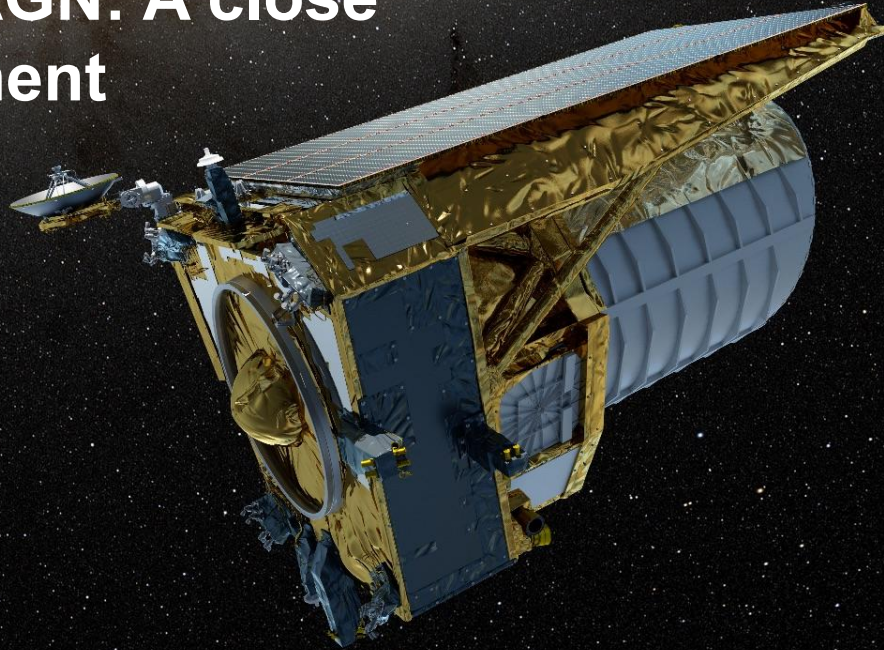


Euclid & AGN: A close entanglement

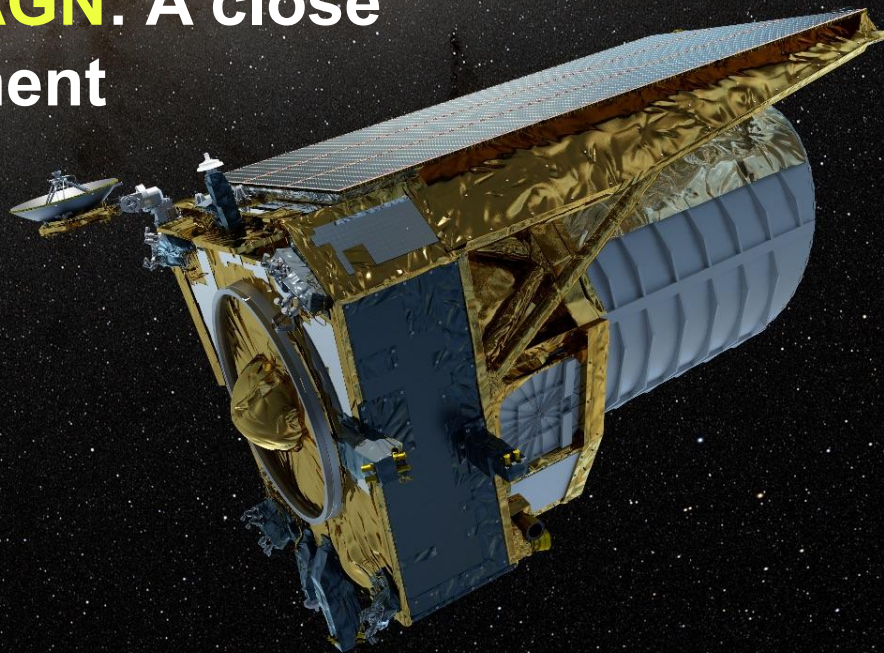


Viola Allevato - INAF OAC Napoli

ESA Mission

Active galaxies

Euclid & AGN: A close entanglement



Viola Allevato - INAF OAC Napoli

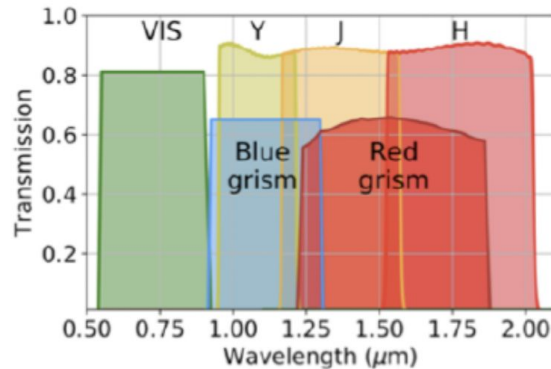
Euclid 300 B.C.

Launch: 1st of July 2023



“Observatory”

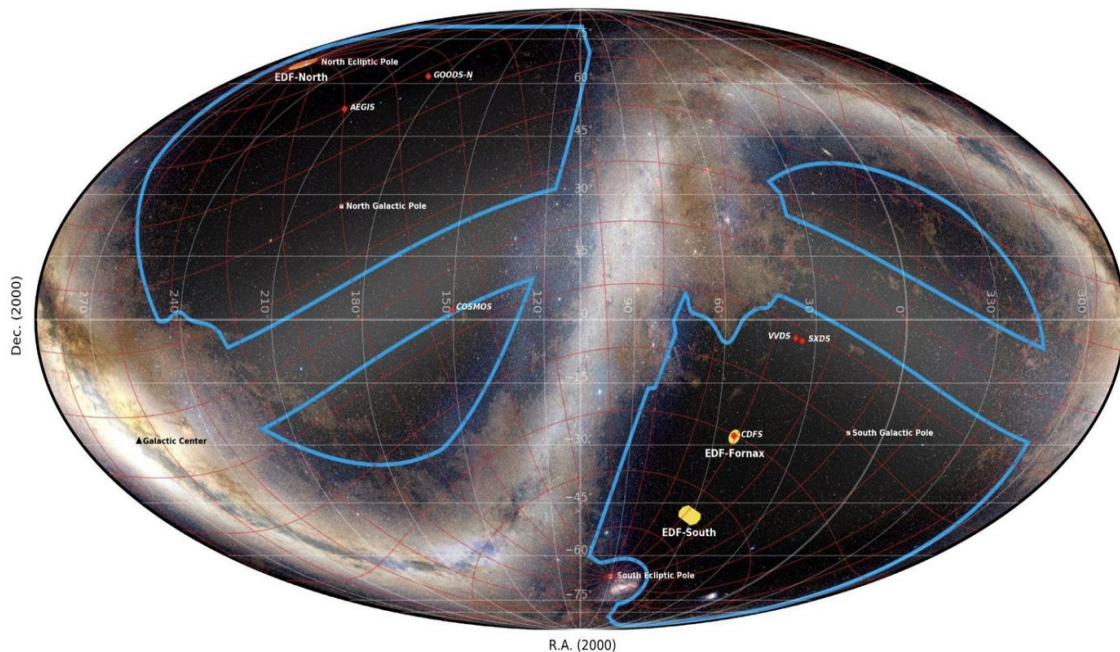
- **Telescope:**
Korsch 3-mirror anastigmat
1.2m primary mirror, FOV ~ 0.54 deg²;
- **Visual Imager (VIS):**
36 CCDs, Pixel 0.1x0.1 arcsec
single filter
 $0.55 < \lambda < 0.99$ micron;
- **NISP:**
Imaging: 3 filter, Y, J, H
Spectroscopy: slitless
 - **Red grism:** 1.25-1.85 μm
 - **Blue grism:** 0.92 - 1.30 μm



PLM unpacked, October 2021. Credits: J-C G.

