Euclid and the ground–based surveys

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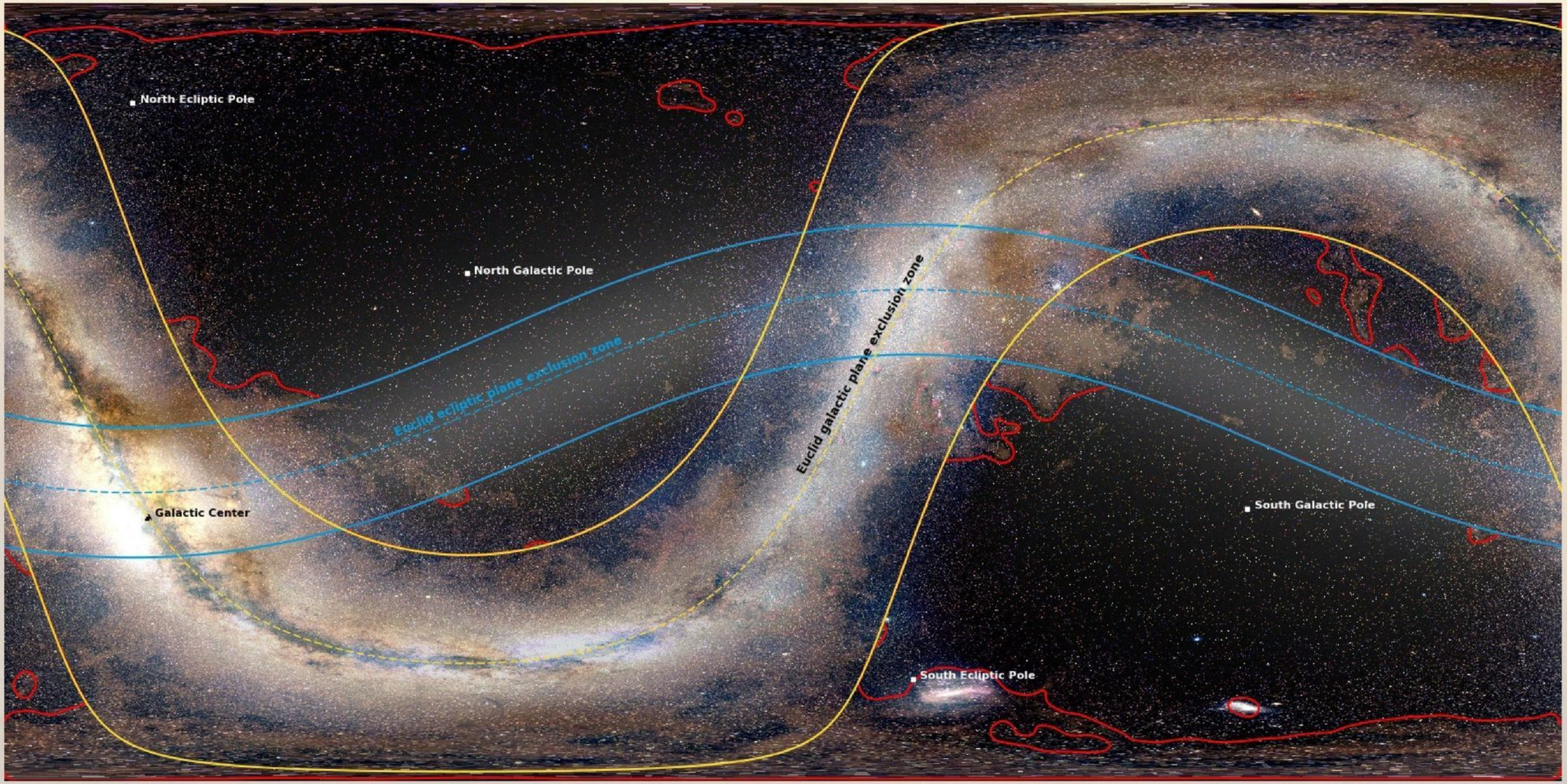
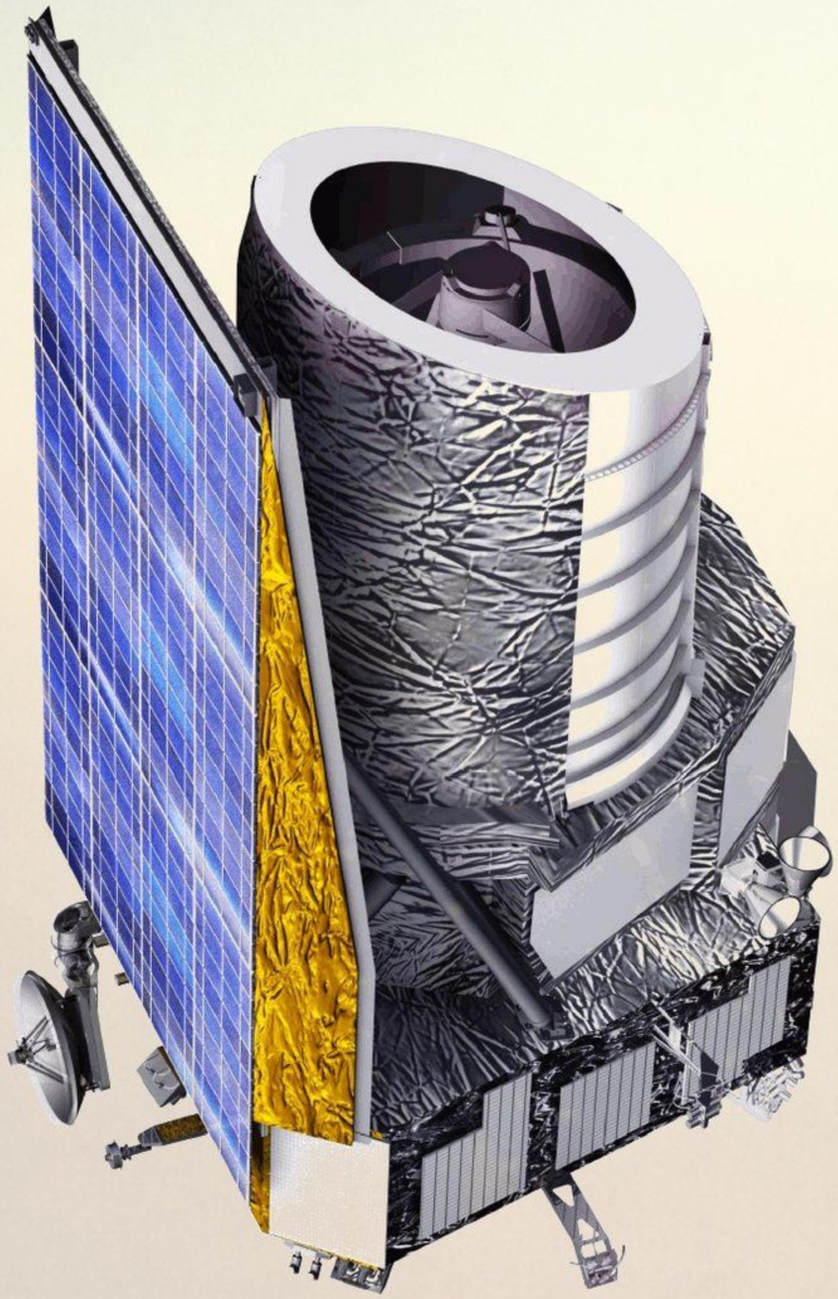
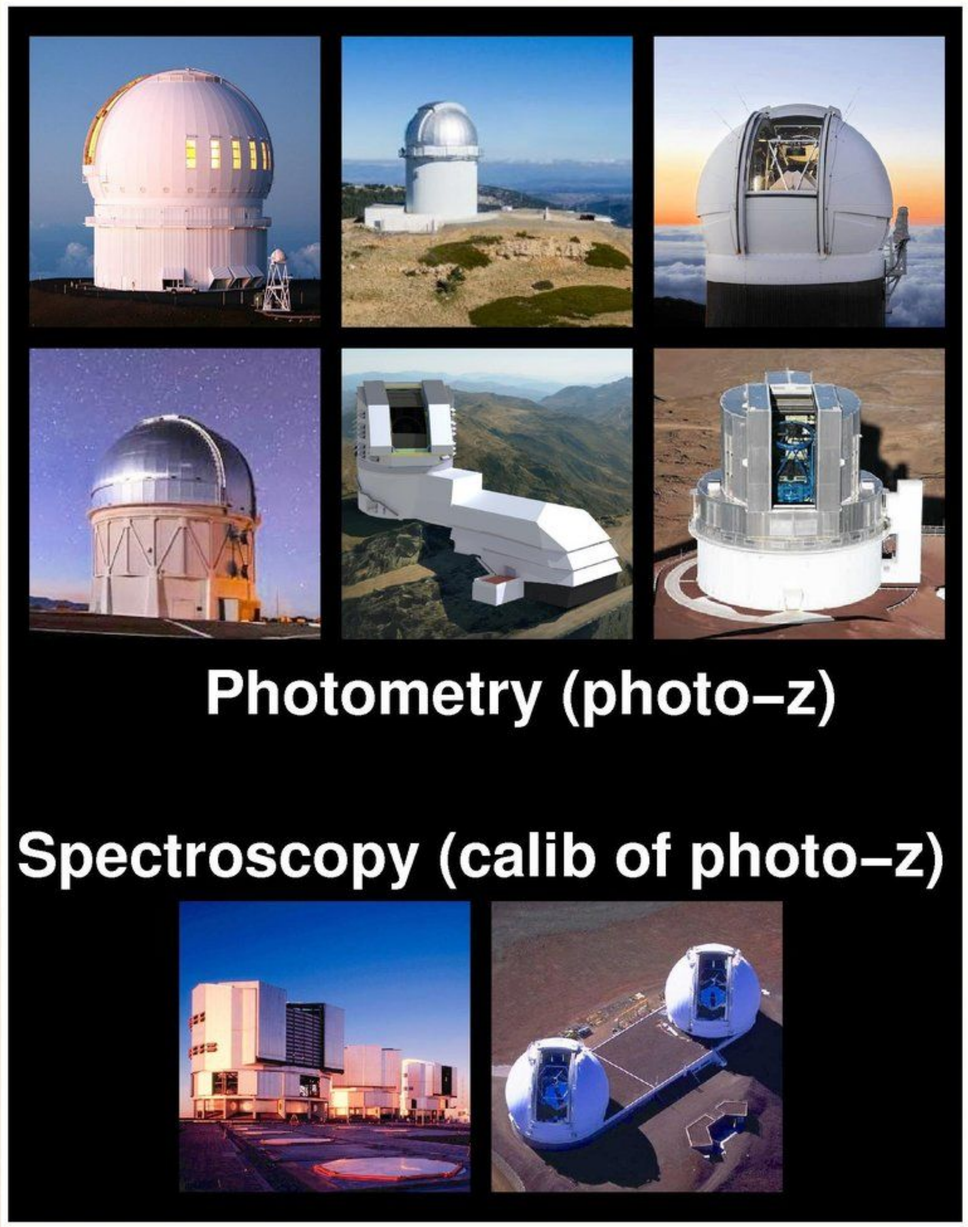


