Euclid Legacy Science

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on behalf of the Euclid Consortium

Cosmological survey mission

Wide-field telescope
1.2 m diameter
FoV: 0.69x0.74 deg^2

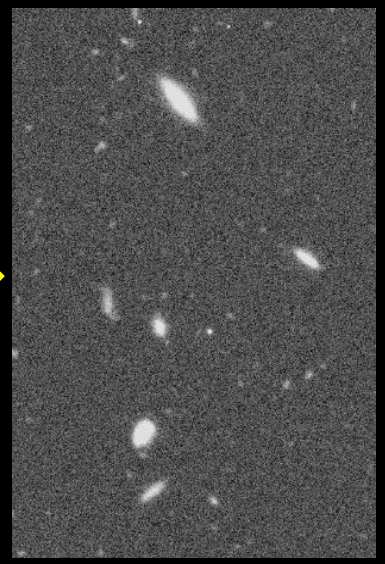
Visual Imager (**VIS**)

Near-Infrared Imager+Grism Spectrometer (**NISP**)

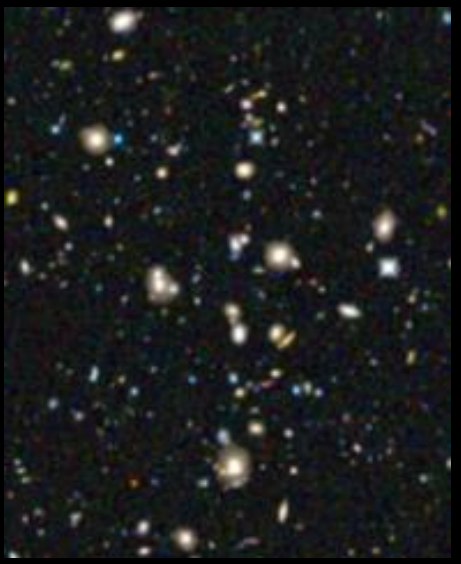
~100 GB compressed data/day

Launch: 2022

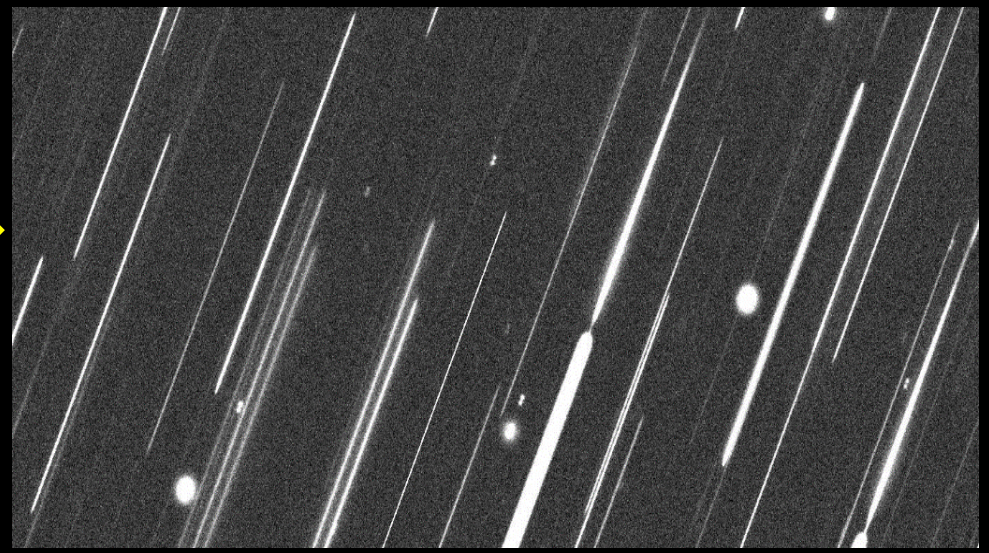
IMAGING SURVEY	**WIDE – 15,000 deg²** VIS: $m_{AB} \leq 24.5$ NISP: $m_{AB} \leq 24.0$ **DEEP – 40 deg²** VIS: $m_{AB} \leq 26.5$ NISP: $m_{AB} \leq 26.0$
SPECTROSCOPIC SLITLESS SURVEY	**WIDE – 15,000 deg²** 1.25–1.85 μm (3 grism orientations) $F_{line}>2x10^{-16}$ cgs, $H_{AB} \leq 19.5$ **DEEP – 40 deg²** 1.25–1.85 μm (>10 orientations) 0.92–1.30 μm (>10 orientations) $F_{line}>6x10^{-17}$ cgs, $H_{AB} \leq 21.5$



VIS: RIZ (0.1"/pix)



NISP: Y, J, H (0.3"/pix)

