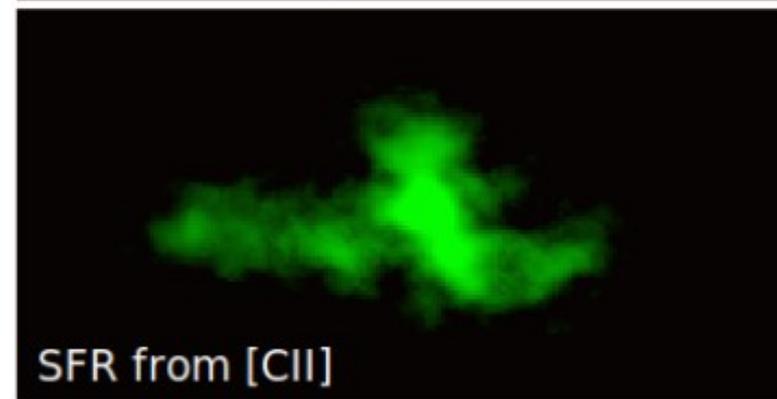
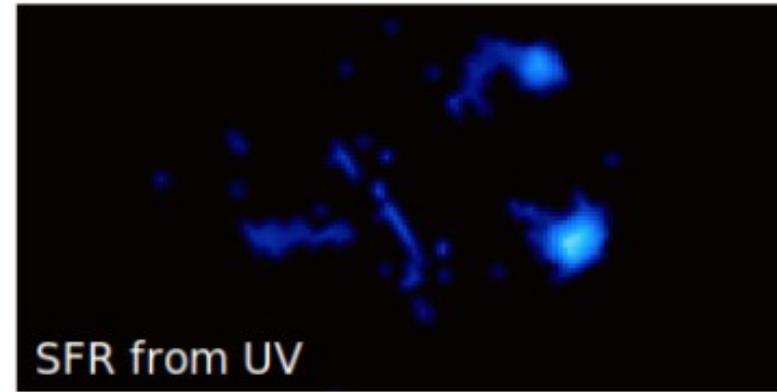


SFR from UV

SFR from [CII]

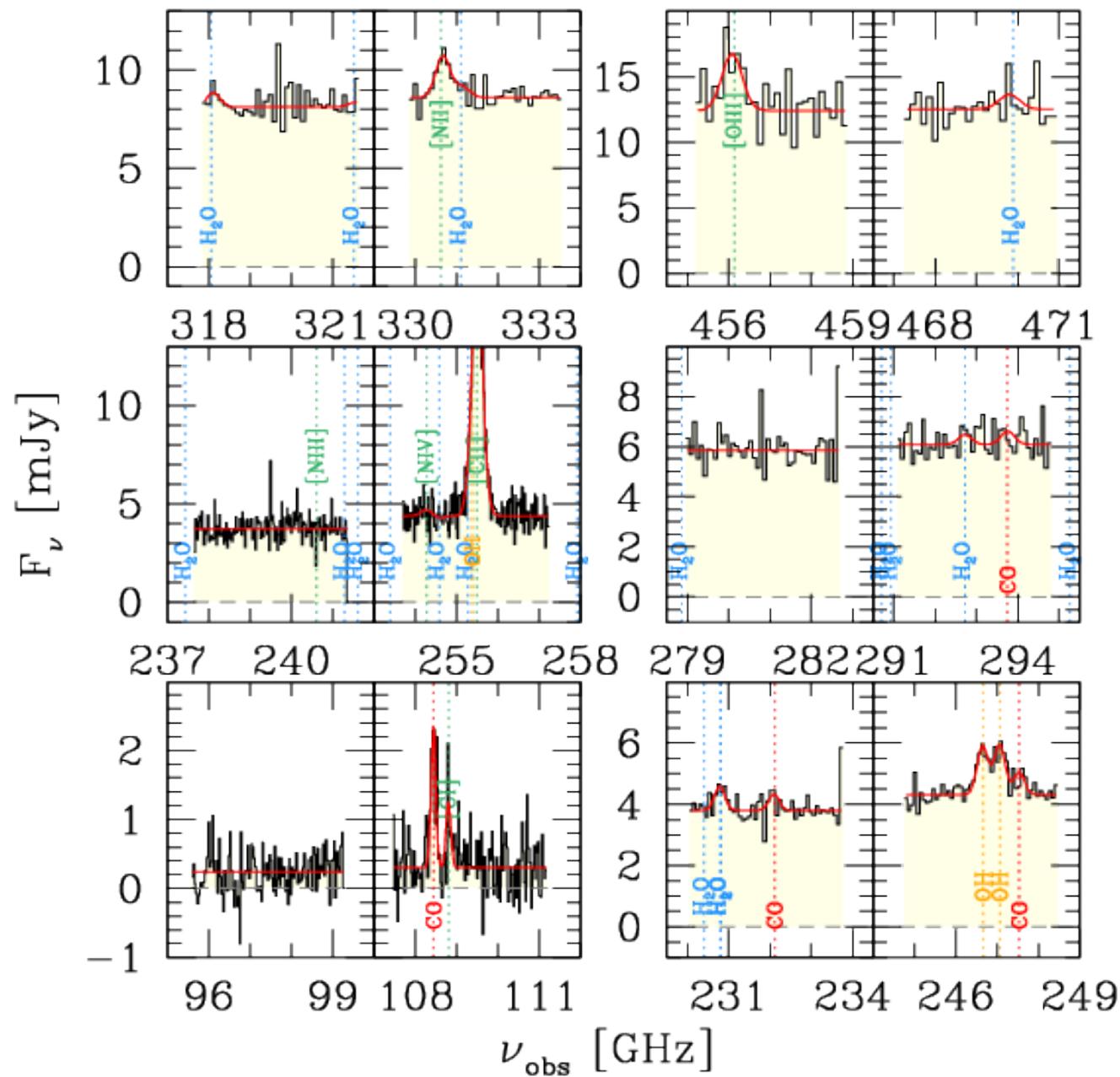
SFR from dust

Decarli et al. (in prep)



ISM in quasar hosts at $z > 6$

18 lines in
6 frequency
settings



AGN vs star-forming galaxies

ALPINE: survey of [CII]
in 122 galaxies at $z=4.4-5.9$
in COSMOS

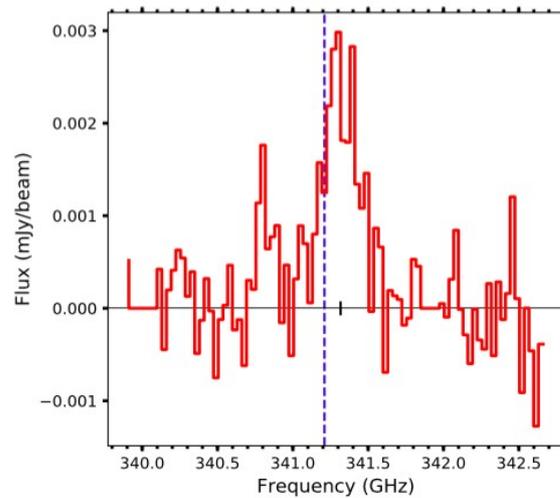
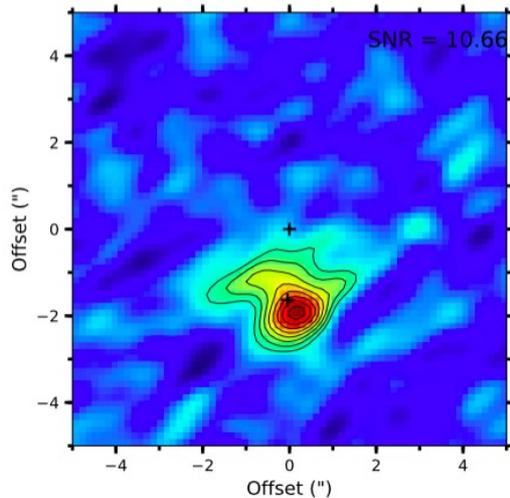