How the Euclid mission should be perceived

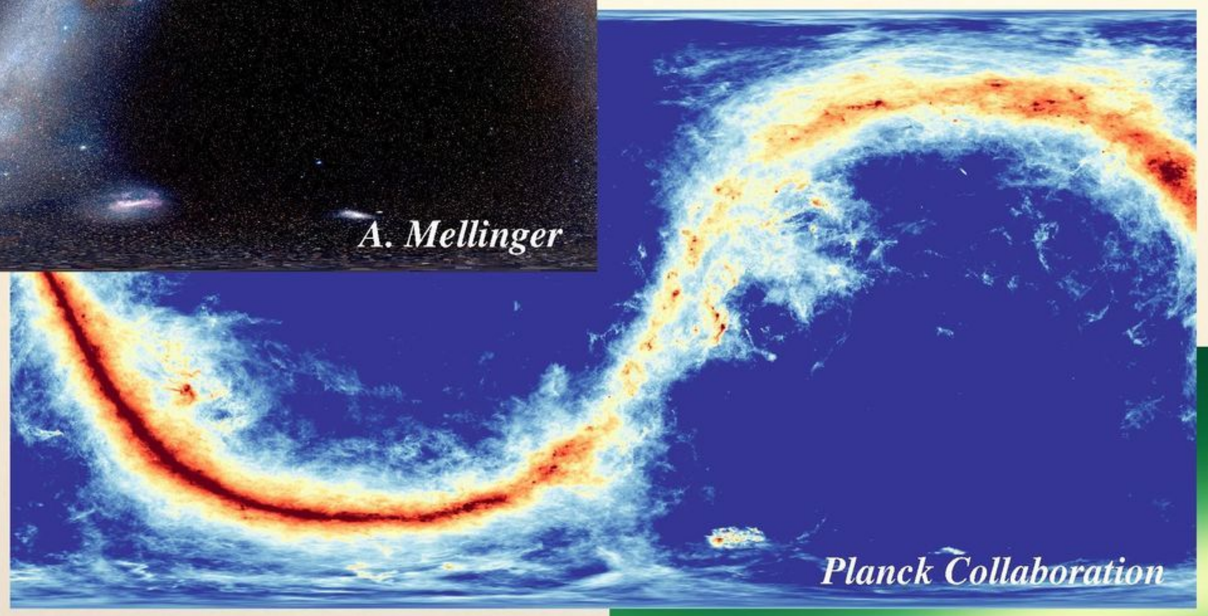




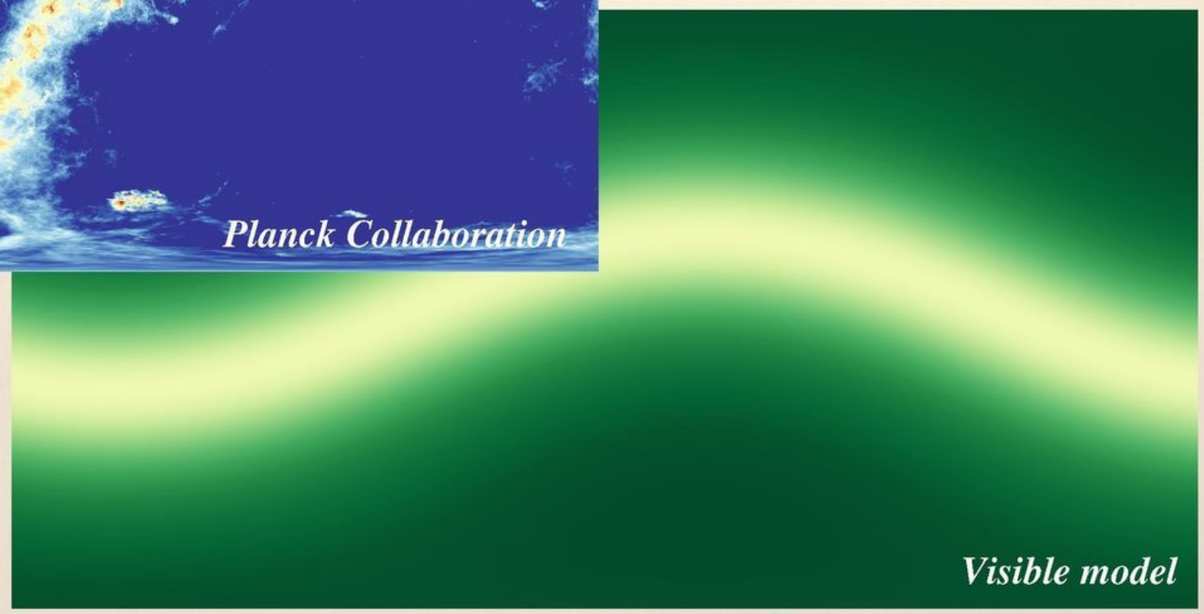
- The ESA mission, 6 years non–stop of space observations
- Plus 1,000 nights across several world–class ground–based telescopes
- A combo critical to reach the mission core science goals on dark energy