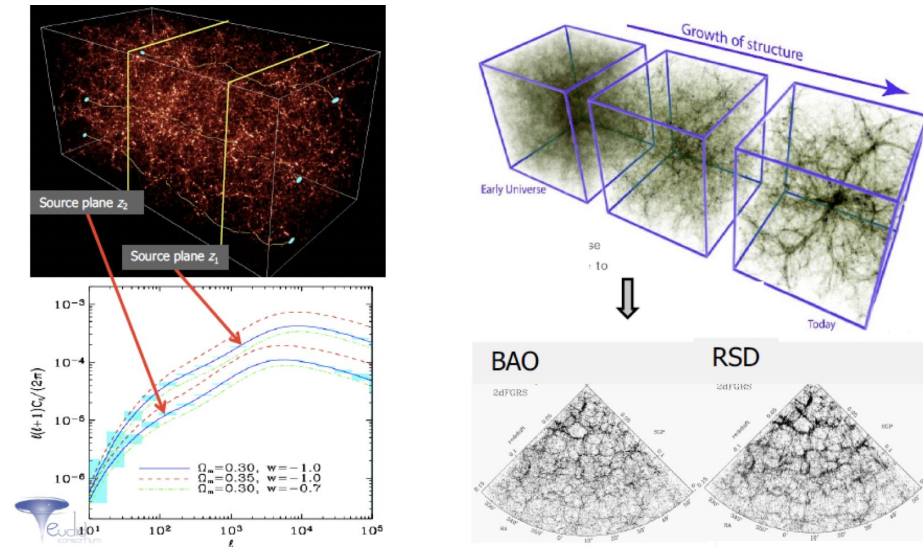
ESA Mission

- **Euclid Wide Survey:**
~15k deg² in 6 years
VIS < 26.2 - Y,H,J < 23.4
Ha > 2 x e-16 erg/s/cm²
- **Euclid Deep Survey:**
50 deg²
VIS < 28.2 - Y, H, J < 26.4
Ha > 2 x e-16 erg/s/cm²



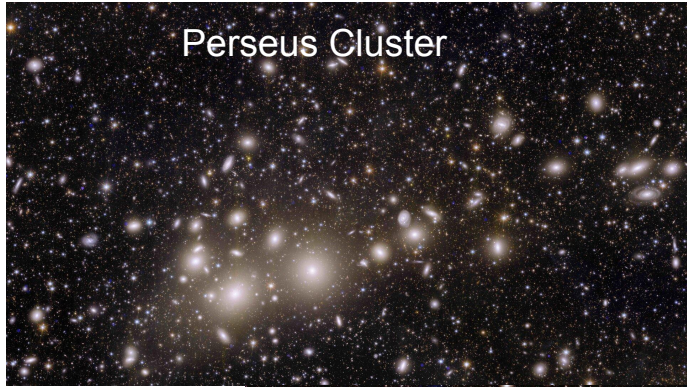
Cosmological Probes

- Weak lensing: galaxy shapes, shear and phot-z with 0.05 $(1+z)$ accuracy over $\sim 15,000 \text{ deg}^2$ for 2 billions of galaxies;
- Galaxy Clustering: BAO, RSD for millions of galaxies with spec-zs with 0.001 $(1+z)$ accuracy over $15,000 \text{ deg}^2$

