

Galaxy & AGN evolution SWG

WP10

High-z galaxies ($3 < z < 7$)

Giulia Rodighiero & Karina Caputi

Wiki page: https://euclid.roe.ac.uk/projects/geswg/wiki/High-z_objects

Slack channel: #swg-gae-wp10-highz

Mailing list: euclid-gaeswg-wp10@googlegroups.com

Main activities

identification of photometric sources falling at $3 < z < 7$

- ⇒ color selections, photometric-redshifts: massive sources, dusty red galaxies, quenched population
- ⇒ lot of interesting contaminants ($z > 7$)
- ⇒ classification (SED/spectral type, AGN) ⇒ LINK TO MANY OTHER WPs

statistical properties

- ⇒ luminosity functions, mass functions, contribution to the SFRD

Main overlap/coordination with SWG-PU

our interlopers $\Leftrightarrow$ their targets

their interlopers $\Leftrightarrow$ our targets

same for DR1-KP-JL-1: Cosmic Dawn Survey

(leads J. Weaver, S. Toft)

the redshift cut is no
more meaningful

DR1 KP Papers

This KP invites applications for paper leads! (due July 18th)

Compared to other KPs, our list is relatively small:

1. *The Cosmic Dawn Survey Master Catalog of the Euclid Deep and Auxiliary Fields*
2. *Stellar Mass Function of Star-Forming and Quiescent Galaxies at $3 < z < 10$*
3. *The Galaxy–Halo Connection to $3 < z < 10$*
4. *UV Luminosity Function and Cosmic Star Formation Rate Density over $3 < z < 10$*
5. *Large-Scale Structure, Proto-Clusters to $3 < z < 10$, & the Topology of Reionization*

Proof of concept: ERO data release

Giorgia Girardi Standar Project: *Identification of extremely red objects in the Perseus field*

$H - 4.5 \mu\text{m} > 2.25$

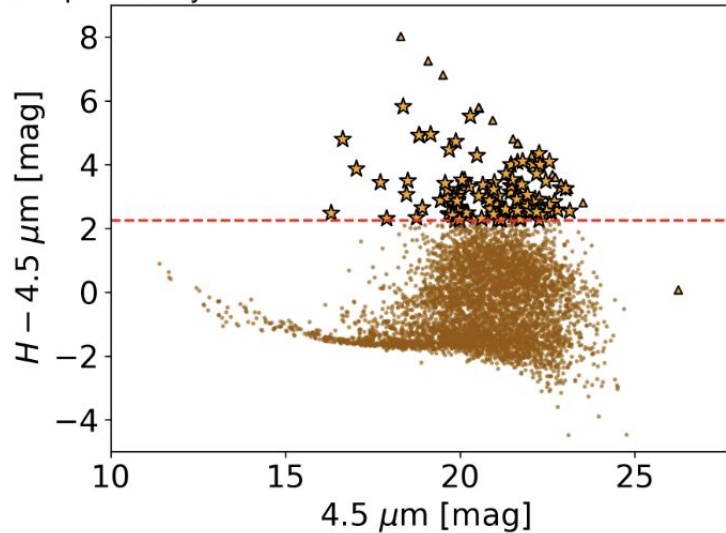


HIEROs

(Wang et al. 2016)