The entire sky: building the Euclid exclusion zones

The Galaxy



Reddening



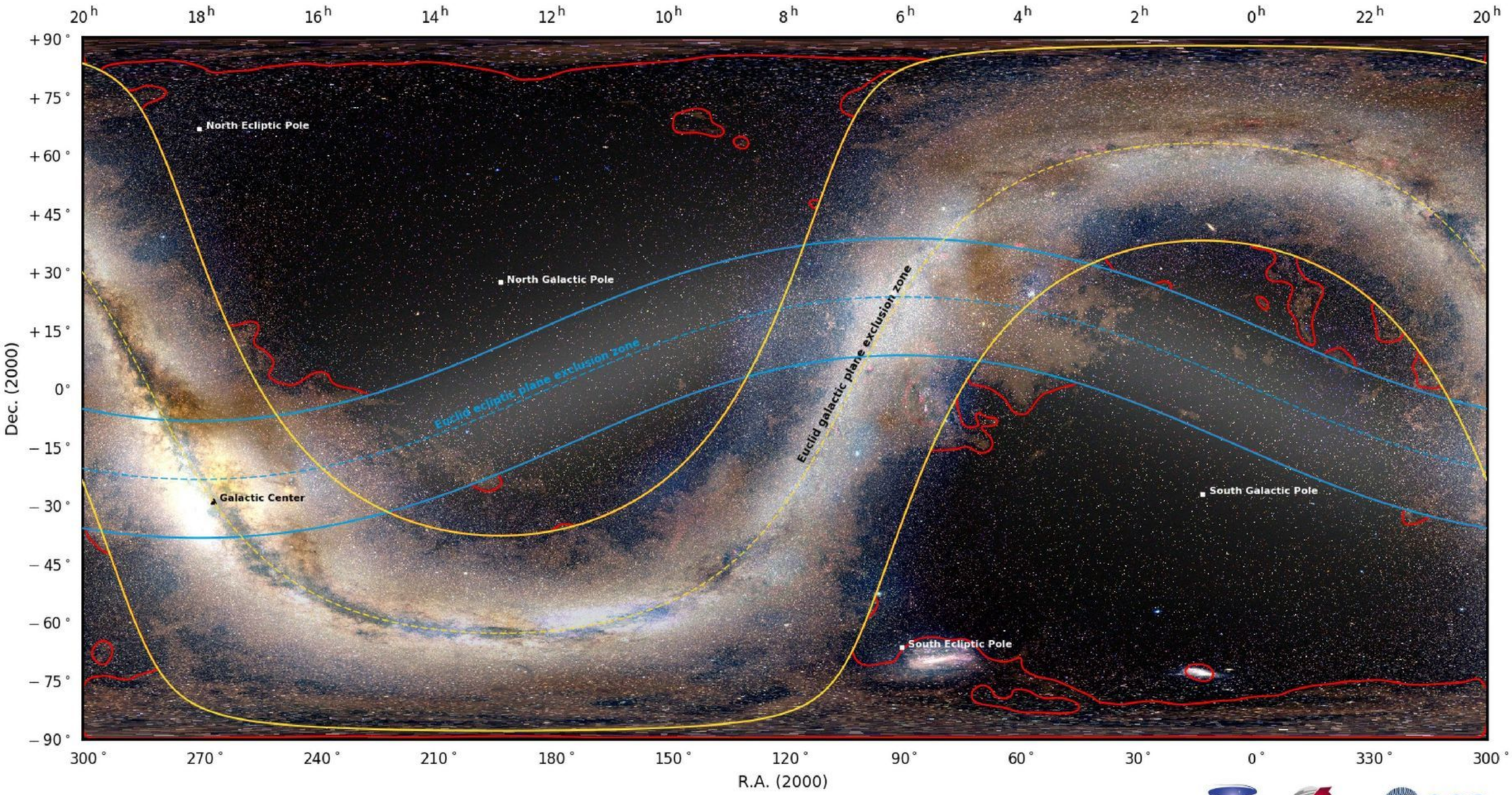
Zodiacal light

– Stellar contamination+Straylight+Reddening+Background define the exclusion zones

– Equatorial coordinates (ground–based astronomy) on an equirectangular projection

– Hour angle (RA on x–axis) shift to feature the two galactic caps unclipped

The Euclid Wide Survey exclusion zones



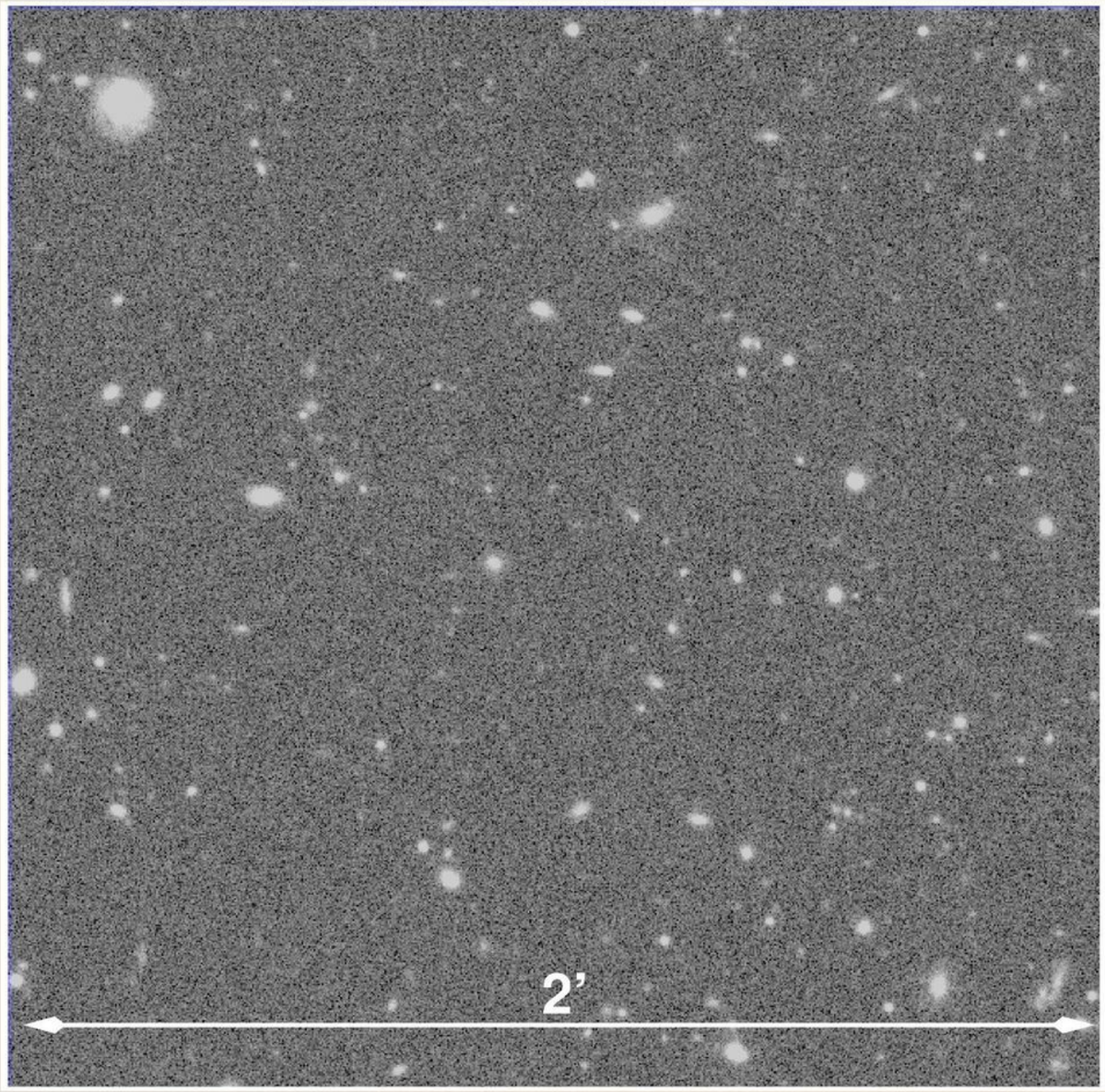
The Euclid Wide Survey exclusion zones leading to the 15,000 deg.^{2} sky area

- Ecliptic plane [zodical light background] : +/- 15 deg. ecliptic latitude exclusion zone
- Galactic plane [stellar contamination] : +/- 25 deg. galactic latitude exclusion zone
- Absorption [dust] : E(B-V)<0.08 + holes&islands avoided by pushing locally up to 0.15