Federica Loiacono
(PhD)



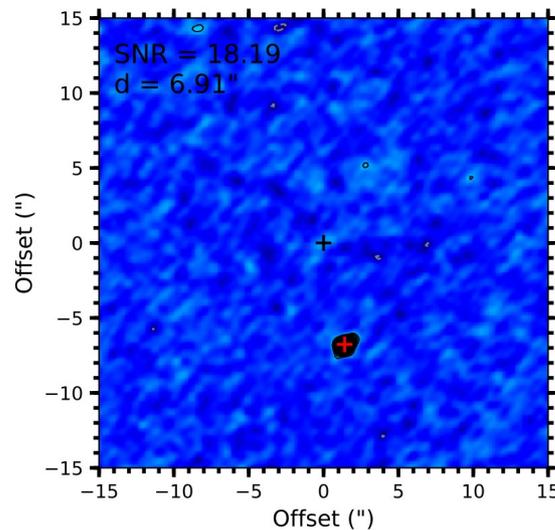
Carlotta Gruppioni

AGN vs star-forming galaxies



ALPINE: survey of [CII]
in 122 galaxies at $z=4.4-5.9$
in COSMOS

For free, survey of field
sources
- dust continuum LF
- high-J CO



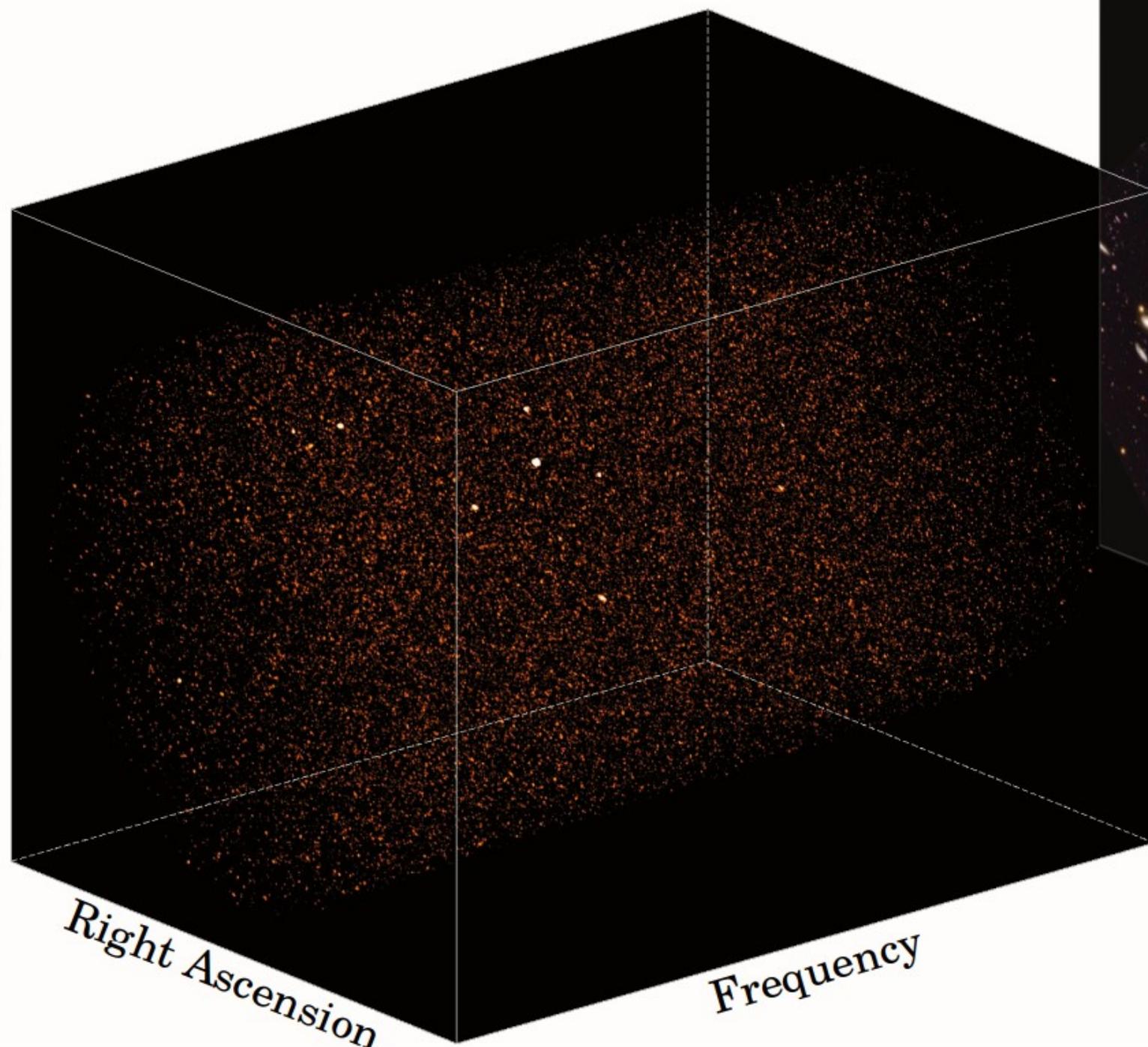
Federica Loiacono
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Carlotta Gruppioni