IRAC *ch2*
magnitude limit:
~ **22.6 mag**

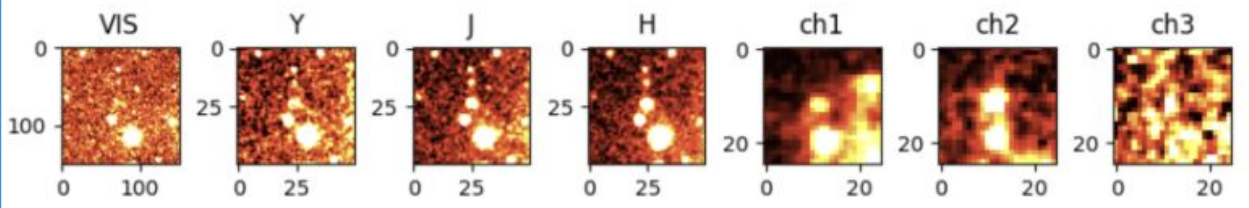
Euclid preliminary



paper
circulated
across
SWG-GAE
and SWG-PU

<https://euclid.roe.ac.uk/projects/624>

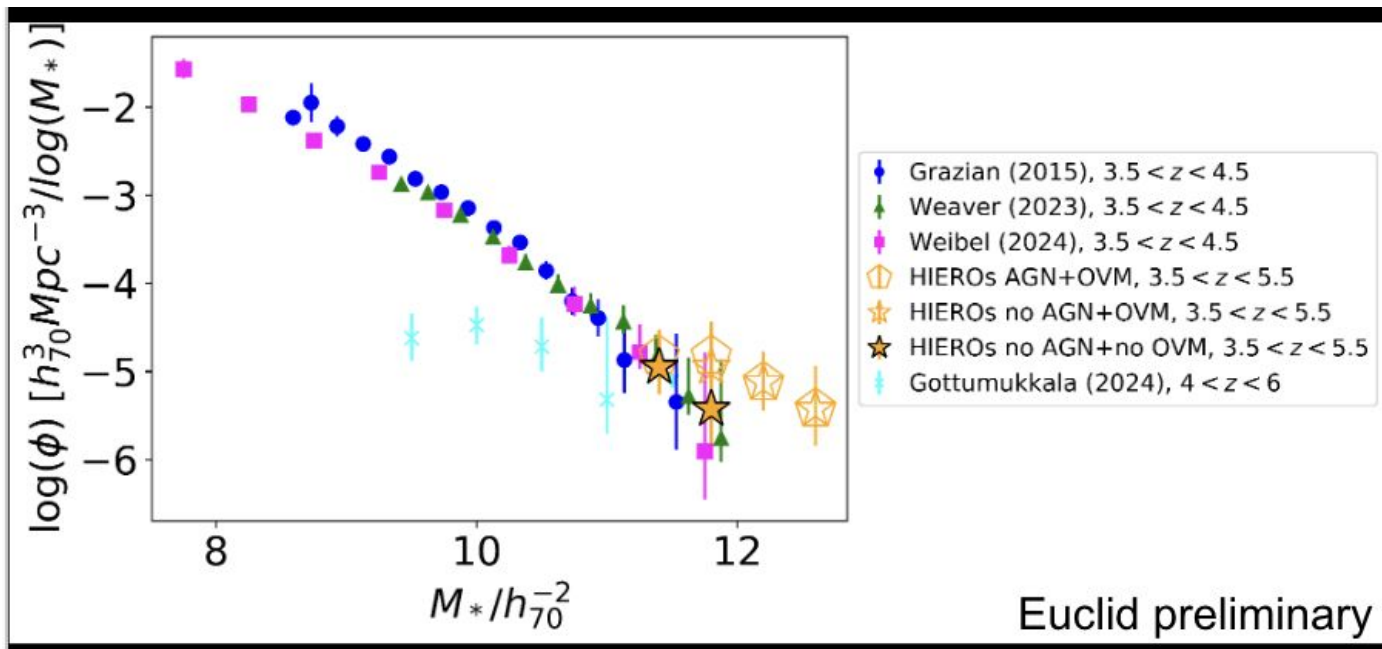
Pilot investigation:
Euclid ERO of the
Perseus field
(EC: Cuillandre et al. 2024)