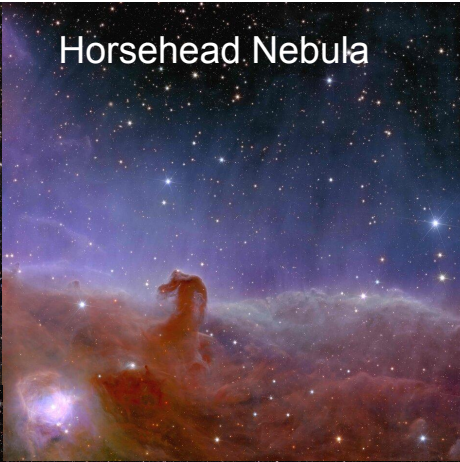


ERO Images

Perseus Cluster



Horsehead Nebula



Globular Cluster NGC 6397



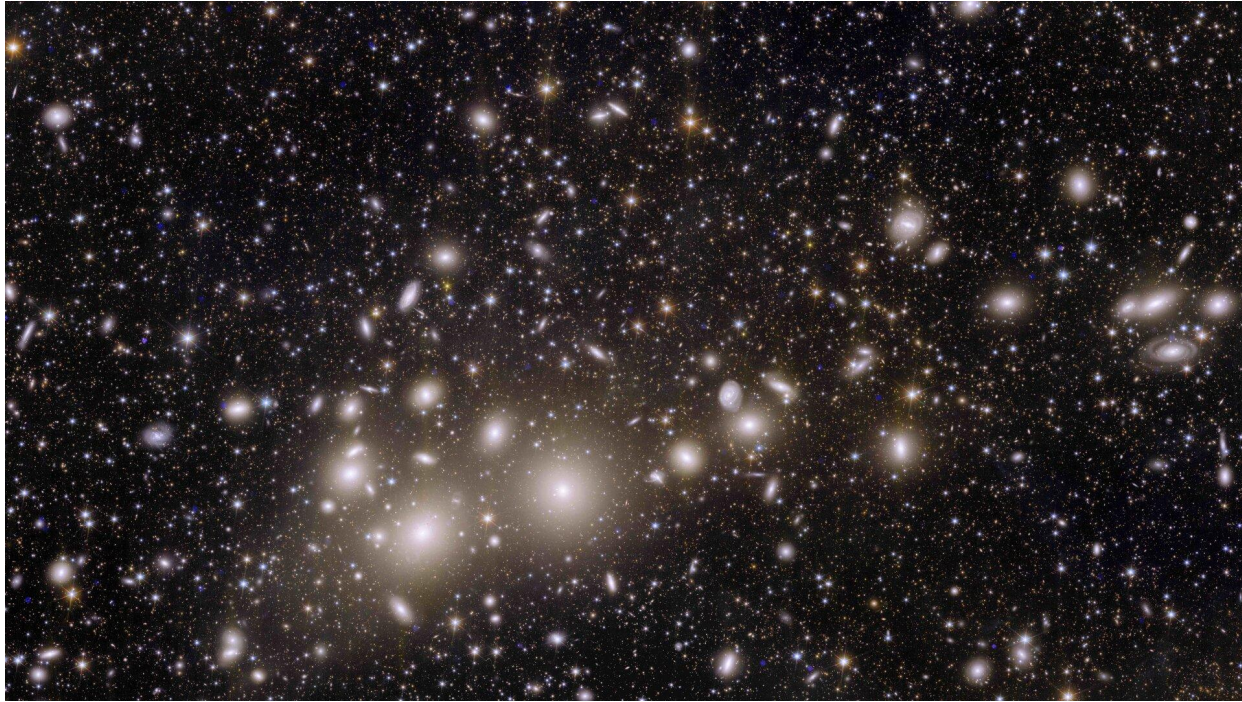
Spiral Galaxy IC 342



Irregular Galaxy NGC 6822



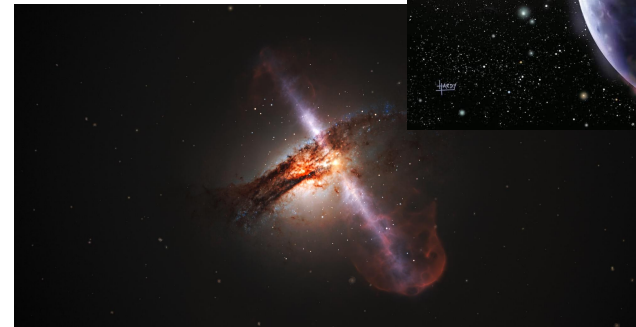
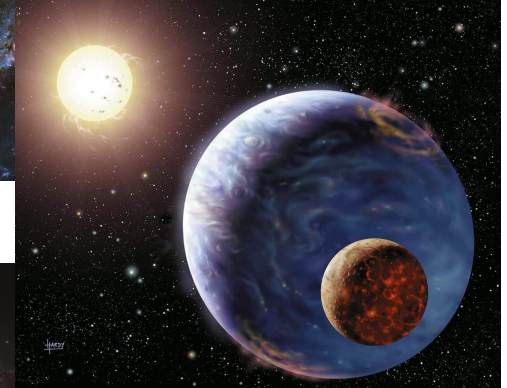
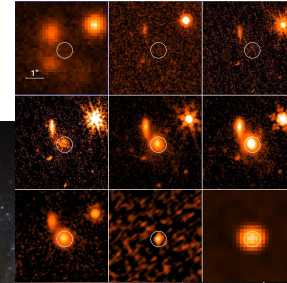
ERO Image: Perseus Cluster



> 50000 galaxies - more than any space telescope has ever taken in one shot!