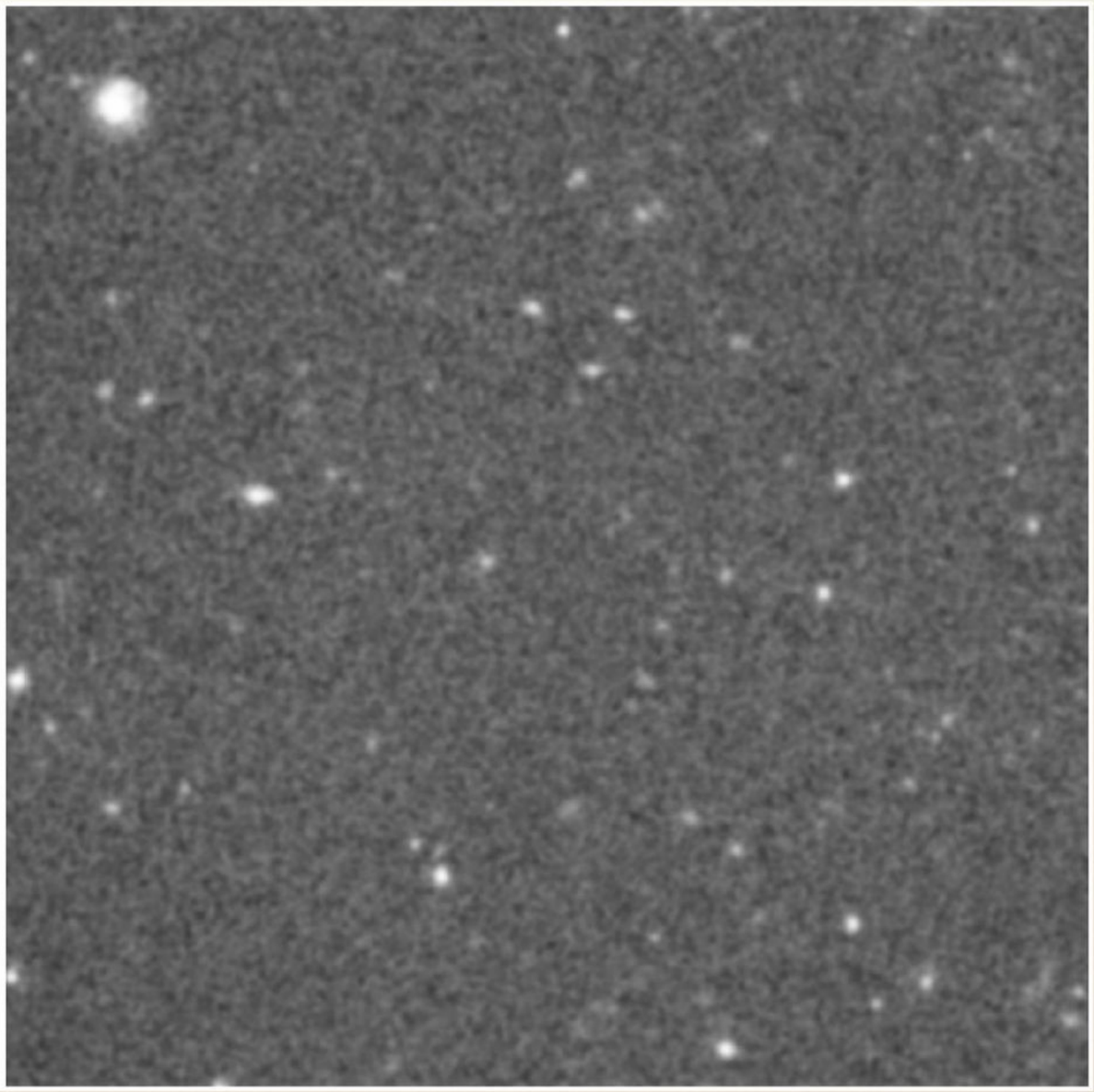
Background image: Euclid Consortium / A. Mellinger / Planck Collaboration

Euclid data are deep, a challenge to match from the ground

Wide survey example: 2x2 sq. arcmin = 1/13,500,000 of the total survey area



VIS depth: ~30 "Euclid" galaxies/arcmin2 (ACS, i)



Sought ground–based data (CFHT, r)

– Euclid will measure the shape of nearly 2 billion galaxies

– Wide survey depths can be reached with high etendue 2 to 4–m class telescopes

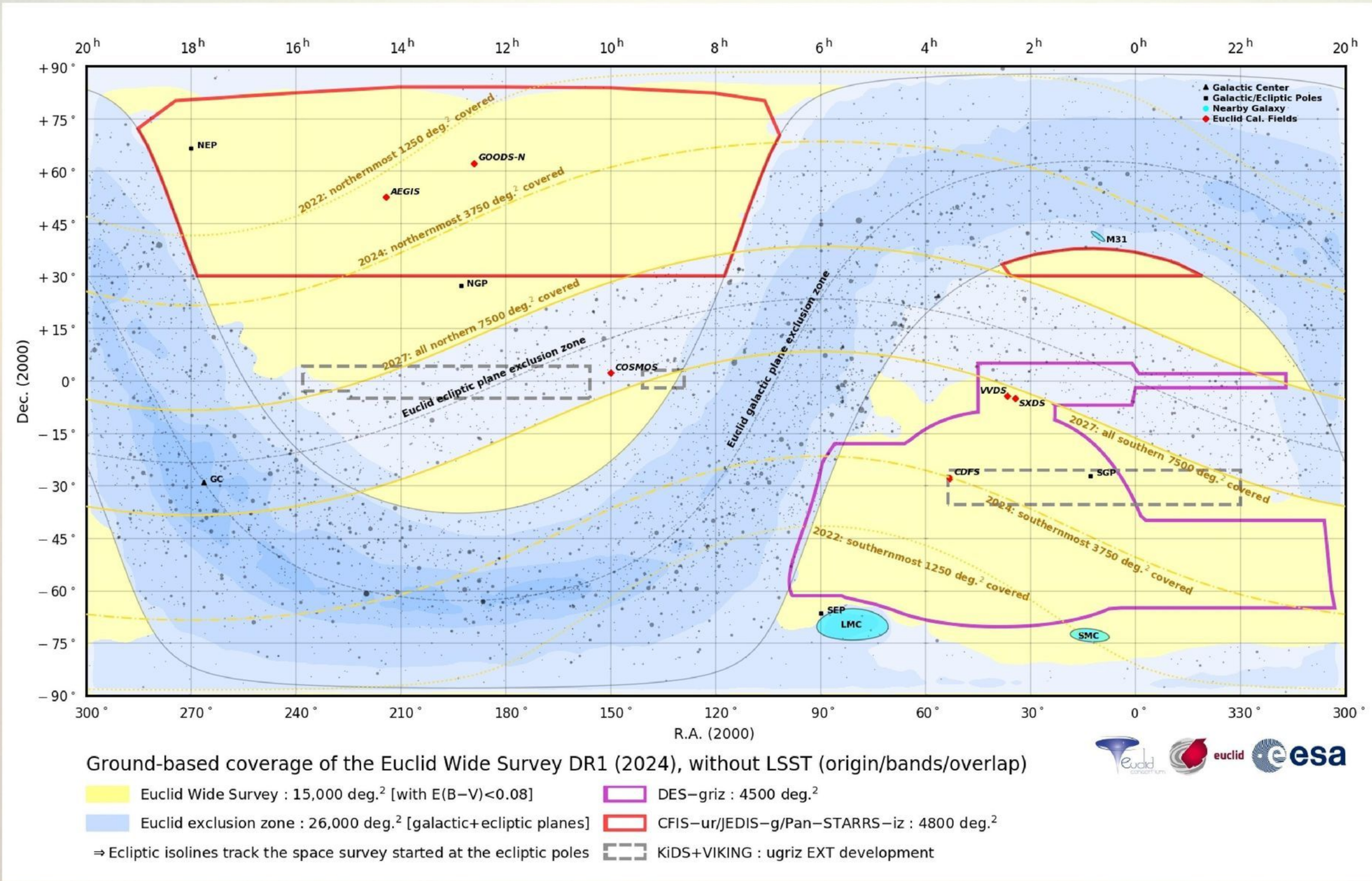
– The Euclid deep fields are 2 magnitudes deeper: 8–m class telescopes needed