Final sample
of **42** objects

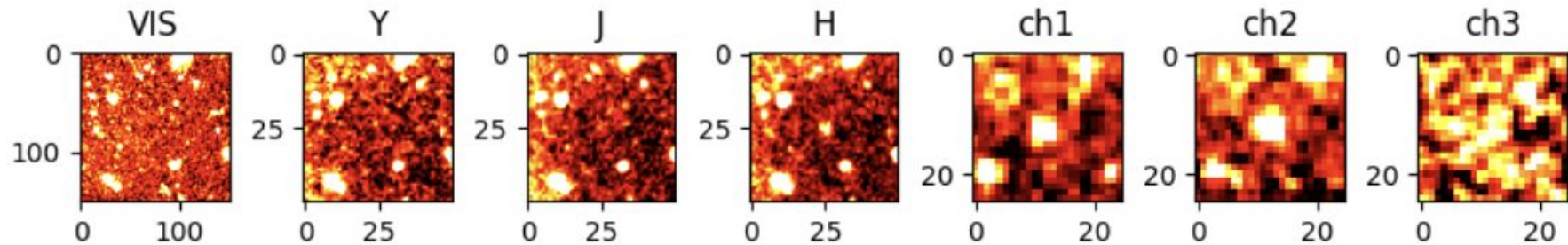


SED fitting:
Bagpipes



- **agreement** with previous results
- **massive end** of the MF

Candidate at
 $z \sim 14$?



Dropout at $\lambda < H$ band

Two ongoing Q1 projects:

DR1-KP-GEV-3: Statistical distributions of galaxy properties

- Q1 key papers:

	Paper	Person interested to lead	People interested in participating	Short description	KP code	Main WPs involved
1)	Massive galaxies at $z=3-7$	R. Navarro Carrera/K. Caputi	G. Rodighiero, G. De Lucia	We will identify photometrically a complete sample of the most massive sources sitting roughly at $3 < z < 7$. In particular, we will constrain the massive end of the Galaxy Stellar Mass Function at these redshifts. We will use VIS and NISP photometry, as well as external data available (in particular Spitzer).		WP10, WP8, WP1
2)	Statistical properties of the reddest (dusty) high- z objects	G. Girardi	G. Rodighiero, K. Caputi, L. Bisigello, A. Grazian, G. Gandolfi, G. De Lucia	We plan to apply a set of color selections to identify Extremely Red Objects, combining Euclid to Spitzer data. By performing an SED fitting procedure to the overall photometry, we will compute photo- z and the main physical properties of the sample. We will then compute the contribution of the sample of the dusty and massive population to the stellar mass function at $z \sim 4-6$.		WP10, WP9, WP8, WP1

1) **Rafael Navarro Carrera**

2) **Giorgia Girardi** $\Rightarrow$ extension of ERO standard project (see Giorgia's talk)

Euclid: Identification of Massive Galaxy Candidates at the End of the Epoch of Reionization

**Euclid: Navarro-Carrera+25
(in prep.)**

Q1 Second Splash @ October

Euclid Collaboration, R. Navarro-Carrera^{*}, K. I. Caputi[†], and Friends

Selection Criteria:

$$\int_5^7 p(z) dz > 0.7$$

$$M^* > 10^{10.5} M_{\odot}$$

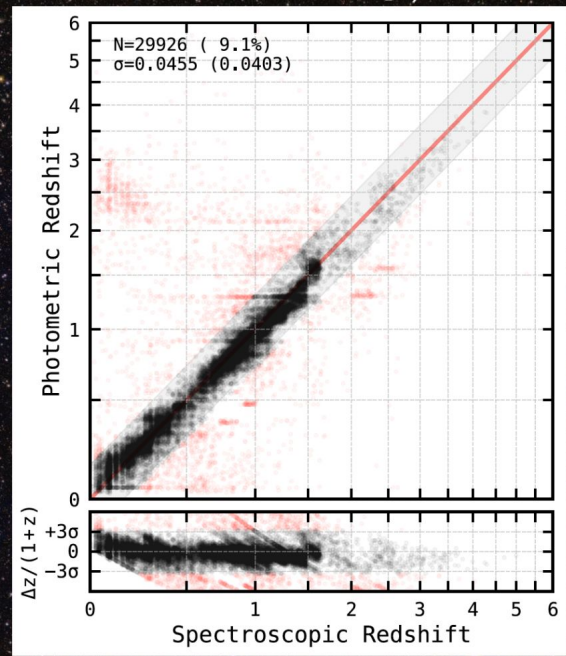
IRAC [ch1] or [ch2] detection (< 25AB)