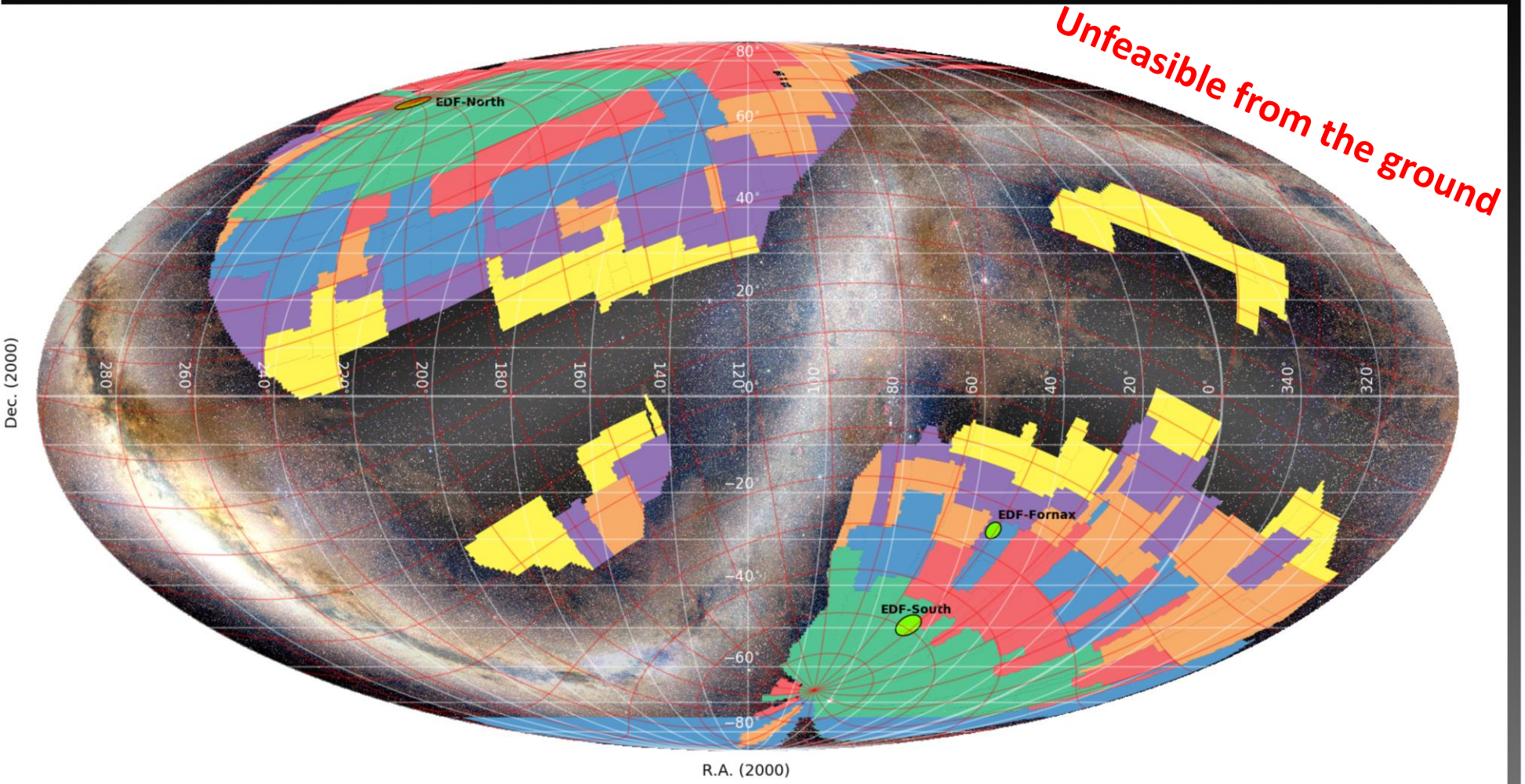


NISP (0.3"/pix, R~300)

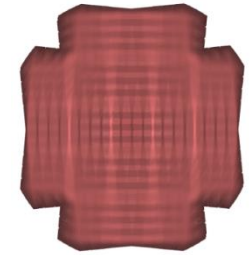
+External data (imaging & spectroscopy)

DES, CFHT, JST/T250, Subaru?, LSST?, Keck,
VLT, Spitzer, GTC?, … and many more to come

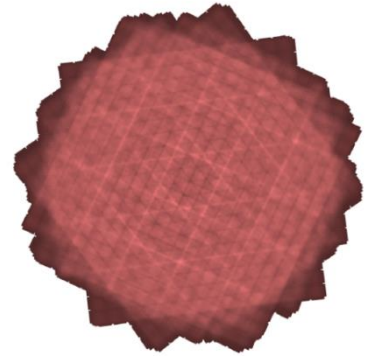
survey for SPV2: yearly breakdown



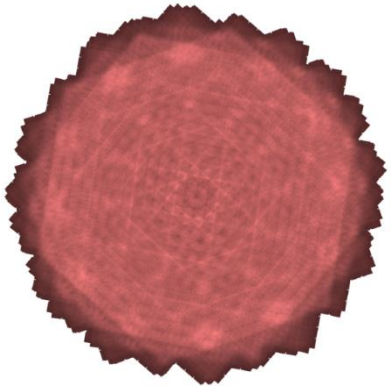
Plot by J.C. Cuillandre



Deep Fornax (10 deg^2)