Present and upcoming wide–field imagers relevant to Euclid

Facility	Year	Aper.	FOV	IQ	CCD class	Type	Hemisphere
LSST	2021	6.6m	9.6 sq.deg.	0.8"	Deep depletion	Surveyor	South
Subaru	2013	8.2m	1.8 sq.deg.	0.6"	Fully depleted	Observatory	North
Blanco	2013	4.0m	3.0 sq.deg.	0.9"	Fully depleted	Observatory	South
JST	2018	2.5m	4.8 sq.deg.	0.7"	Deep depletion	Surveyor	North
CFHT	2003	3.6m	1.0 sq.deg.	0.6"	EPI	Observatory	North
PS1	2008	1.5m	7.0 sq.deg.	1.0"	Fully depleted	Surveyor	North

Etendue

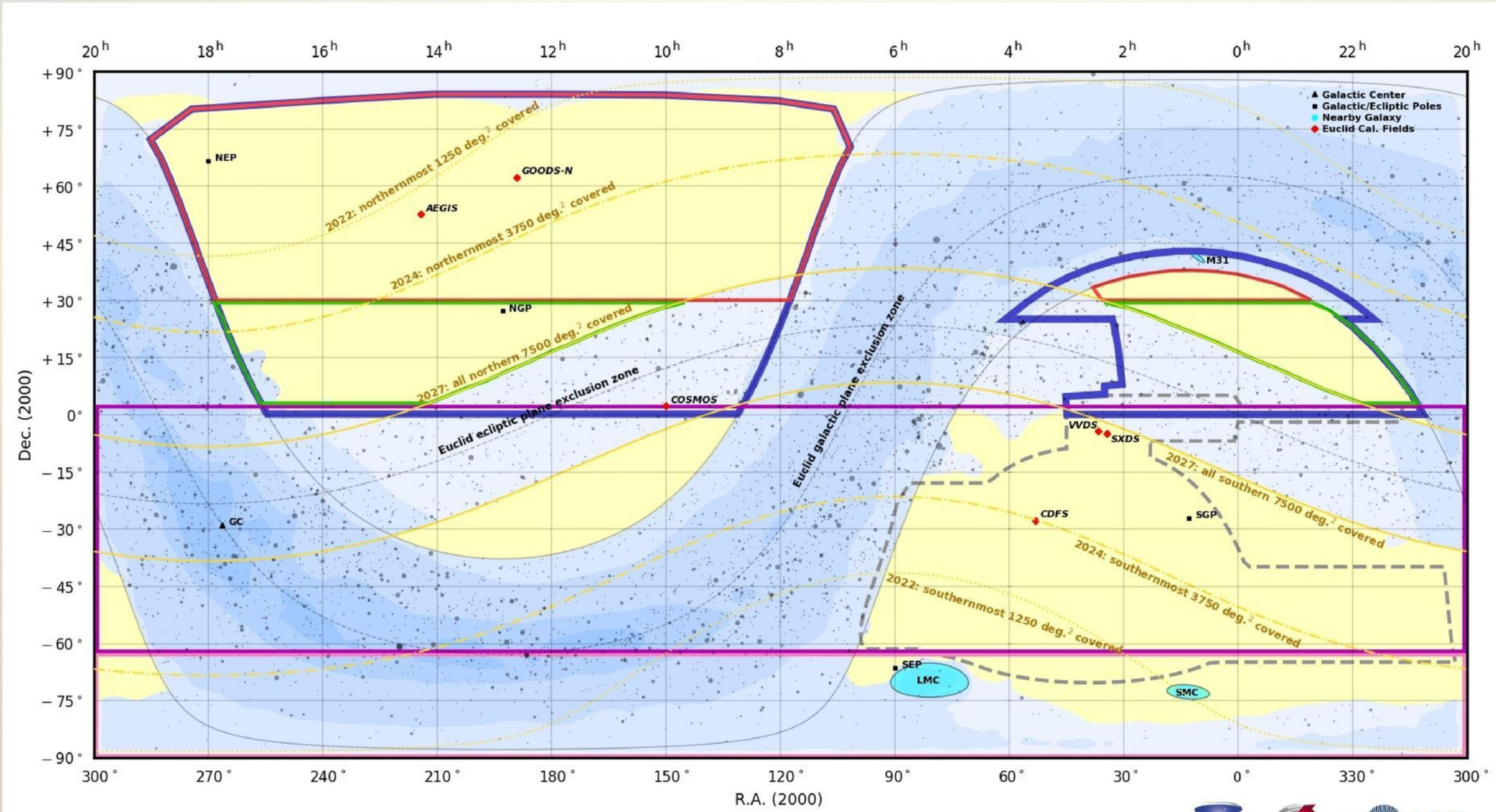
The Euclid Wide survey without LSST: Euclid North & DES



– The Euclid Consortium has now secured a plan for DR1 (2025)

– Euclid North will be used for DR2 (2027) and DR3 (2030)

Euclid & LSST synergy: 2/3 of Euclid Wide + 1 Deep Field



Expected ground-based coverage of the Euclid Wide Survey DR2/DR3 (2026/2029) (origin/bands/overlap)

euclid esa

Euclid Wide Survey : 15,000 deg.^{2} [with E(B−V)<0.08]