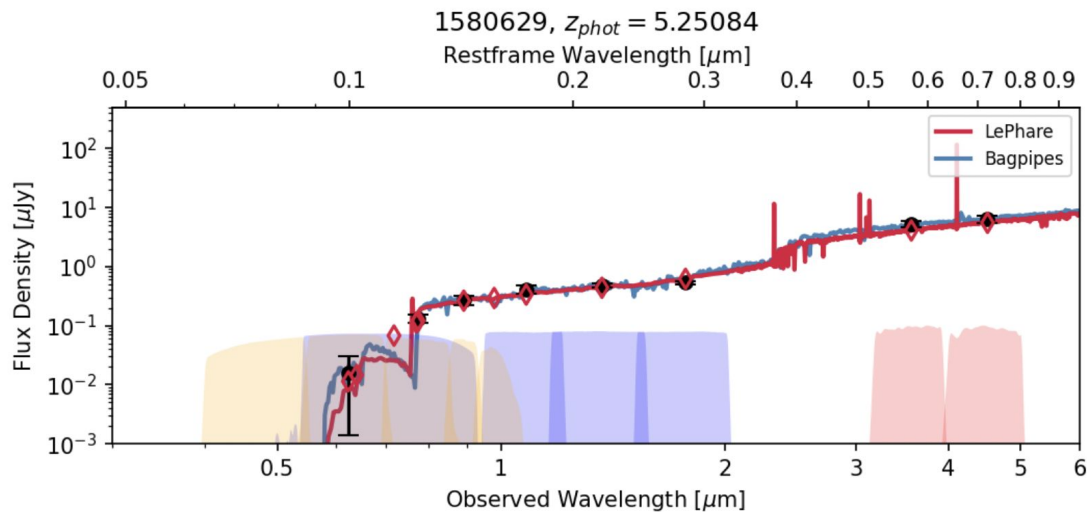
NISP YJH < 24AB

- DAWN catalog (J. Weaver, see Zelensky+24, McPartland+24...): {HSC+EUCLID+IRAC} & Euclid data products

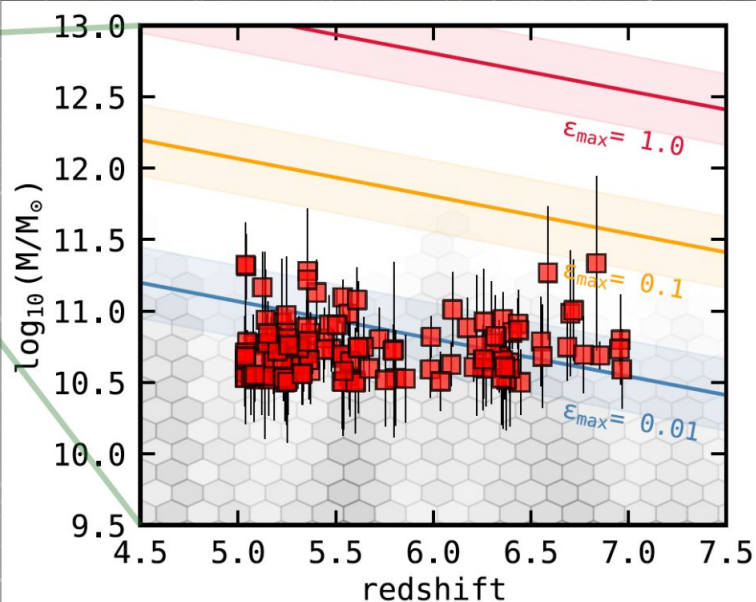
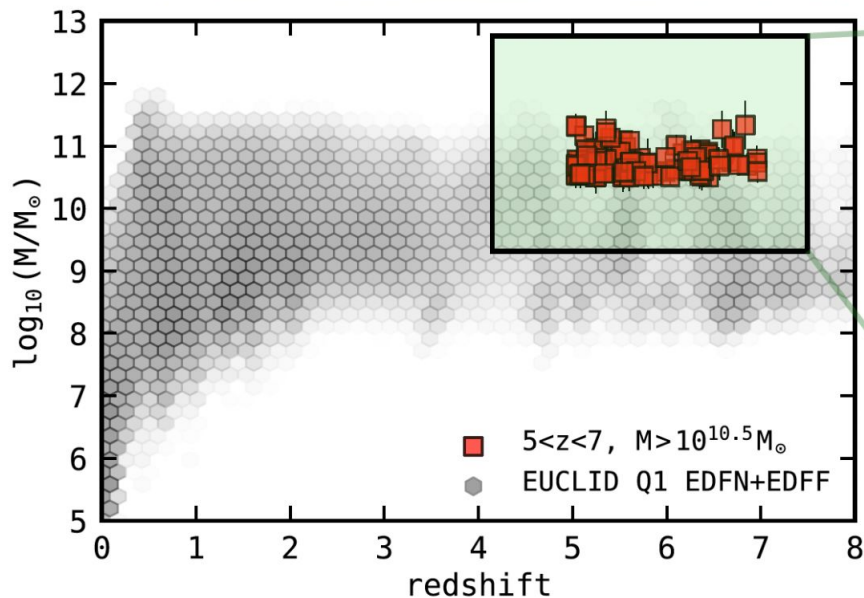
- Photo-z & phys. props. using LePhare for ~7.5M sources in EDF-N and EDF-F