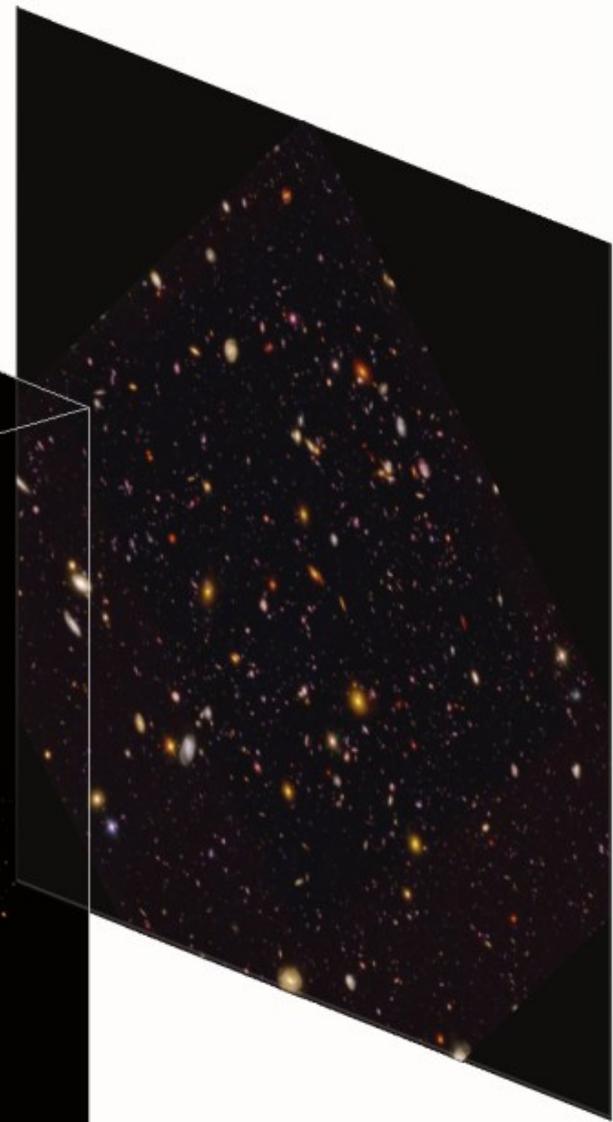
ASPECS

Declination

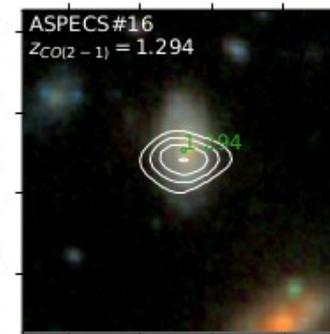
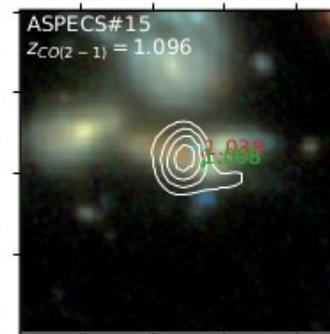
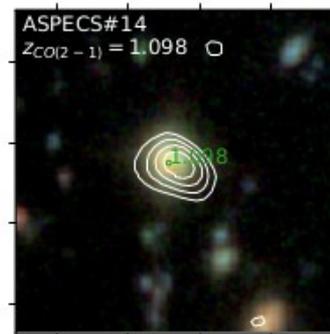
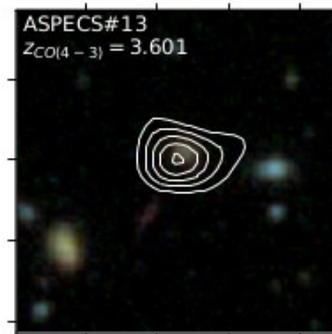
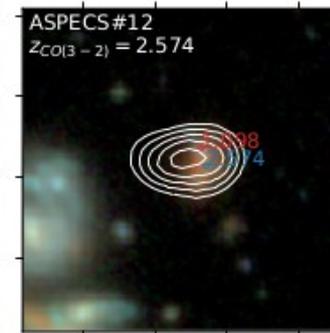
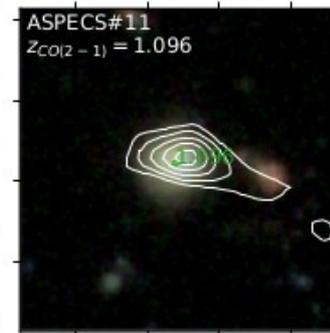
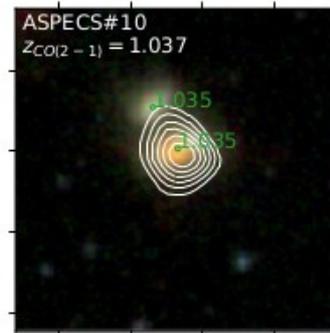
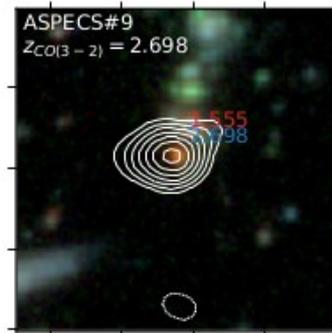
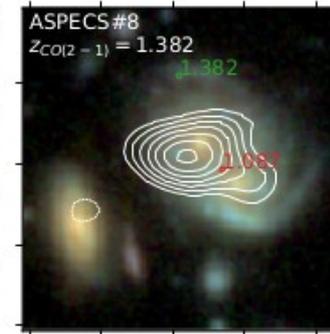
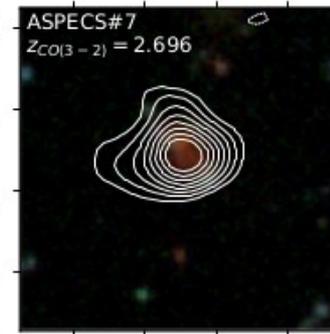
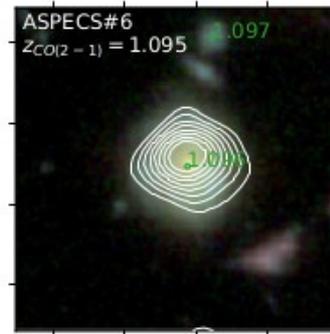
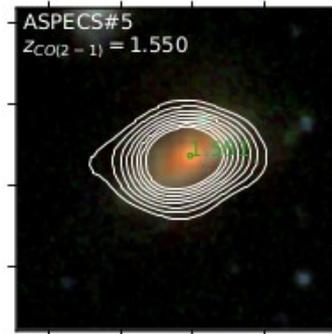
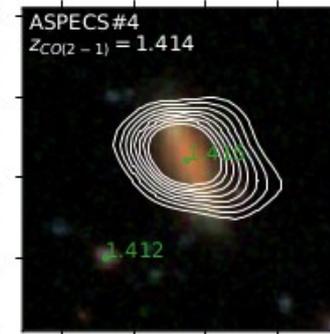
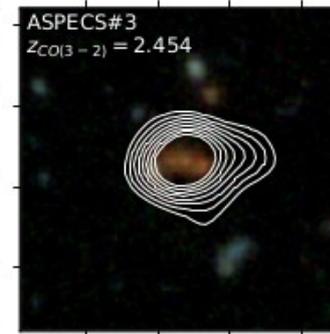
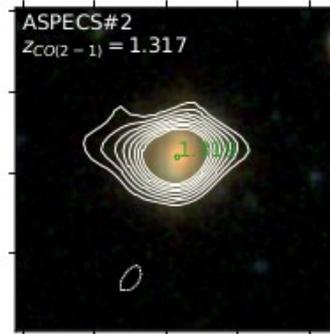
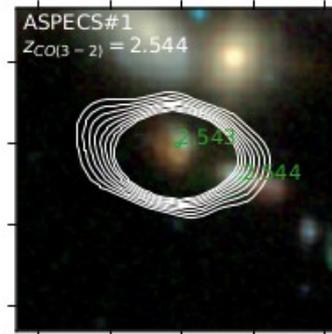