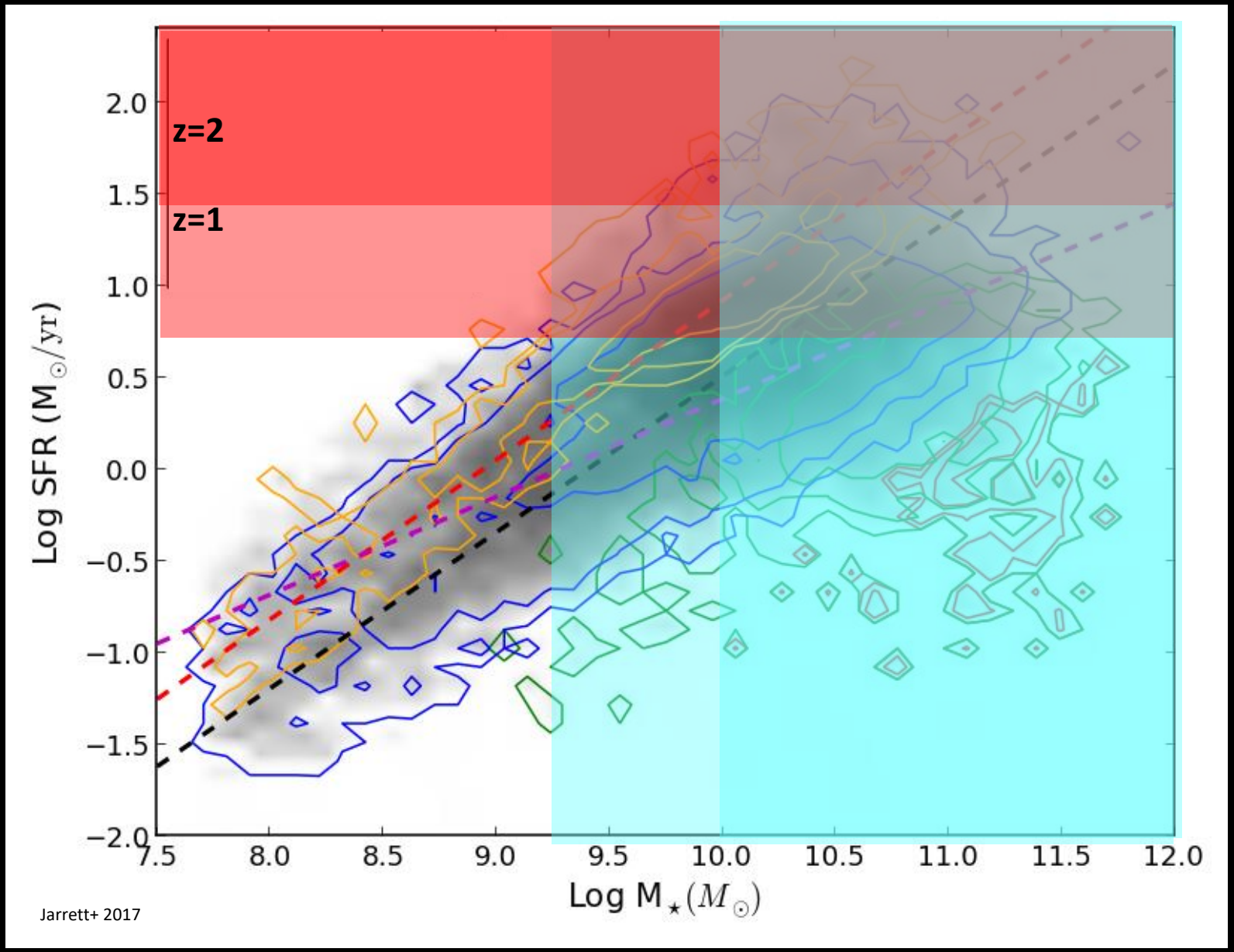


Deep Field North (10 deg^2)
Centred on the NEP



Deep Field South (20 deg^2)
Close to SEP

Wide Survey



Jarrett+ 2017

IMAGING

2 billion galaxies to H=24

ugrizYJH photometric SEDs
Photometric redshifts

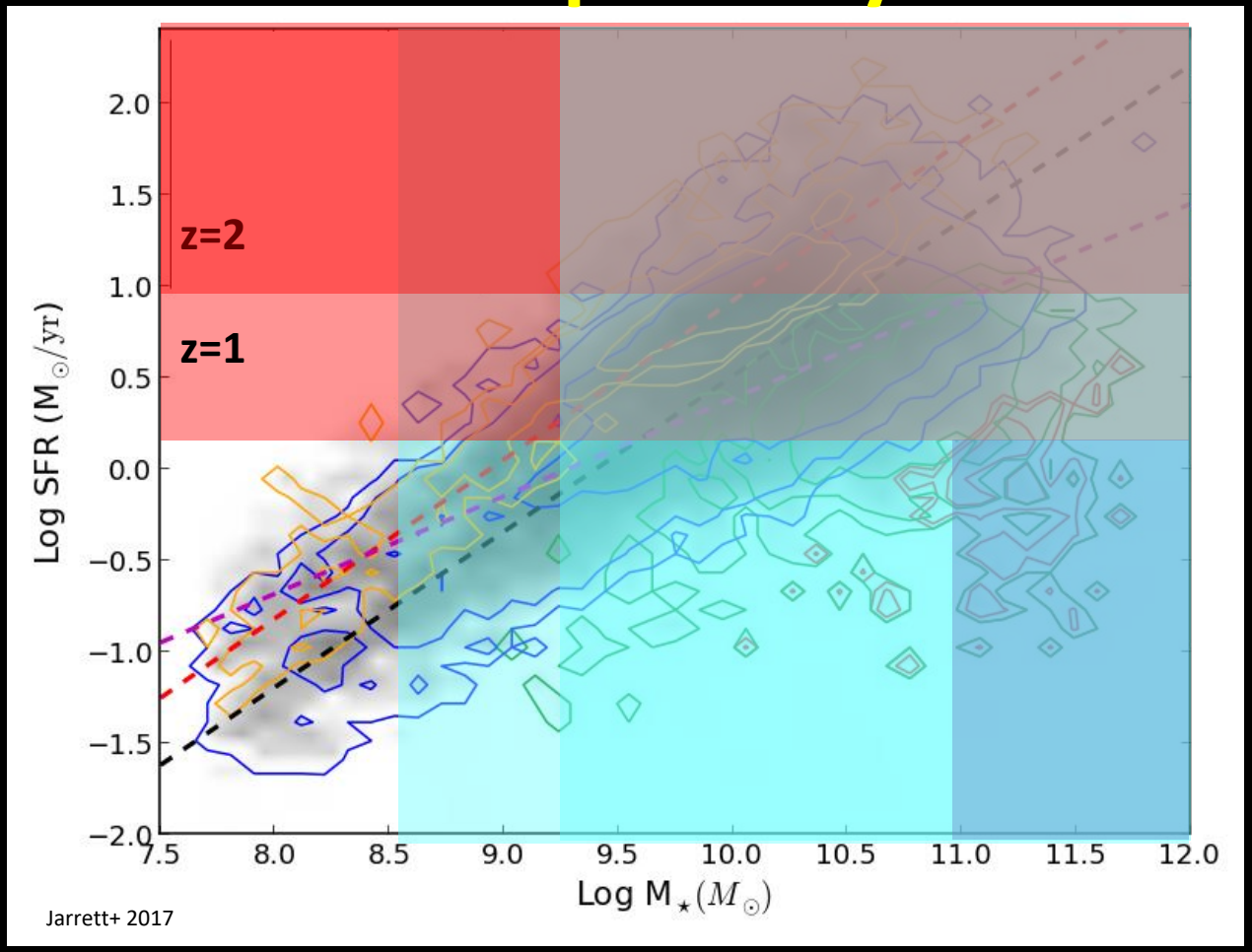