9.1% outlier fraction and $\sigma = 0.045$ for ~30k spec-zs between $0 < z < 5$.





$z_{\text{phot}} = 5.25, M_{\star} = 10^{11.3} M_{\odot}$
 $E(B - V) = 0.3, t_{\text{fi}} = 0.8 \times 10^9 \text{ yr}$



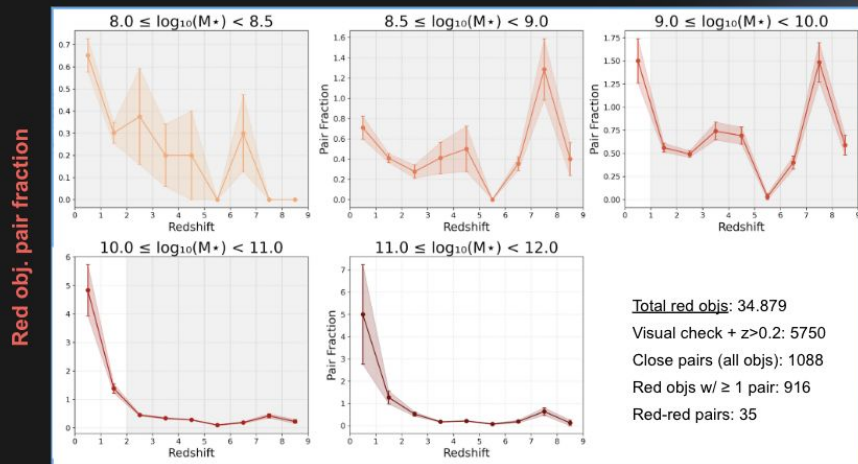
Euclid: Navarro-Carrera+25 (in prep.)

Observations do not require extreme SFEs

EVS, adapted from Lovell+23 for EDF-N

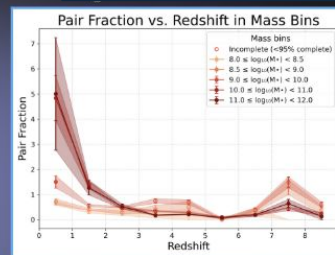
No "Universe Breakers"

Pair fraction evolution

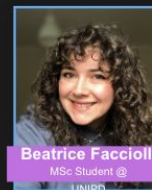


Total red objs: 34.879
Visual check + z>0.2: 5750
Close pairs (all objs): 1088
Red objs w/ ≥ 1 pair: 916
Red-red pairs: 35

(EUCLID PRELIMINARY)



- Only red objects (HIEROs) available
- Euclid's large area let us probe source association at low z
- Two new high-mass bins
- A spike is present at 7 < z < 8