Right Ascension

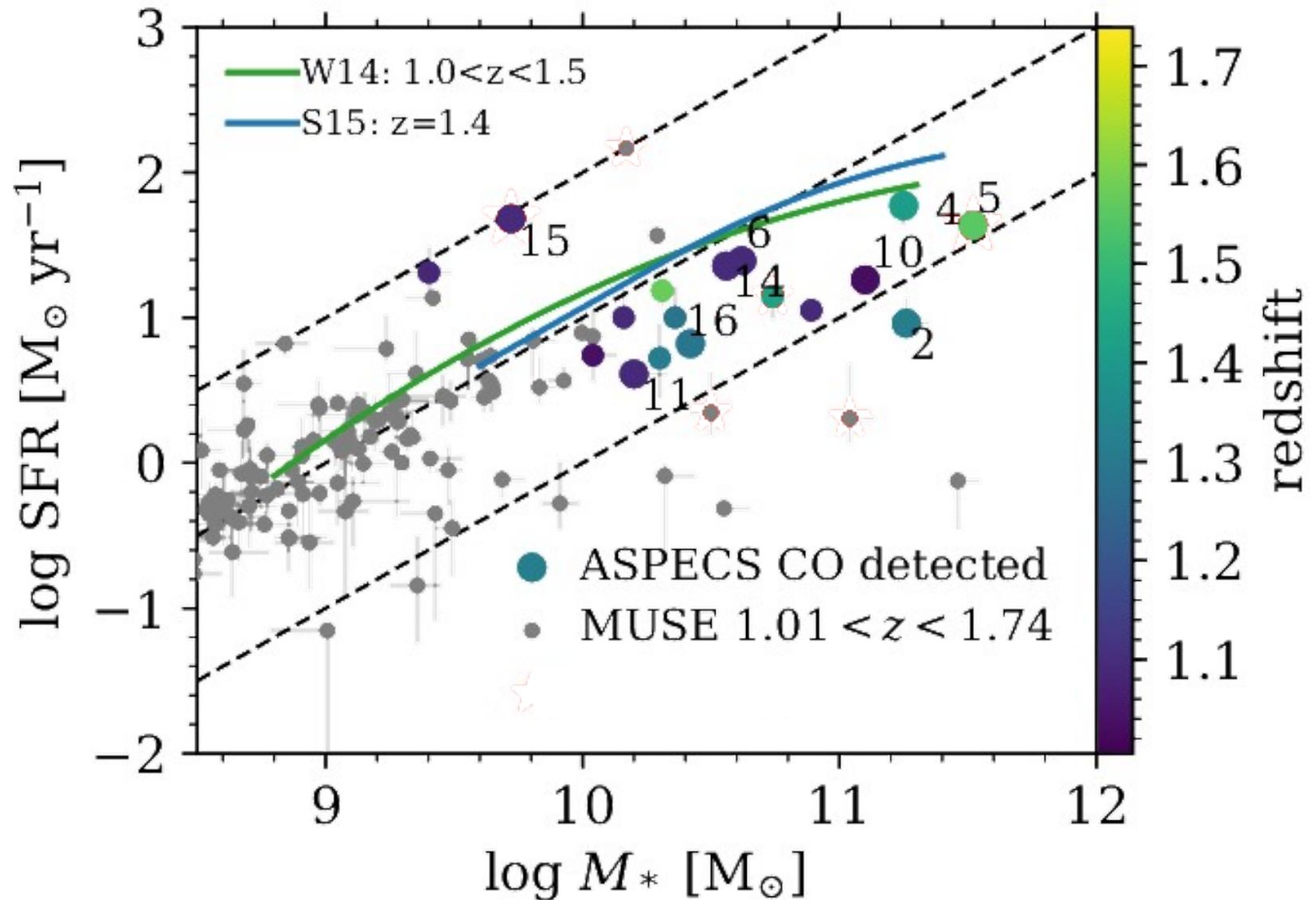
Frequency



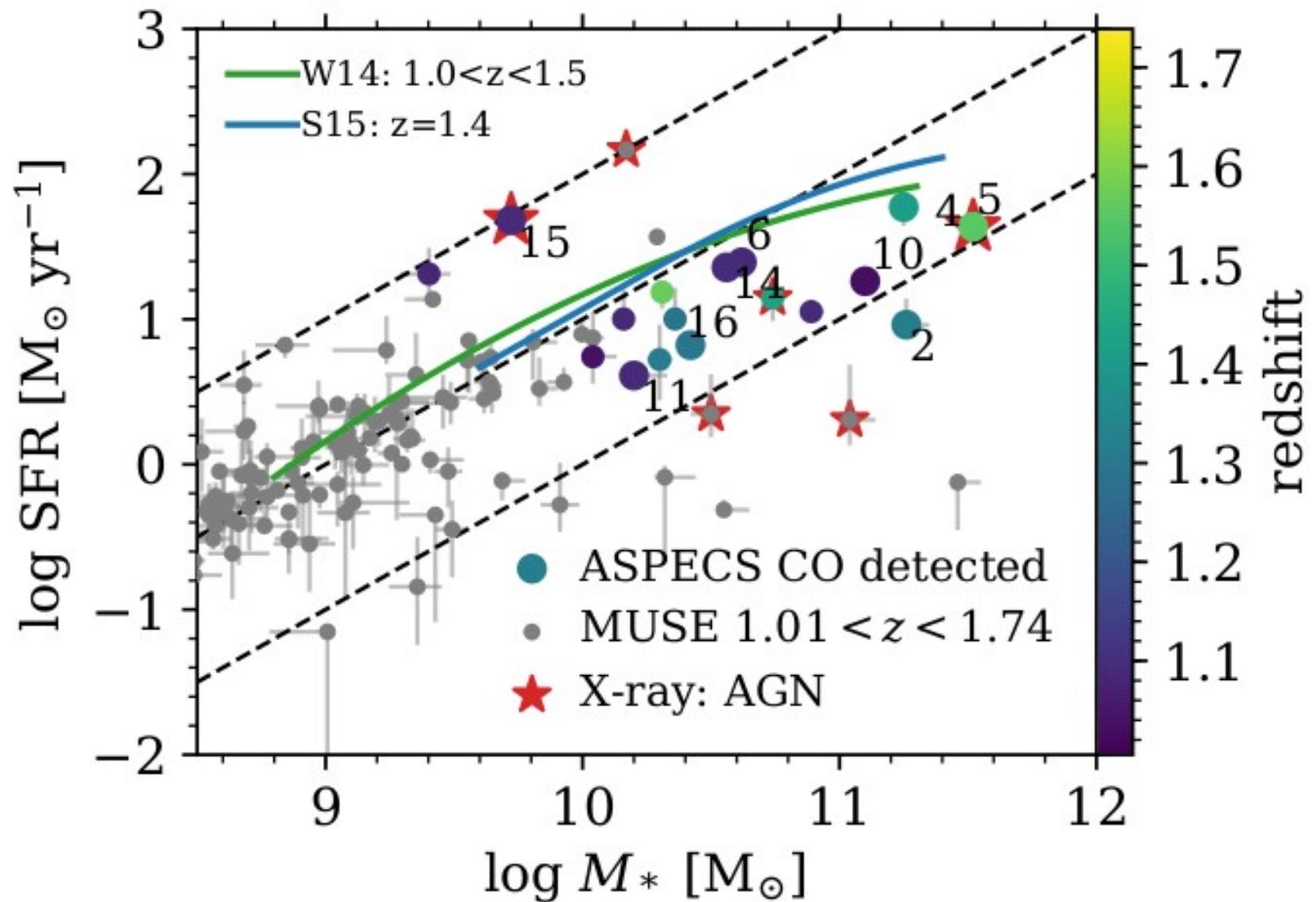
“Blind” census of molecular gas in the HUDF