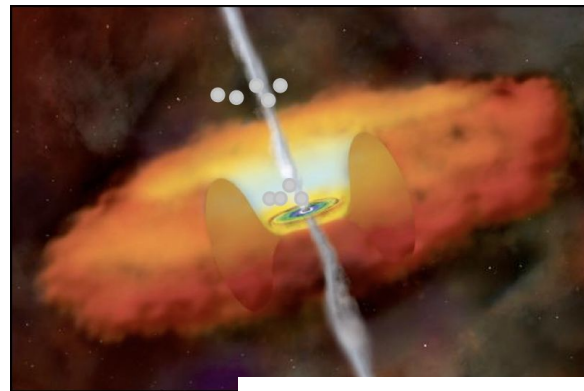
Euclid Legacy Science

- **Beginning of the mission**, Legacy Science will be the main science;
- The number of **Legacy Science papers** will significantly exceed that of cosmology papers;
- Euclid will likely be a **cornerstone for extra-galactic astronomy**;
- Euclid will provide an **exceptional dataset** of billions of galaxies;

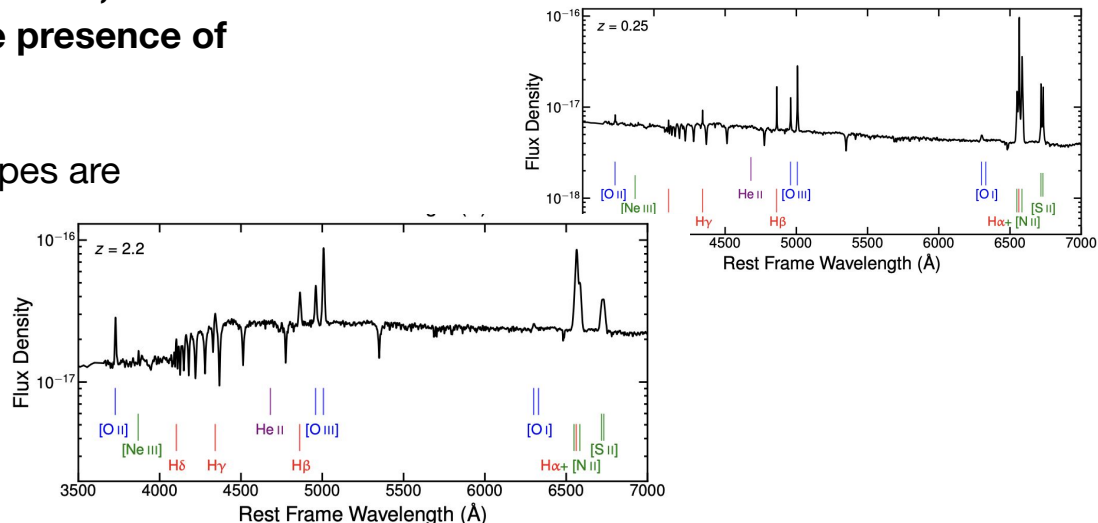


AGN Unified Models

- **AGN** are the most luminous sources of electromagnetic radiation;
- The BH ($>10^6$ Msun) is surrounded by an **accretion disk** and behind a dusty torus;
- AGN characteristics depend on the **BH mass, the rate of accretion, the orientation, the presence of jets**;
- In evolutionary models different AGN types are different stages of the AGN life;
- Broad line and Narrow line Regions:
Type 1 & Type 2 AGN