SPECTROSCOPY

30-50 million star-forming galaxies

0.9<z(Hα)<1.8

Other emitters at z<0.9 or z>1.8

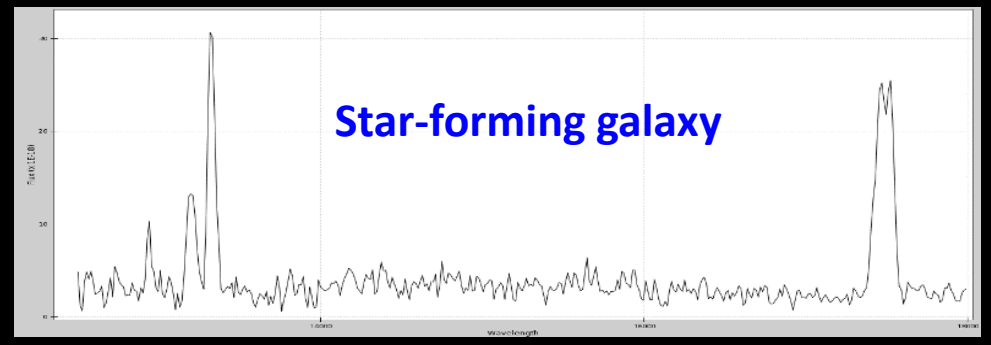
Deep Survey

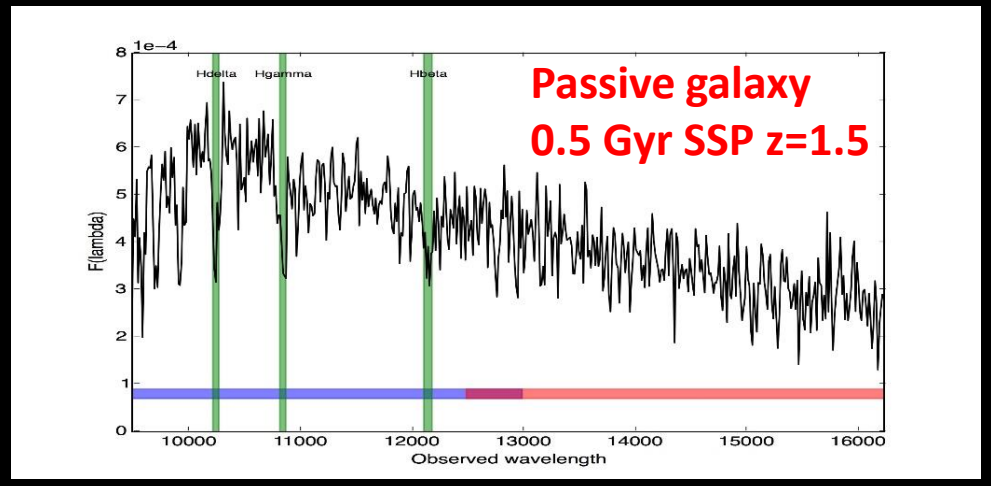


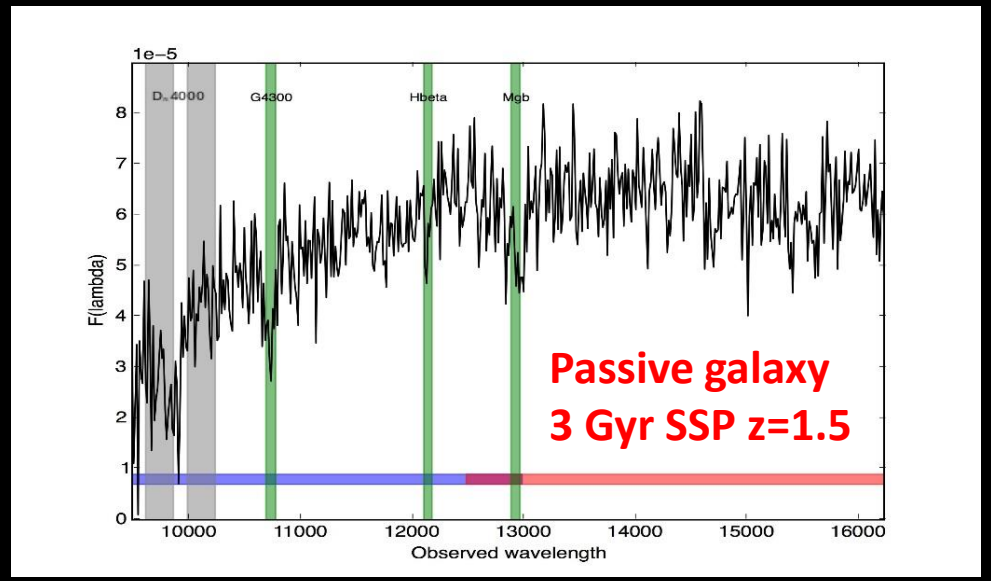
Jarrett+ 2017