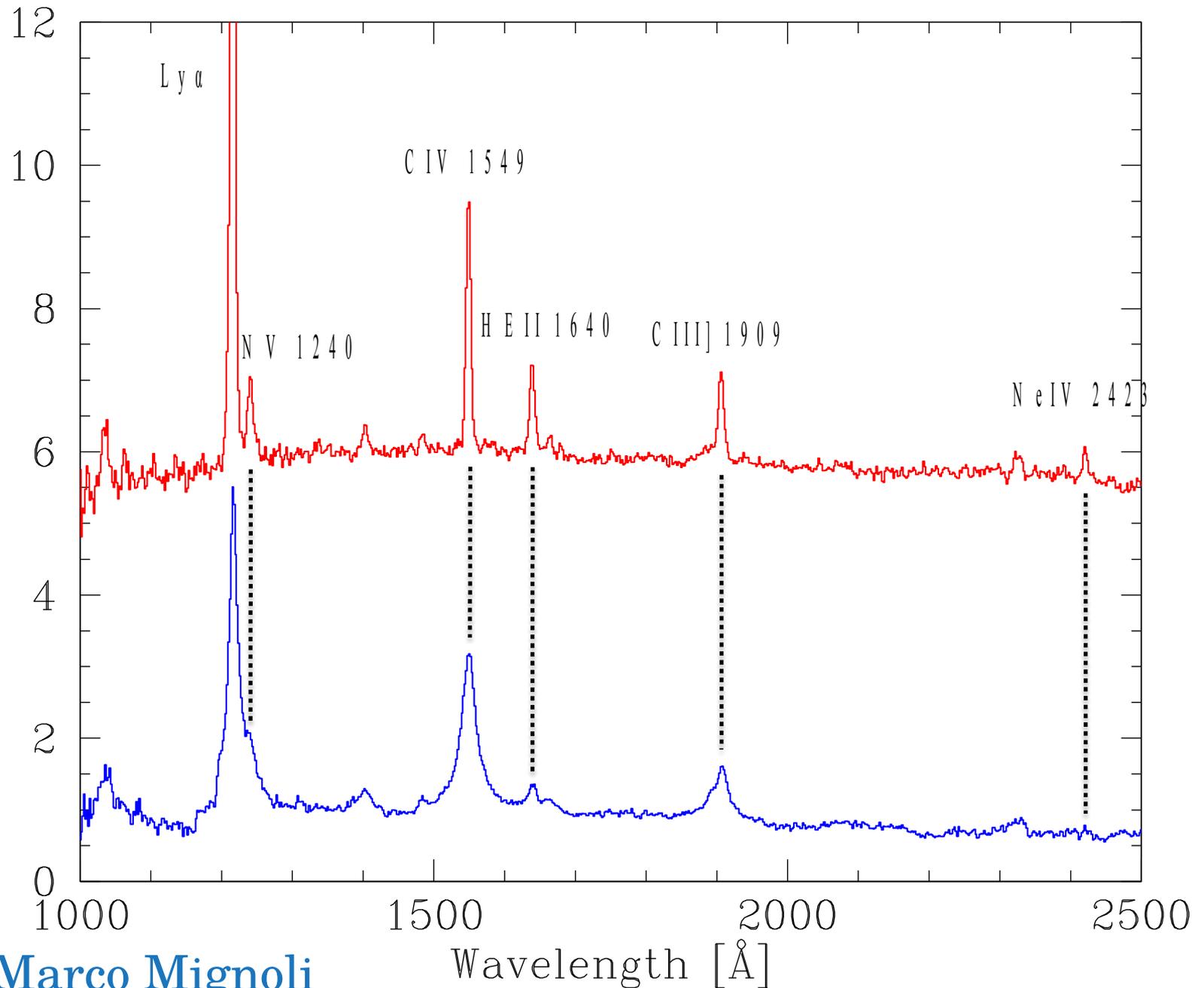
Position wrt Main Sequence



AGN flag

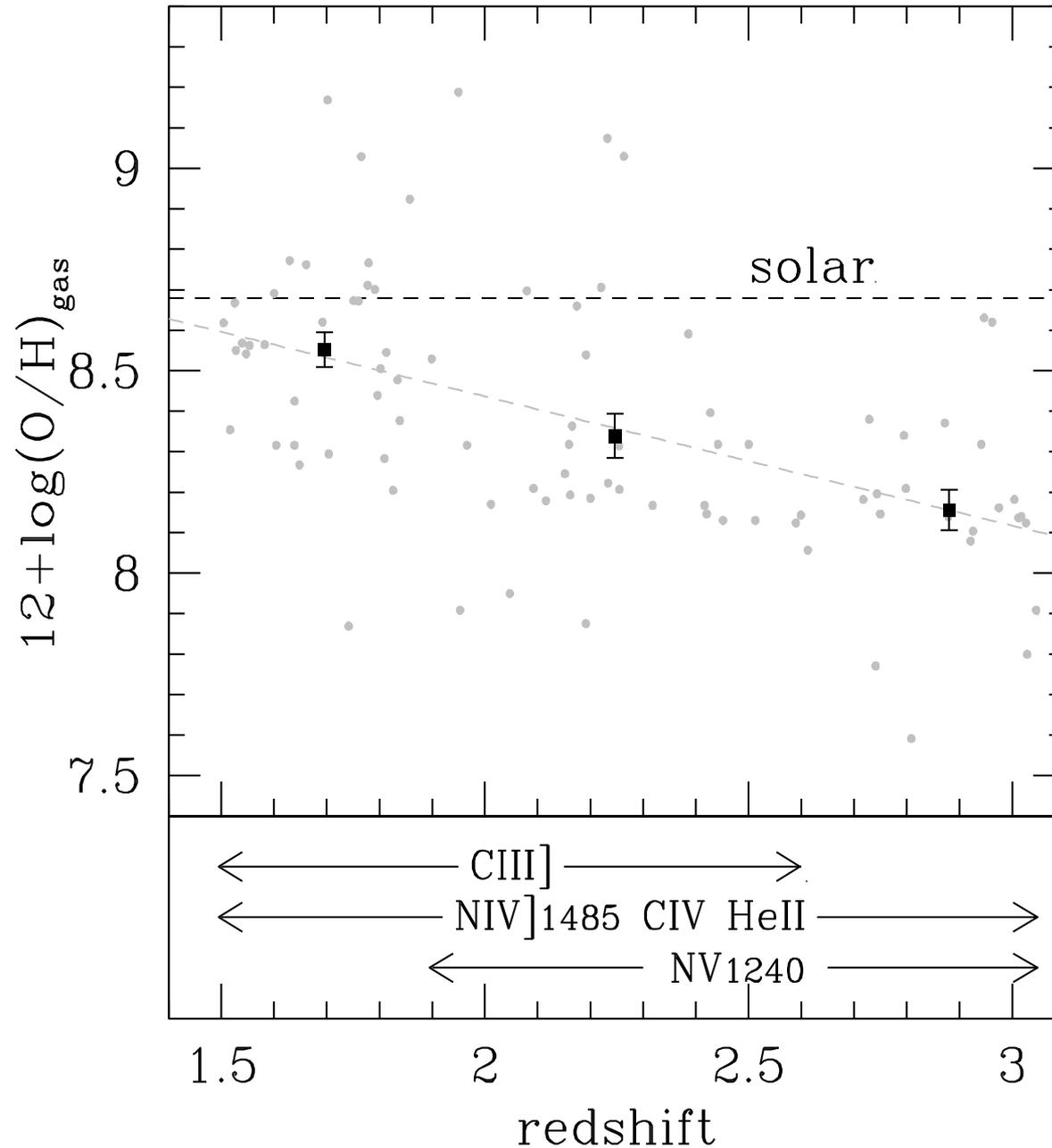


Gas diagnostics based on UV lines

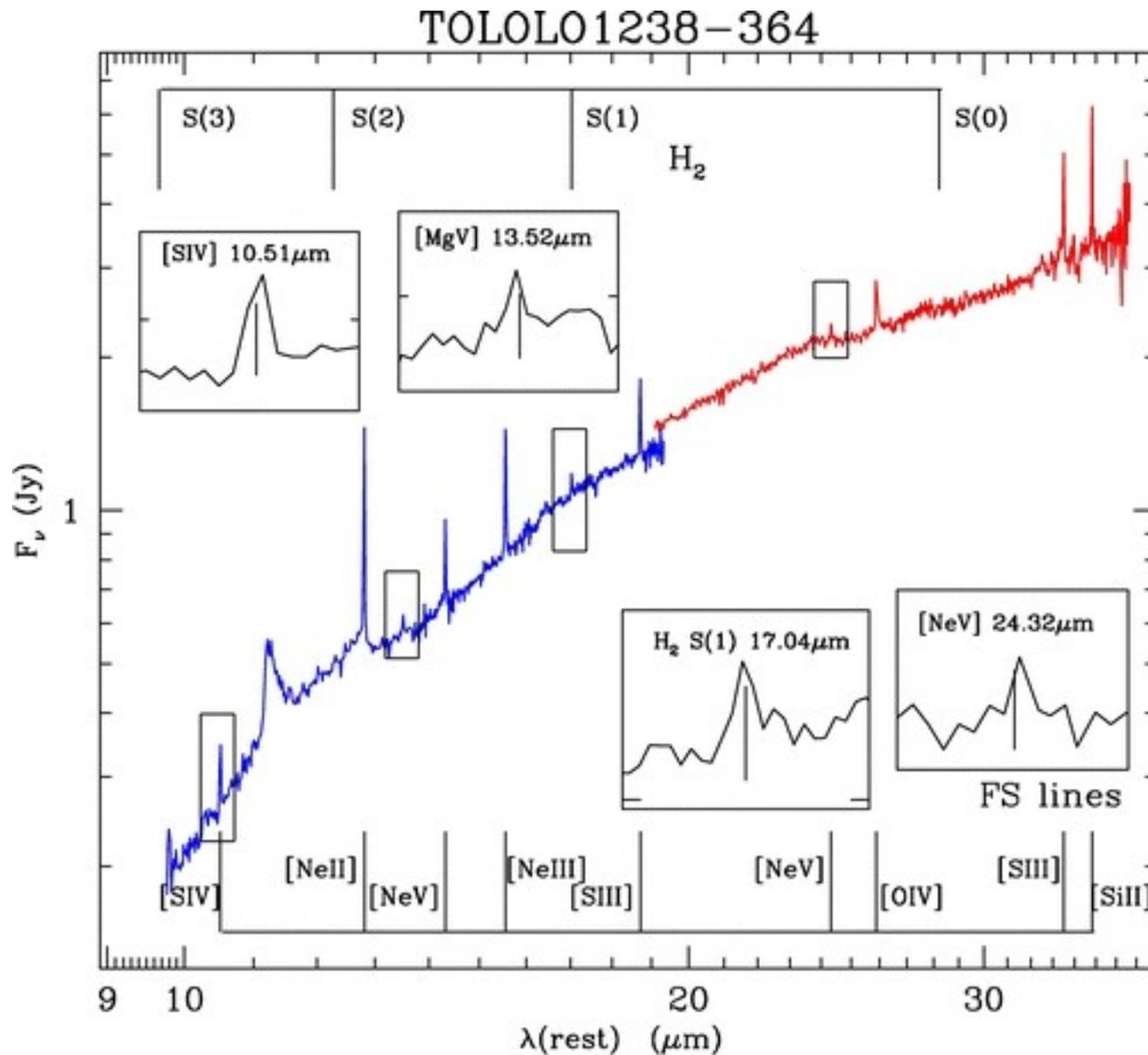


Marco Mignoli

Evolution of metallicity in the NLR



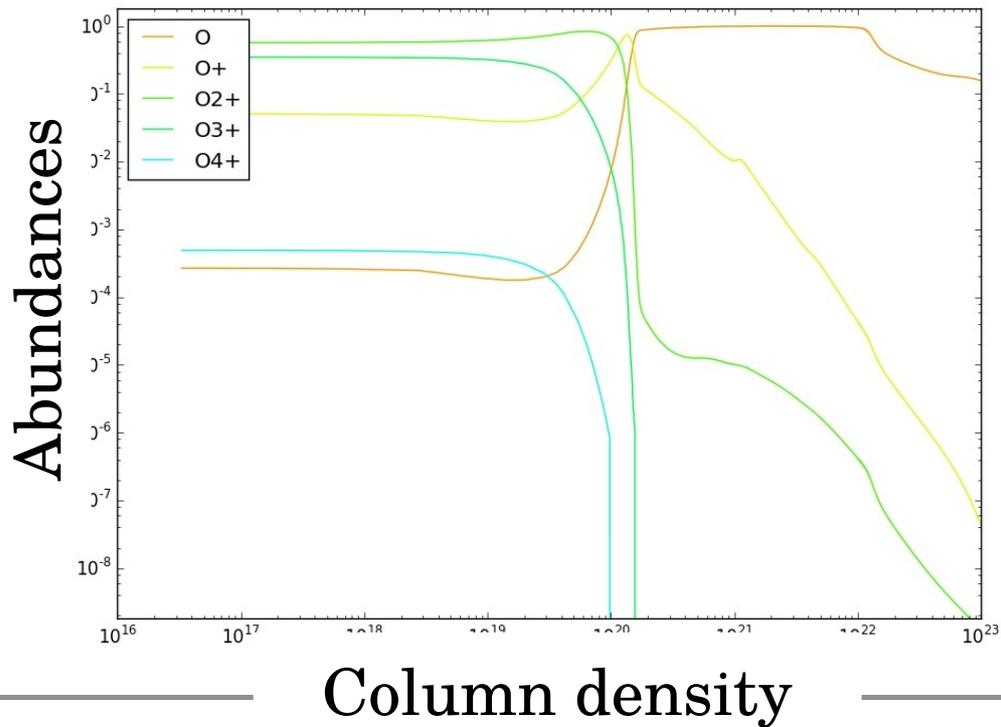