Euclid exclusion zone : 26,000 deg.^{2} [galactic+ecliptic planes]

⇒ Ecliptic isolines track the space survey started at the ecliptic poles

DES−griz : 4500 deg.^{2}

CFIS−u : 7300 deg.^{2}

CFIS−r/JEDIS−g/Pan−STARRS−iz : 4800 deg.^{2}

LSST main survey, ugriz : 7000 deg.^{2}

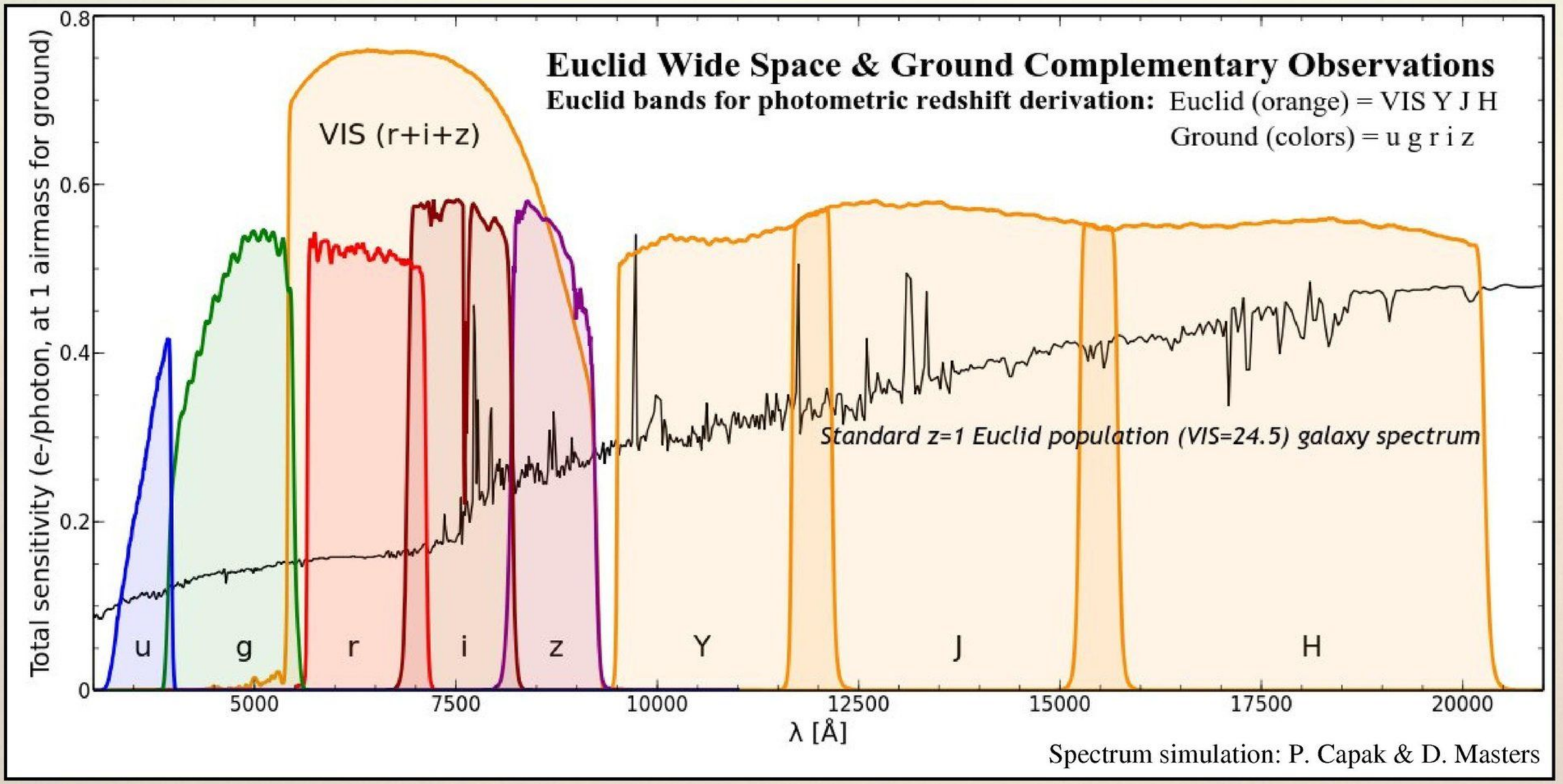
LSST south extension, ugriz : 1000 deg.^{2}