Urry & Padovani
1995



Euclid AGN

- Euclid spectroscopy will detect **10^8 galaxies with NIR spectra** (spec-z + emission lines) more than few times **10^6 AGN** over the redshift range $0.7 < z < 9$.
- Type 2 AGN will possibly constitute 50% of the dataset.
- Euclid will **POTENTIALLY** identify and characterise largest ever samples of AGN and Type 2 AGN at $z > 1$;

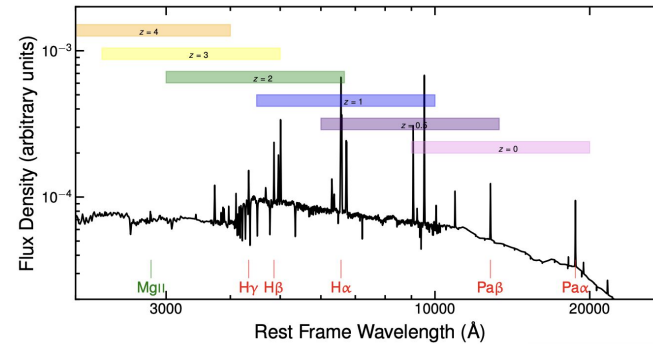
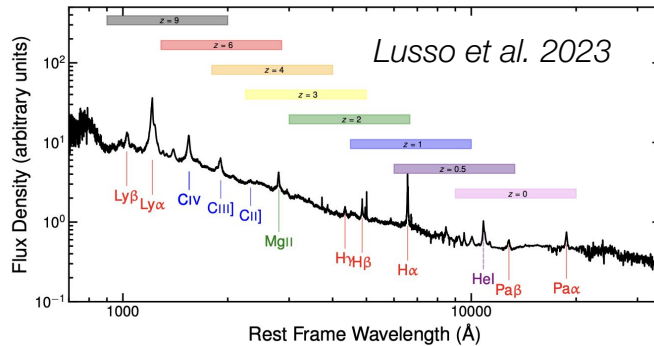
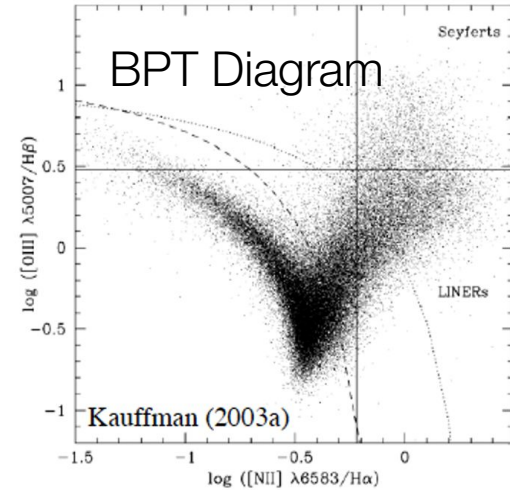


Euclid Working Group: Type 1 & 2 AGN

Co-leads: V. Allevato, S. Fotopoulou
~80 Members

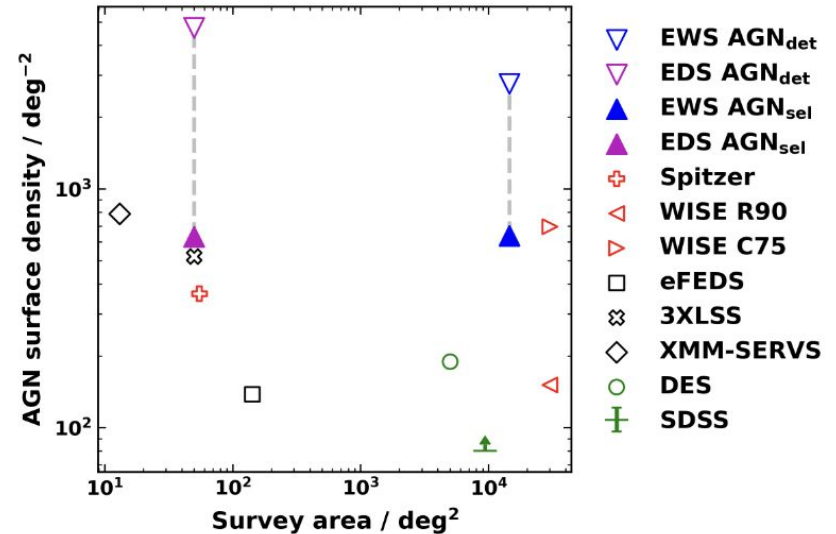
AGN Identification - Spectroscopy

- **NIR Spectroscopy:**
 - Broad Emission lines (Type 1 AGN)
 - Narrow Emission lines (BPT diagram, Type 2)
- Redshift Estimates:
 - For 90% of AGN
- Mbh estimates for Type 1 AGN by using Ha line