IMAGING: 20 million galaxies to H=26
ugrizYJH+3.6µm+4.5µm photometric SEDs

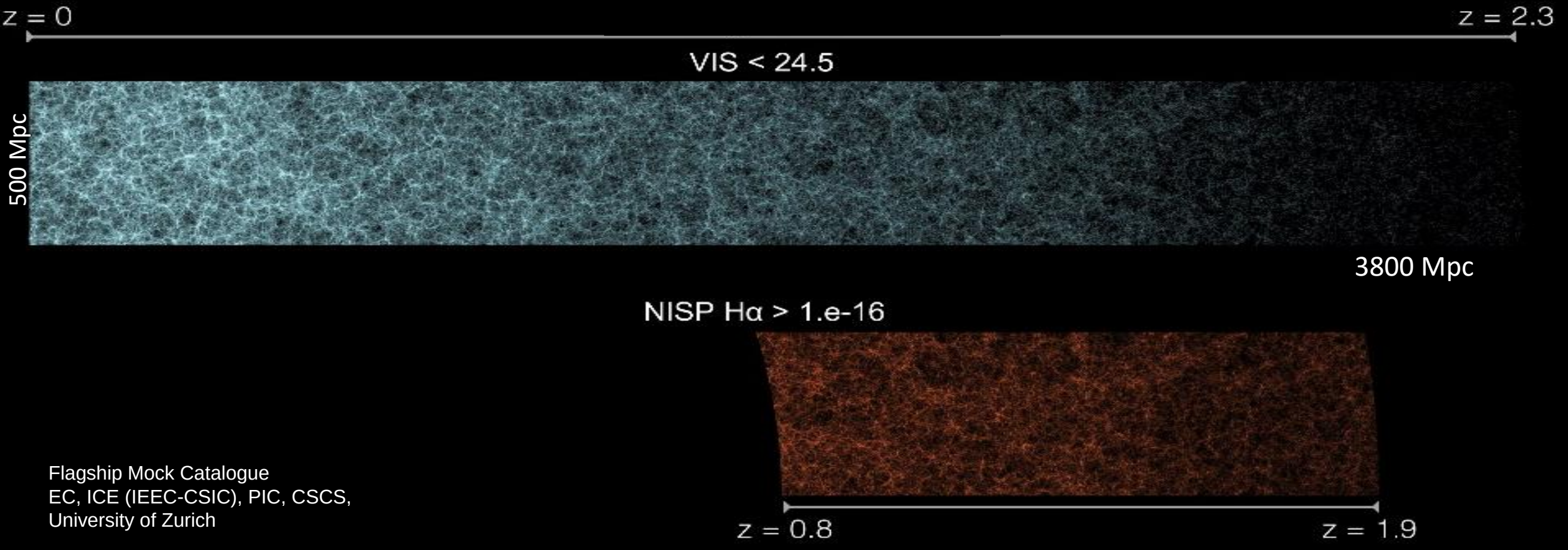
SPECTROSCOPY: 10^6 SFGs + $10^{3\text{-}4}$ QGs + 10^4 AGNs







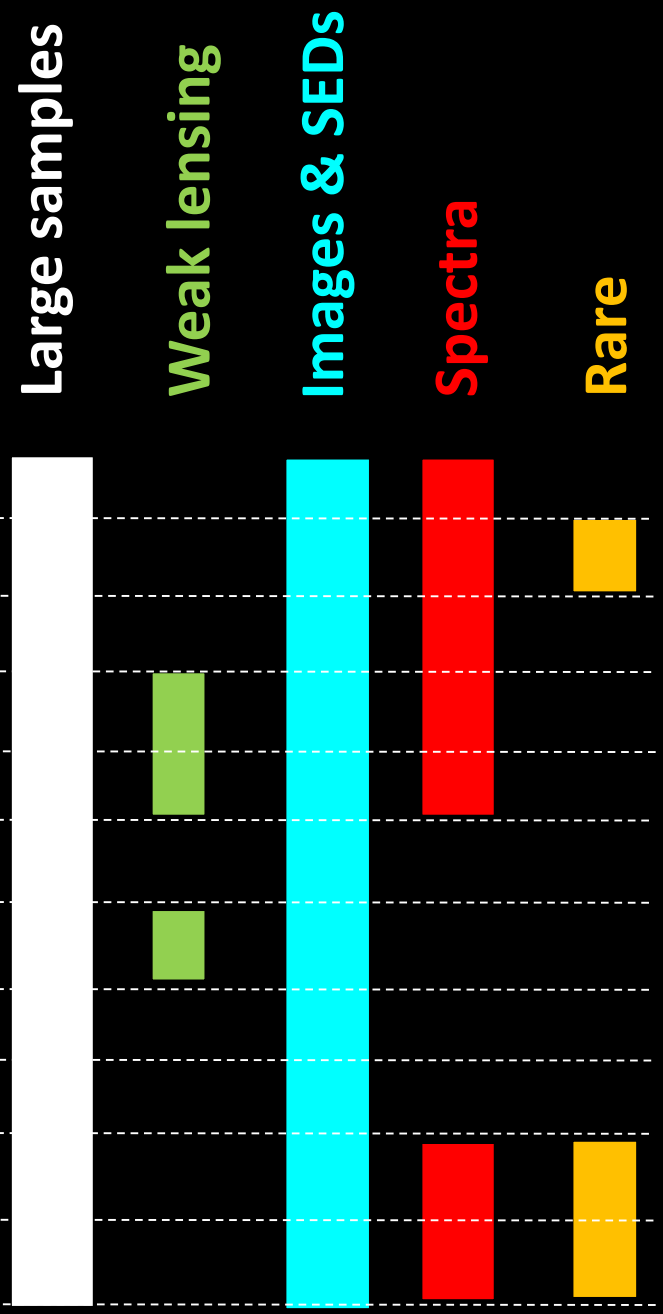
Density field on all scales and in a wide redshift range



Flagship Mock Catalogue
EC, ICE (IEEC-CSIC), PIC, CSCS,
University of Zurich

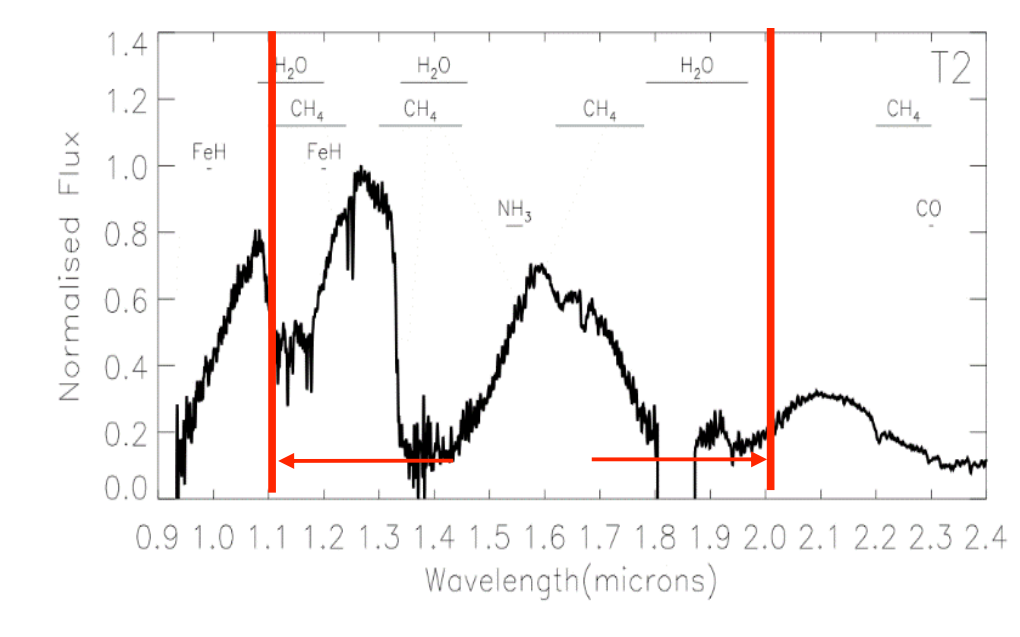
Key Science Cases (galaxy evolution)

- Multi-dimensional distributions of physical parameters
- The growth and evolution of quiescent high-z galaxies
- Galaxy evolution as a function of environment
- Galaxy evolution at fixed halo mass
- Baryon to star conversion efficiency
- Properties of galaxy halos from strong lensing
- Intrinsic alignments and galaxy properties
- Galaxy merger evolution
- Morphology evolution
- AGN evolution out to z>7
- Reionization (Lyα emitters & AGNs at z>6-7 in the Deep Survey)



Local Universe, Milky Way & Resolved Stellar Populations

- Near-IR+optical imaging/photometry → stellar populations in nearby galaxies
- Luminous giant branch stars in galaxies out to 5 Mpc → substructure and formation
- Low-mass stars, ultra-cool dwarfs and brown dwarfs
- MW stellar streams
- MW missing satellites
- Halos of the MW and nearby galaxies
- Synergies with *Gaia*

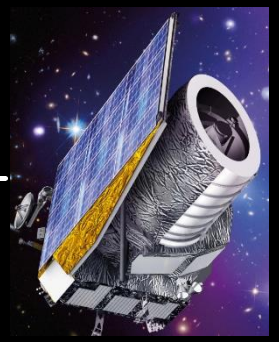


Stand-alone

- **Homogeneity, accuracy**
- **Unprecedented statistics**
- **Slitless spectroscopy**

(successful lessons learned from HST)

- **Morphologies + SEDs + photo-z or spec-z + spectra + environment**



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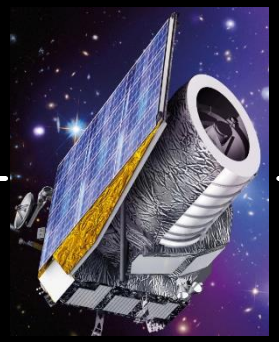
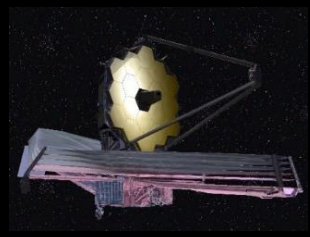


Synergies (2022+)



- **Higher resolution spectra & other wavelengths** (MOONS, JWST, PFS, ELT)
- **Redshift confirmation, accuracy**
- **Calibration & decontamination**
- **Multi-wavelength follow-up studies**

(ALMA, eROSITA, JWST, ELT, SKA, Athena, SPICA)

Science Working Groups

Doors are open!