LSST north extension, griz : 3000 deg.^{2}

– Advanced discussions between the Euclid Consortium and LSST have started

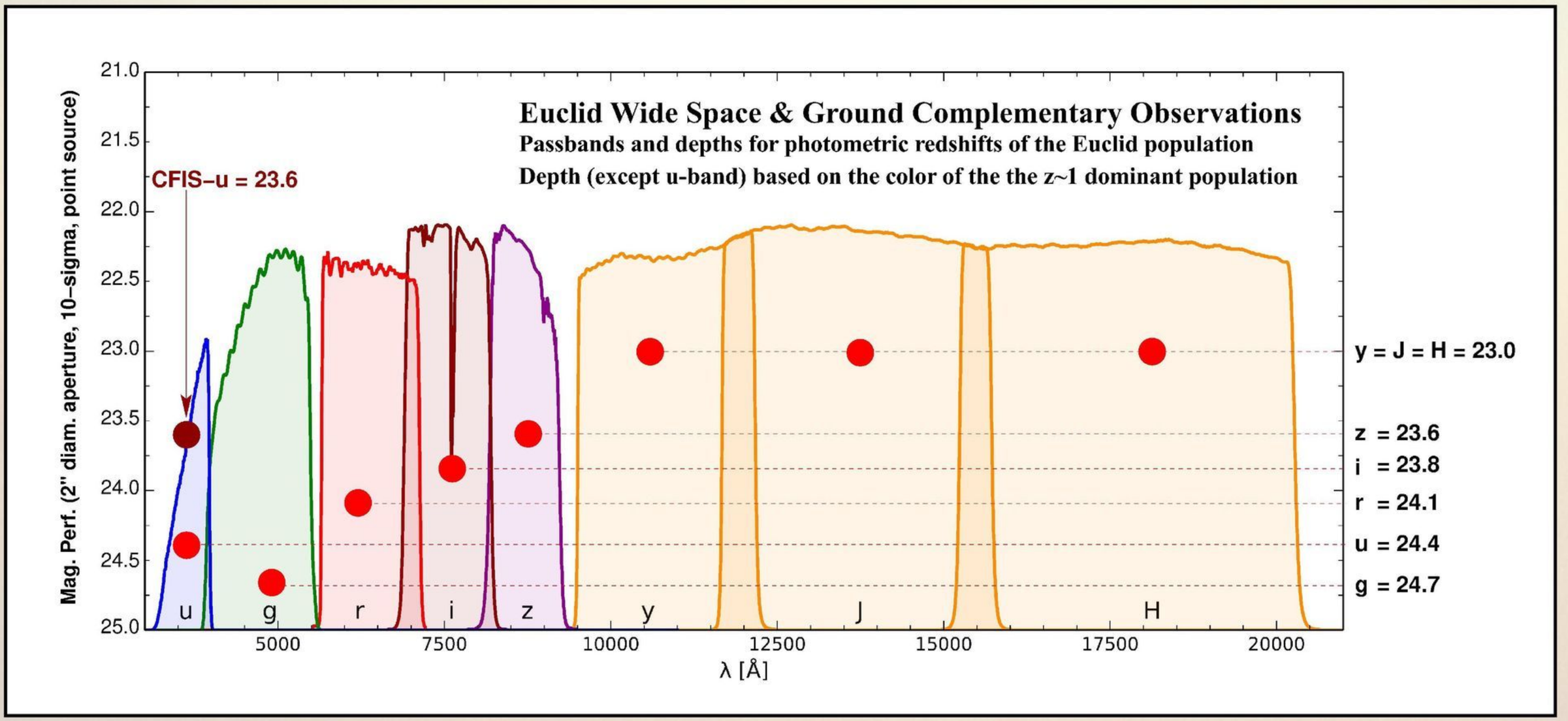
– The "LSST and Euclid Synergy" White Paper out fall 2017 (Rhodes et al.)

The complete Euclid photometric dataset



The VIS band is too wide to contribute to photo–z, it is all about morphometry

Optimizing the depths of the Euclid ground–based surveys

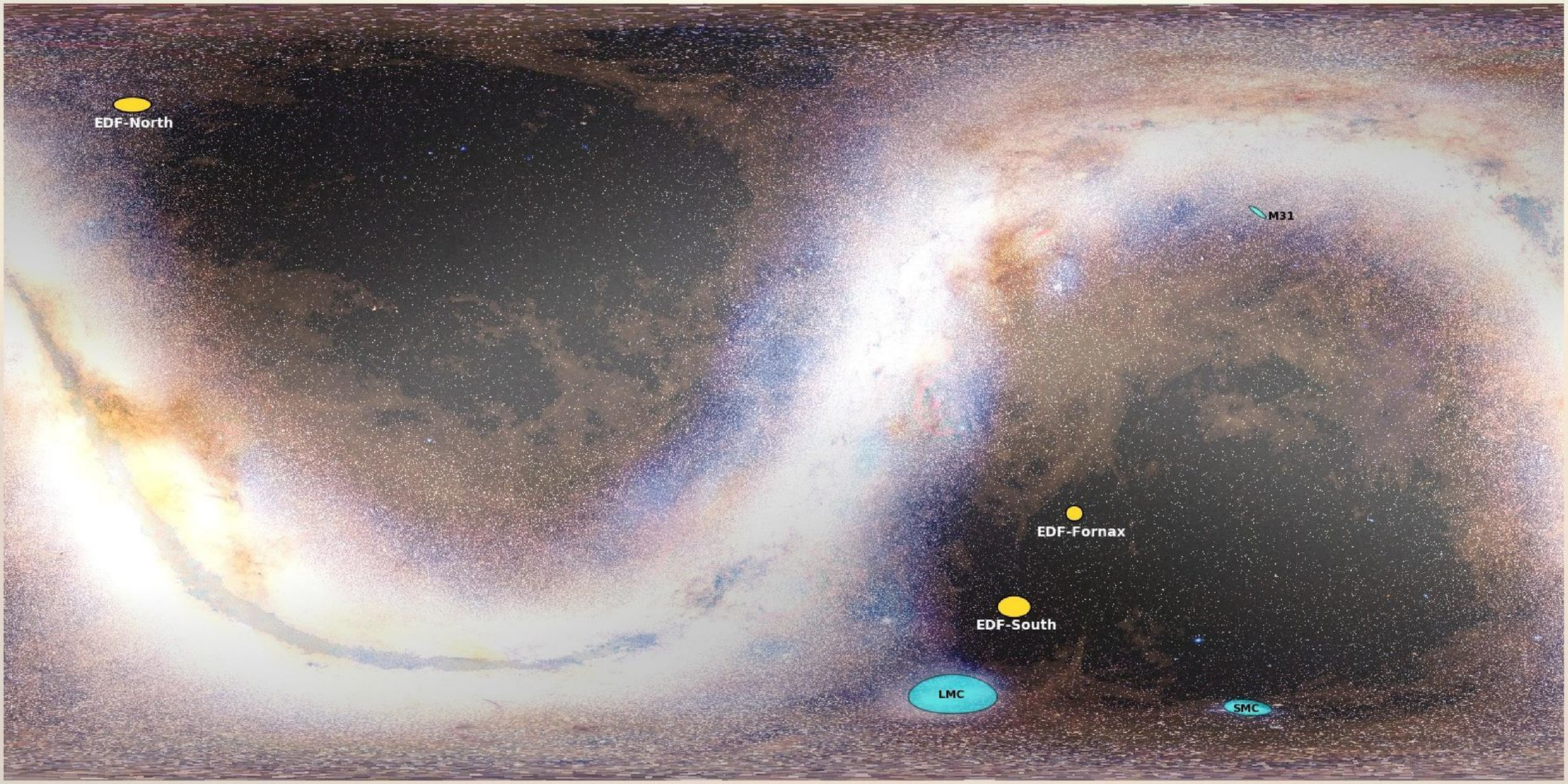


– The Euclid Red Book (reference mission document) depths had to be revisited

– New depths in g,r,i,z based on the colors of the Euclid lensing population (z~1)

– Depth metric: 10–sigma, point source in a 2 arcsec. diameter aperture

Identifying the Euclid Deep Fields



The Euclid sky in high contrast showcasing the best areas