AGN Identification - Photometry

- **Detected AGN** at least in one Euclid filters:
 - EWS: 4×10^7 AGN
 - EDS: 2.5×10^6 AGN
- **Selected AGN** by using Euclid/Rubin filters:
 - EWS: 9.2×10^6 AGN
 - EDS: 3.2×10^4 AGN
- **70% Type 2**
- **30% Type 1**
- **Completeness > 90% in EWS for Type 1**



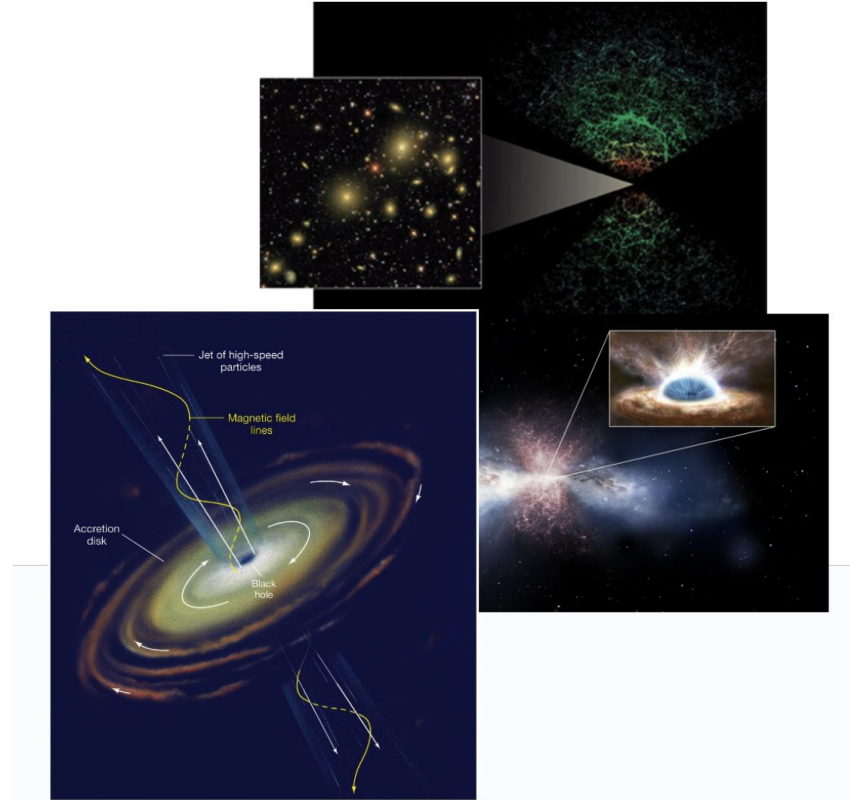
Selwood et al. in prep.
Bisigello et al. in prep.

AGN Identification

- **Imaging:**
 - SED decomposition
 - Variability
- **Ancillary data & Follow-up surveys:**
 - 45% (25%) of the detectable AGN in EWS (EDS) will have X-ray fluxes detectable in the deepest modern medium area X-ray surveys
 - X-ray, radio and mid-IR data already available in parts of the Euclid survey
 - Reservoir of targets for follow-up surveys with JWST, ALMA etc

AGN Science

- AGN Luminosity function in NIR
- AGN host galaxy properties, e.g. Mstar
- BH and host galaxy scaling relations
- AGN large-scale structure
- AGN close pairs
- AGN galaxy mergers