Beatrice Faccioli
MSc Student @
UNIPD

Selecting close pairs

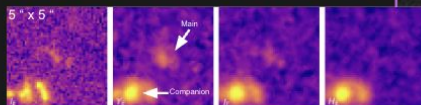
Companions: sources with

$$5 \text{ kpc} \leq \Delta d_{LOS}, \Delta d_{\theta} \leq d_{max}$$

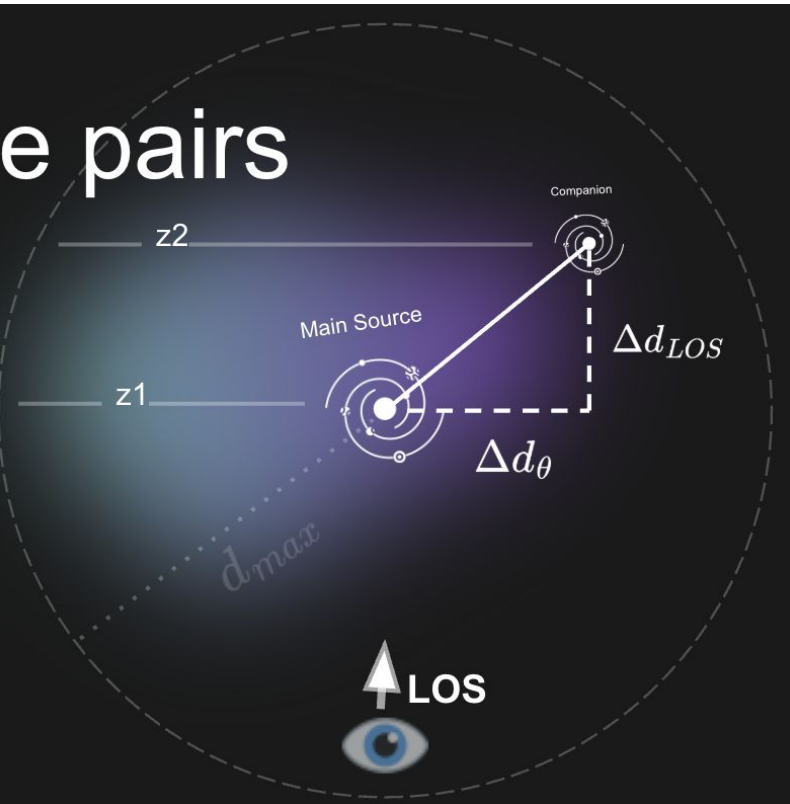
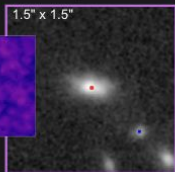
$$\Delta d_{LOS} = |d_C(z_1) - d_C(z_2)|, \Delta d_{\theta} = \theta \times d_A$$

$$d_{max} = \max[50 \text{ kpc}, d_c(z_1 + \sigma_z)] \quad \sigma_z = NMAD_{field} \times (1 + z)$$

EUCLID multi-association at $z \sim 1.3$



JWST companions $z = 3.77$



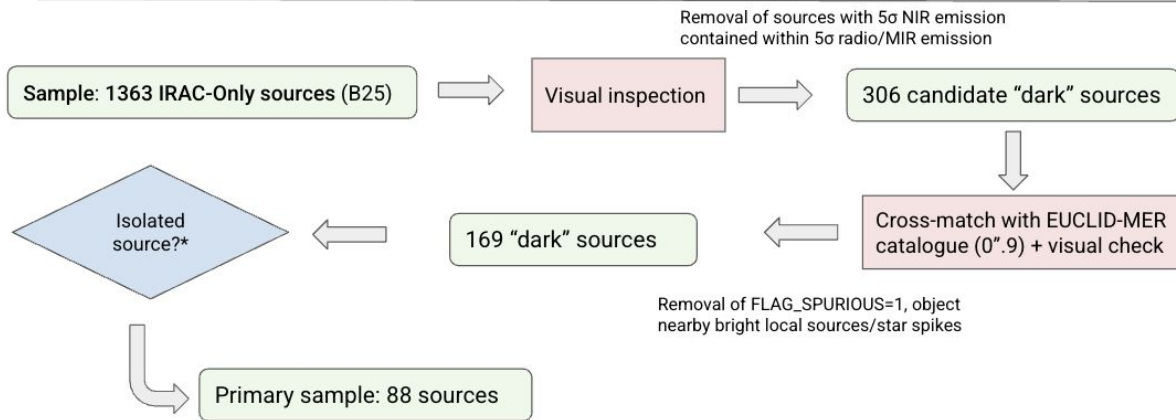
Searching for Radio Selected Dark Galaxies in Euclid