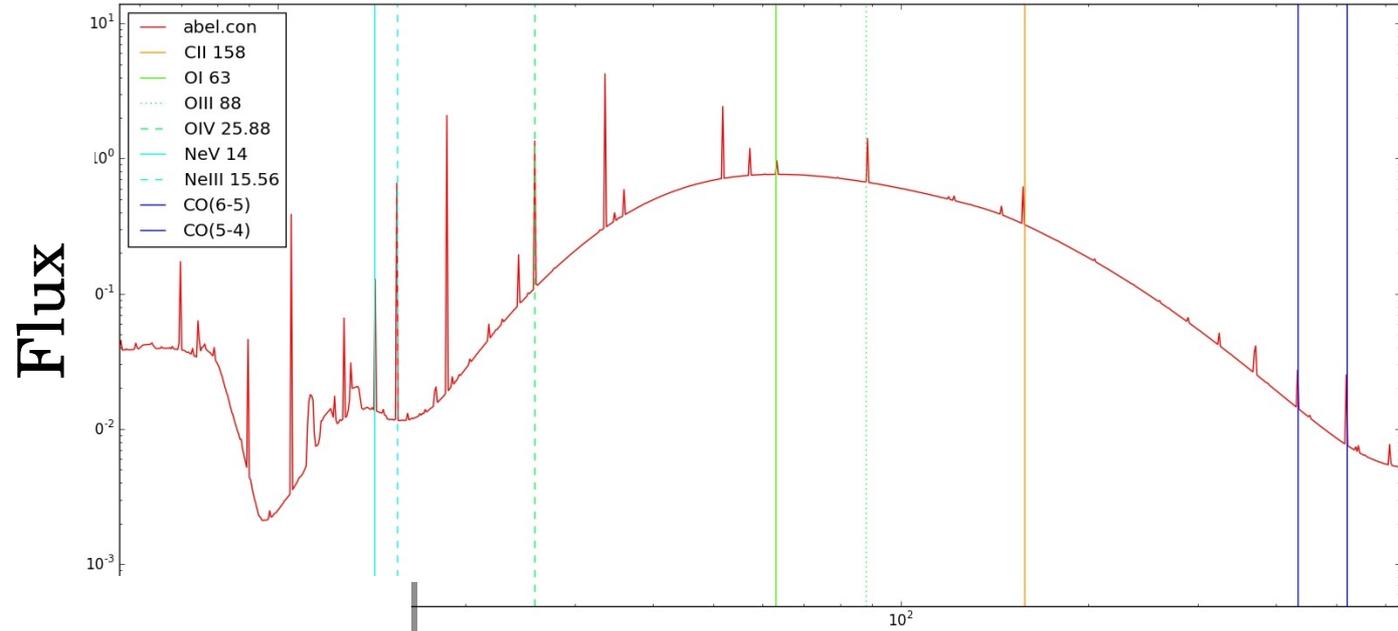
IR lines



MIR and
FIR lines
provide
additional
tracers of
the ISM



Models to connect optical and IR tracers



SPICA: the next generation IR telescope



ESA-led mission + JAXA contribution

2.5m telescope, cooled at **<8 K**

12-230 μm spectroscopy

MIR imaging

FIR spectroscopy

FIR polarimetry

Japanese H3 launcher, L2 halo orbit

5 yr goal lifetime

L-mission at ESA cost of M-mission



Francesco Calura



Carlotta Gruppioni

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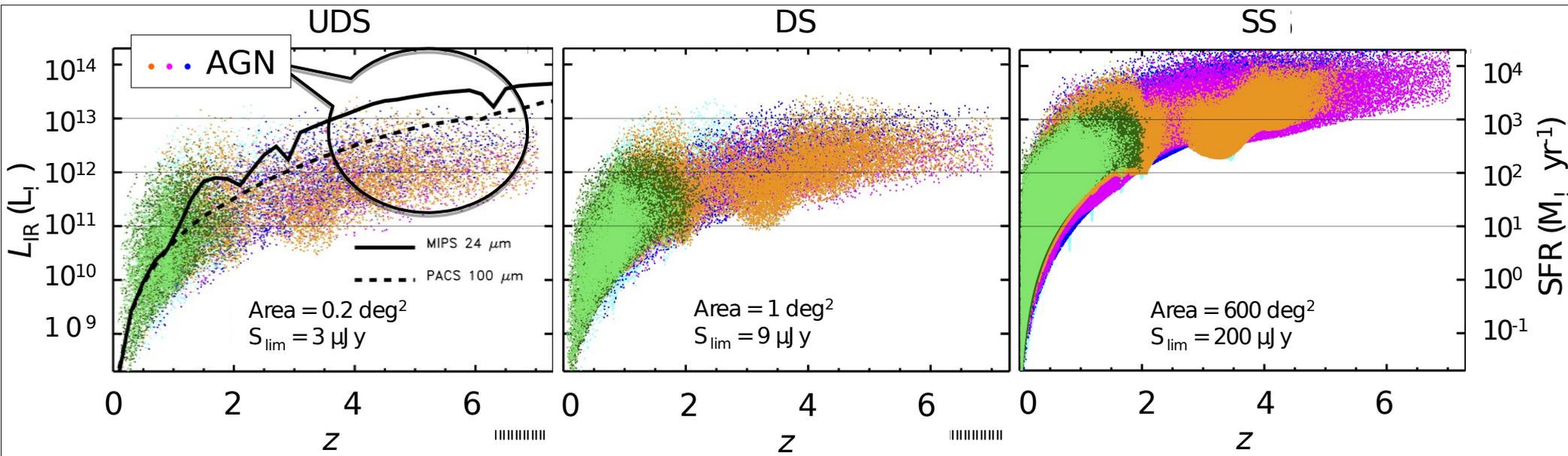
L-mission at ESA cost of M-mission

Pre-selected ESA mission for phase A

Final selection: late 2021

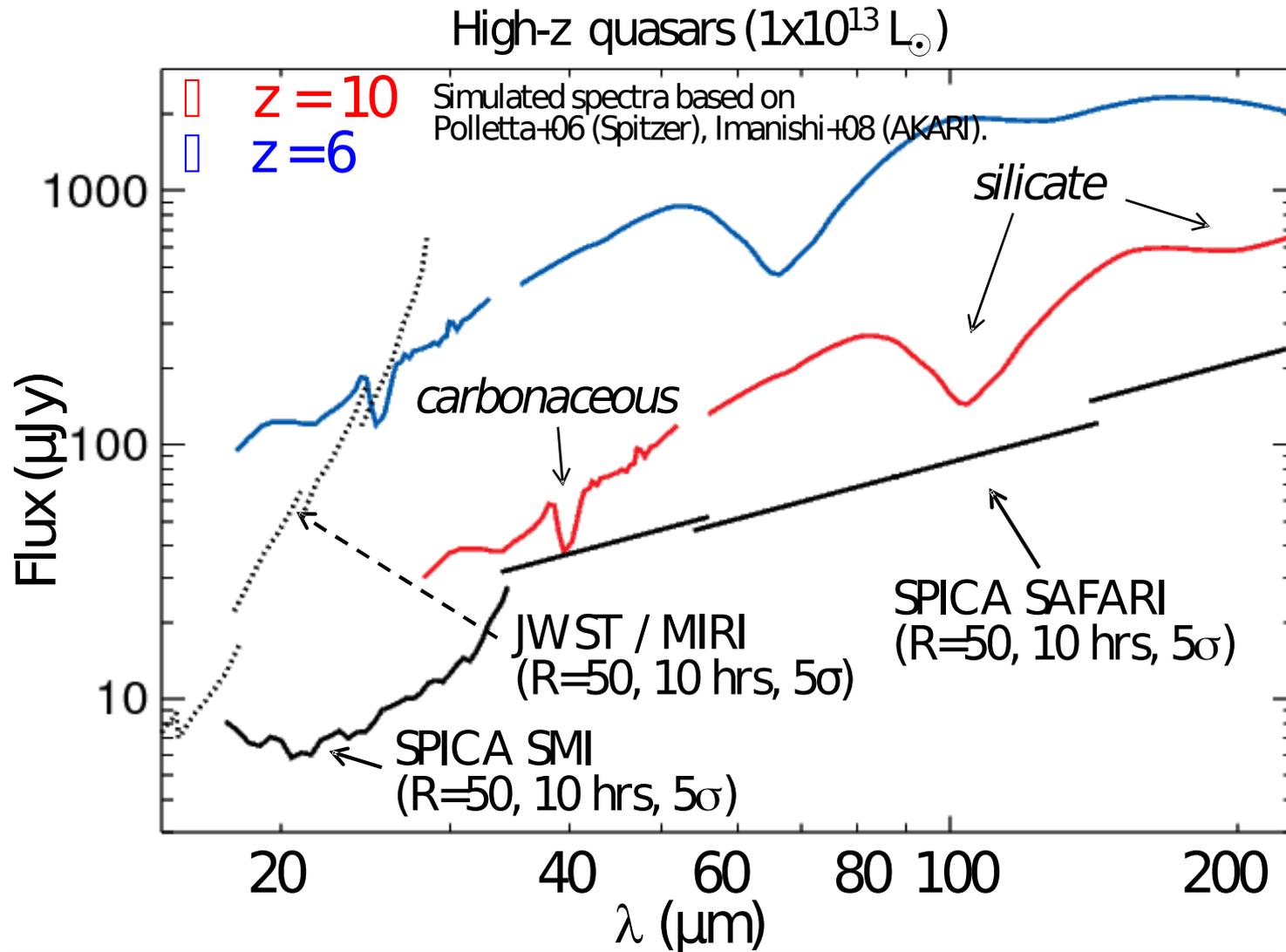
Launch: ~2030

Efficient imaging survey instrument ...



“complete” census
of high- z AGN

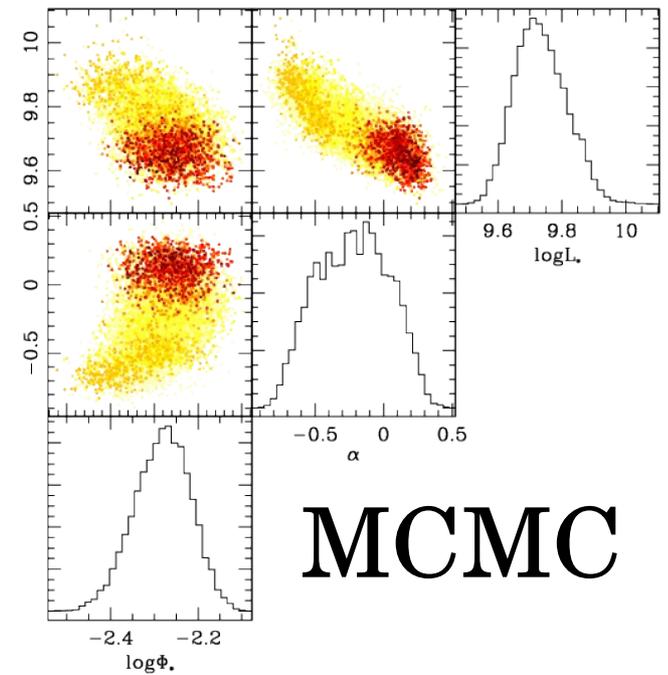
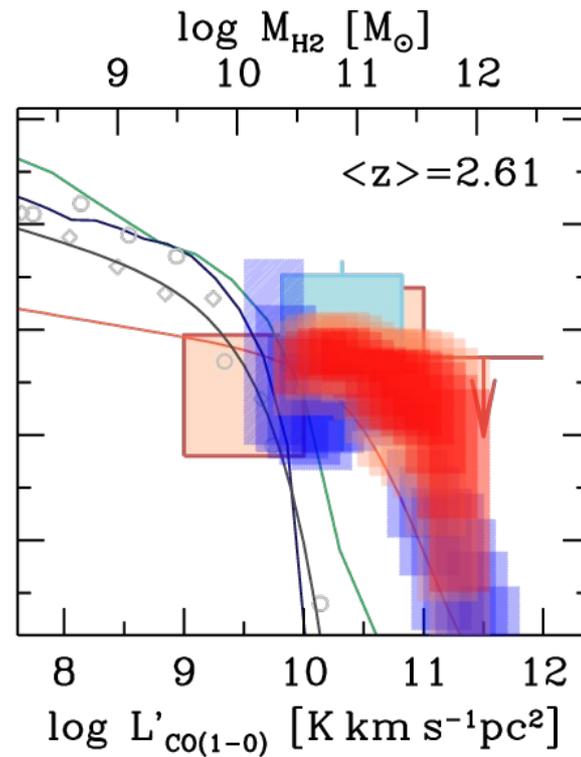
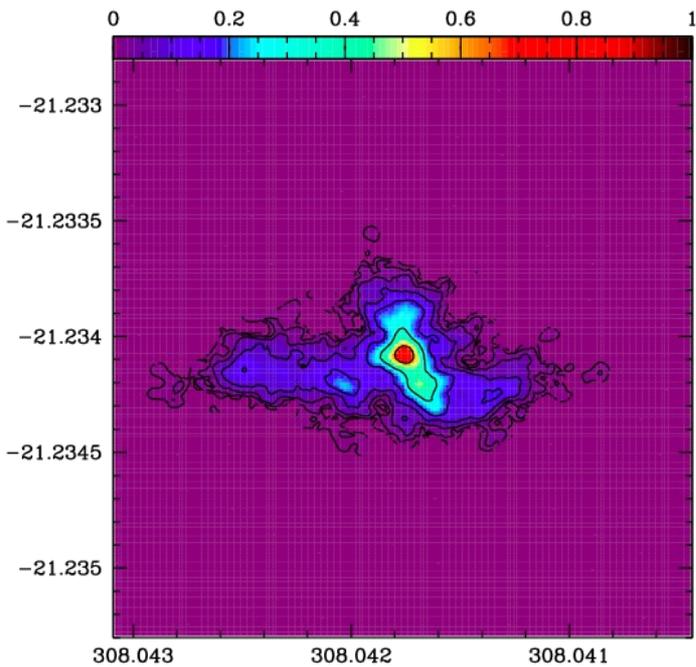
... and spectroscopy of $z > 6$ quasars!



On computing expertise...

On computing expertise...

SuperMongo!



MCMC