SWG – GAEV (Galaxy Evolution)

J. Brinchmann, A. Cimatti, D. Elbaz

WP 1 (L. Pozzetti): **Photometry**
WP 2 (G. Cresci): **Spectra**
WP 3 (M. Magliocchetti): **Environment**
WP 4 (P.-A. Duc, C. Conselice): **Morphology**
WP 5 (M. Moresco): **Passive galaxies**
WP 6 (G. De Lucia): **Theoretical models**
WP 7 (S. Serjeant): **Lensing**
WP 8 (H. Aussel): **Multi-wavelength synergies**
WP 9 (S. Juneau): **Type 1 and 2 AGNs**
WP 10 (E. Daddi): **High-z objects (z<7)**
WP 11 (E. Zucca): **Distribution functions**

SWG – PU (Primordial Universe)

J.-G. Cuby, S. Toft

WP 1 (Cuby, Dunlop): **Survey design**
WP 2 (McLure): **Lyman-Break Galaxies**
WP 3 (Warren/McMahon): **QSOs**
WP 4 (Ferrara): **Intergalactic medium**
WP 5 (Kashlinsky): **Cosmic Infrared Background**
WP 6 (Cooray): **Lensing**

Blue Grism Working Group

R. Laureijs, J. Brinchmann, A. Cimatti, C. Scarlata

SWG – Local Universe

B. Poggianti, C. Conselice

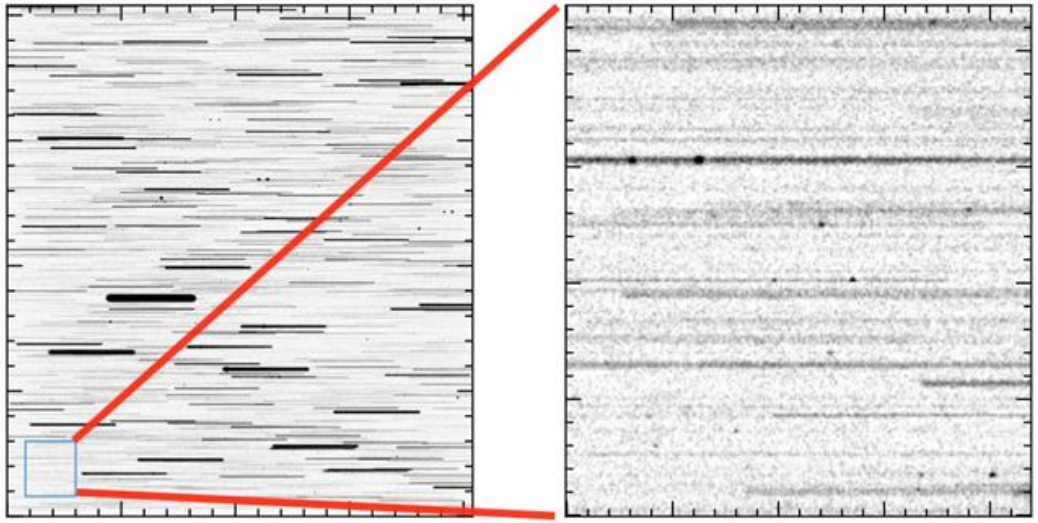
SWG – MW & Resolved Stellar Populations

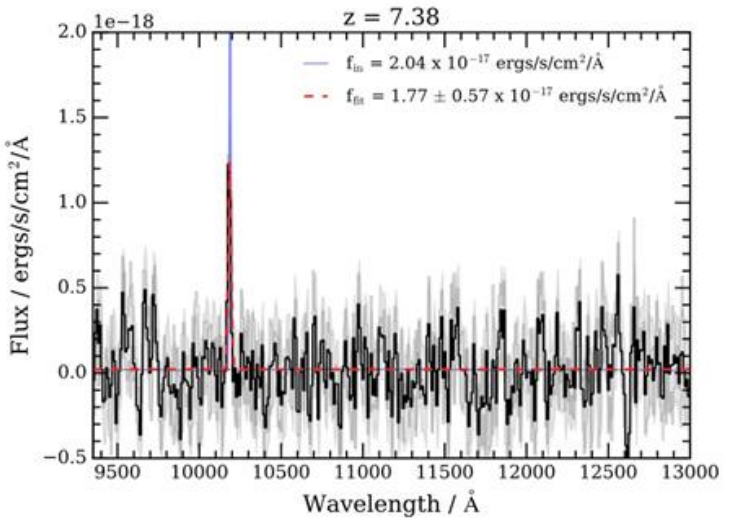
E. Tolstoy, A. Ferguson

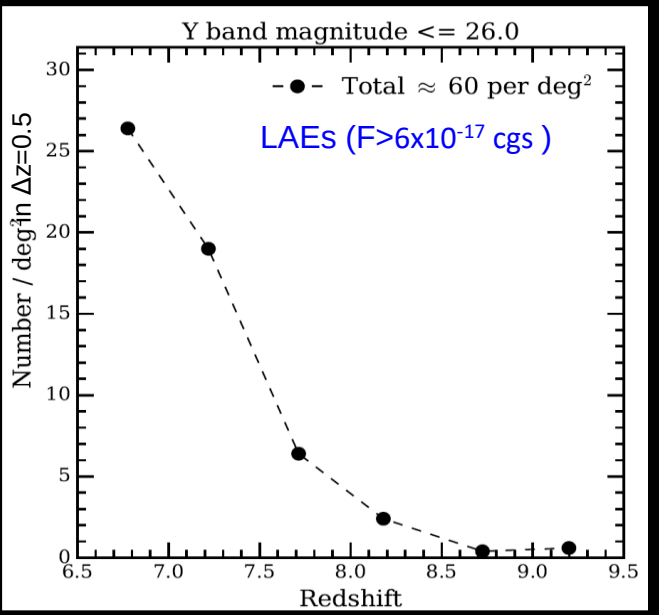
A key case: high-z Lyα emitters and AGNs in the Deep Survey

Blue grism 0.92-1.3 μm: 6.5 < z(Lyα) < 9.7

- Deep survey simulation using empirical galaxy catalog generator (EGG, Schreiber+ 2016) + aXeSIM
- Extrapolate EGG to z>6 + Lyα emitters, consisitent with Matthee+ (2015), f_{esc} = constant = 30%
- Simulated a full 10h exposure with Euclid grisms over 0.5 deg^2





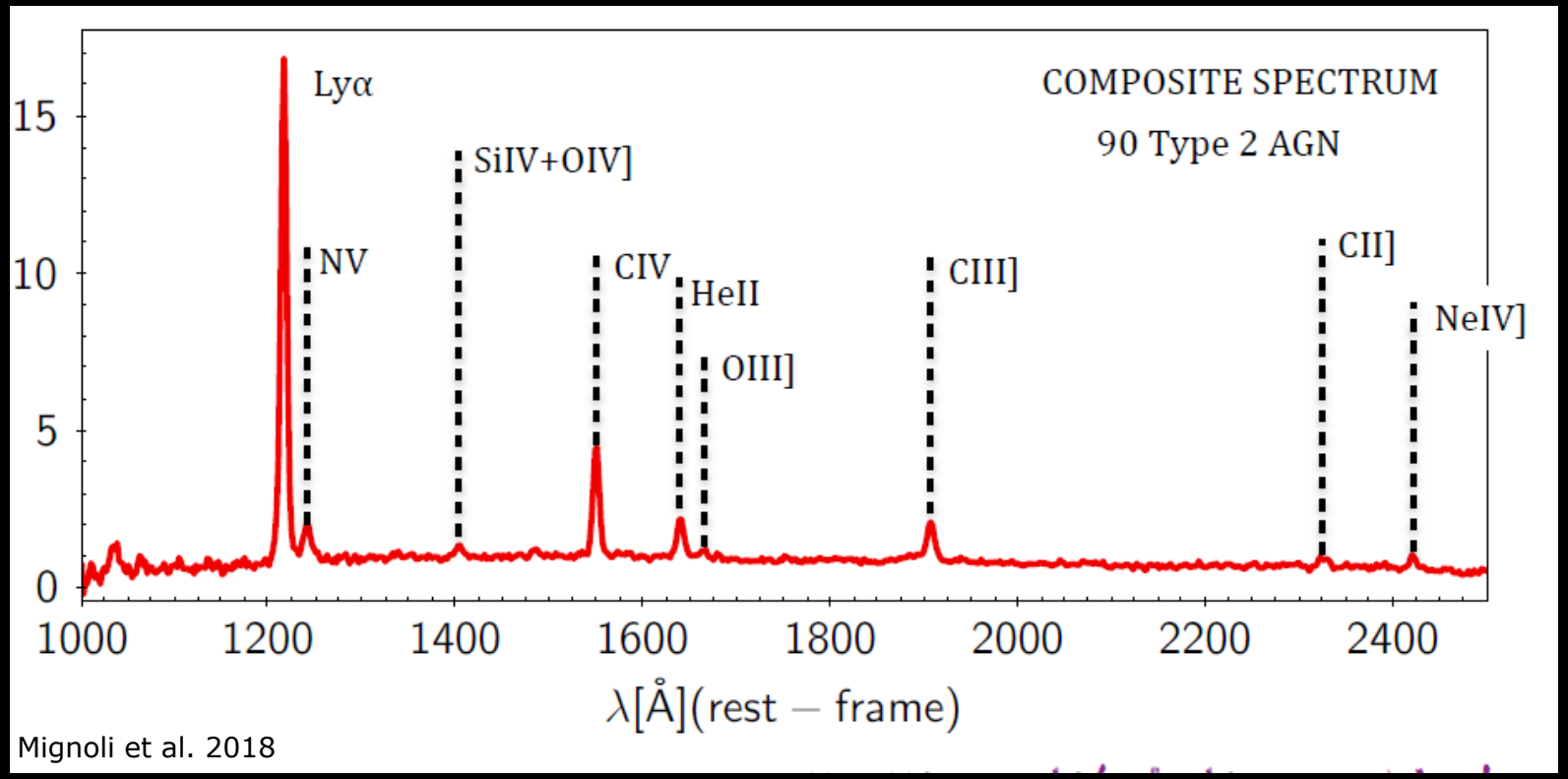


2400 in 40 deg² (100% compl.)

Y-band imaging required

Many more LAEs with Y>26

Not only star-forming galaxies … but also AGNs



Mignoli et al. 2018

- CIII]1908 3.9<z<6.1
- HeII1640 4.7<z<7.2
- CIV1549 5.0<z<7.7
- SiIV1393,1402 5.7<z<8.6

Type 1 & 2 AGN number counts at z>4: work in progress

Several hundreds expected