Projects

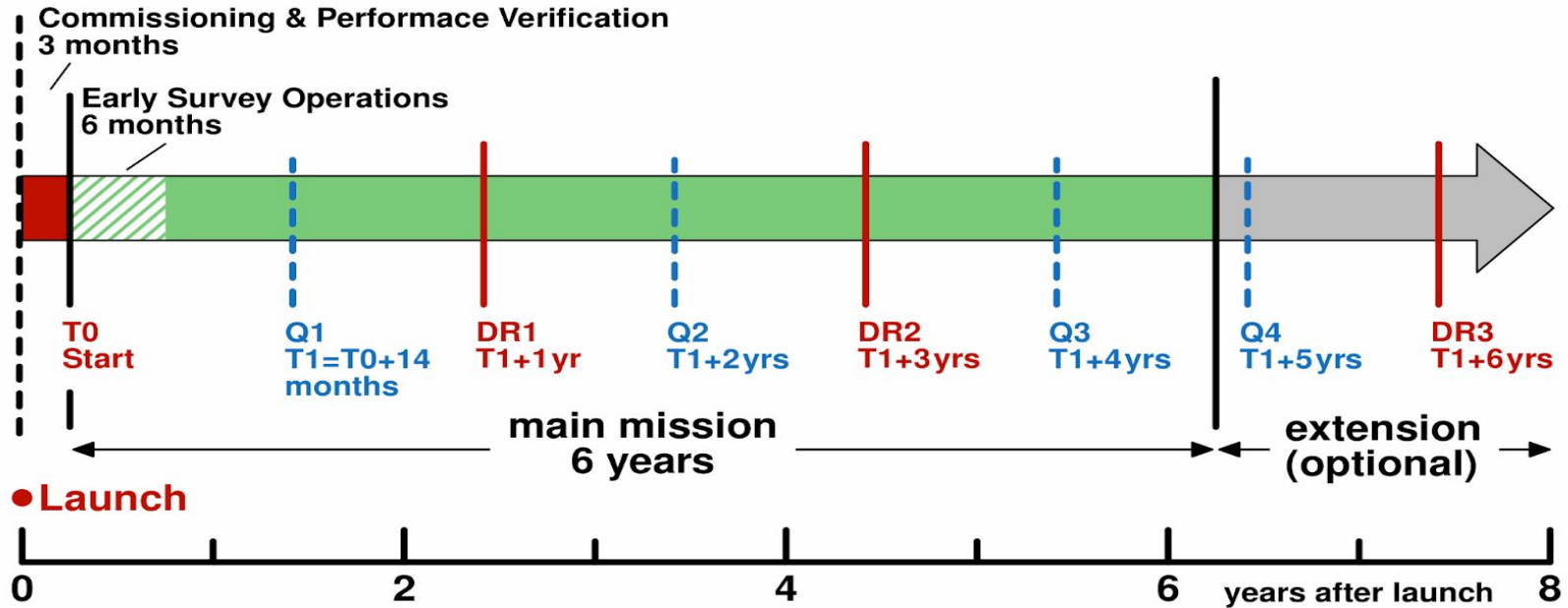
- **Preparatory work before data:**

- Mock catalogs of AGN for Euclid
- AGN identification by using spectroscopy
- Forecasting AGN clustering in Euclid
- AGN SED fitting techniques for Euclid

- **Work on the first Euclid data:**

- Create the official Euclid AGN catalog by using spectroscopy and photometry
- Derive AGN host galaxy and BH physical properties
- Spectral analysis of Euclid AGN spectra
- Clustering properties of Euclid AGN
- BH-host galaxy scaling relations
- AGN host galaxy morphology

Data Releases



Q1 will be released WORLDWIDE in Feb 2025 and DR1 1 yr later

Job opportunities!

- INAF Large Grant: 200k euros
 - **1 Postdoc for 2 years**
 - **1 Postdoc for 3 years**
- HORIZON-SPACE ELSA: 400k euros
 - **1 Postdoc for 2 years**
- PhD projects
- Master projects

Take-home message

- It's the right moment to join the Euclid Consortium!
- **Millions of AGN** will be detected by Euclid
- Lot of **job opportunities** and new projects

viola.allevato@inaf.it