Selection and radio properties of LOFAR-detected NIR-dark galaxies in the EDF-N

Marika Giulietti

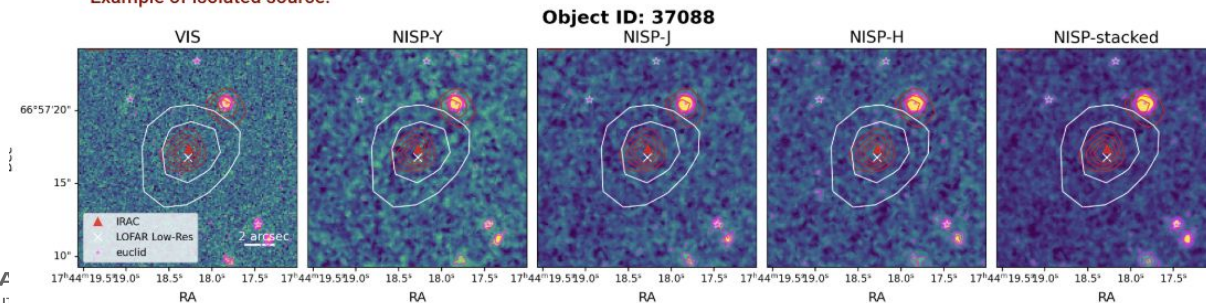
In collaboration with: I. Prandoni, L. Bisigello, G. Rodighiero, M. Bondi, and many more...

Searching for Radio Selected Dark Galaxies in Euclid

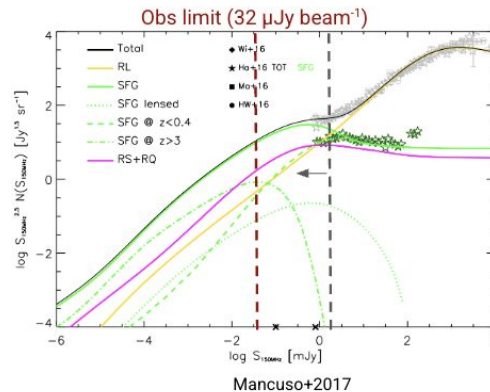
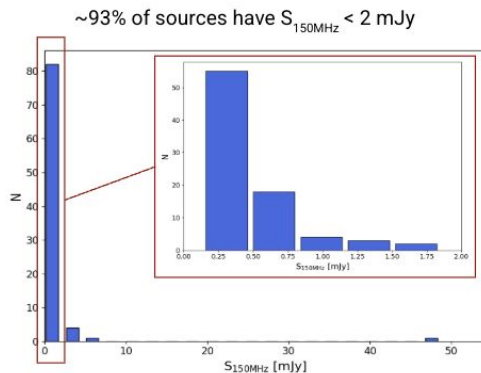


*no overlap between 3σ MIR emission of the target and 3σ MIR/NIR emission of nearby objects

Example of isolated source:



Primary sample



Multi-band data

Band	λ_{eff} [μm]	Depth
CFHT/MegaCam <i>u</i>	0.372	24.2 mag
HSC <i>g</i>	0.480	25.7 mag
CFHT/MegaCam <i>r</i>	0.640	24.8 mag
HSC <i>z</i>	0.891	24.1 mag
VIS/ I_e	0.715	25.45 mag
NISP/ Y_e	1.085	24.6 mag
NISP/ J_e	1.375	24.1 mag
NISP/ H_e	1.773	23.9 mag
IRAC/ch1	3.550	24.8 mag
IRAC/ch2	4.493	24.8 mag
IRAC/ch3	5.696	20.8 mag
IRAC/ch4	7.799	21.9 mag
WISE3	12.082	19.1 mag
WISE4	22.194	17.2 mag
AKARI/FIS65	65	3.2 Jy
AKARI/FIS90	90	0.55 Jy
AKARI/FIS140	140	3.8 Jy
AKARI/FIS160	160	7.5 Jy

Median stacking of the Primary Sample:

