Public release of EUCLID-deep simulated data

imaging and spectroscopy

INAF – OAR for the Astrodeep project

ASTRODEEP

"Unveiling the power of the deepest images of the Universe"

THEME [SPA.2012.2.1-01]

[Exploitation of space science and exploration data]

Grant agreement for: Collaborative project

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ABSTRACT

In this document we provide a description of the simulated data released by the consortium, including the EUCLID-deep imaging dataset. As described in D6.1, the methodology for simulating spectroscopic data is currently in progress and the relevant dataset will be released before the end of the project.
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1. Scope of this document

This document is meant to accompany the release of the first EUCLID-deep simulated dataset. The Euclid simulated images in the four bands (VIS, NIR-H, NIR-J and NIR-Y) can be downloaded from the Astrodeep ftp site (link given below). In addition to the Euclid images, the consortium considered that releasing simulated images in the GOODS-South and COSMOS fields would be equally useful and interesting for the scientific communities. These additional datasets can be distributed from the consortium upon request. The simulation of the spectroscopic dataset has been delayed for reasons explained in D6.1 but will be made available as soon as they are ready, presumably within September 2016.

2. Simulated images

We decided to produce and release sky images (i.e. including noise) normalized to counts/s and background subtracted, and noise-subtracted images (from which the RMS map can be easily obtained), plus the PSFs.

We release three simulated datasets of images, created using the procedure described in D6.1.

- a deep field with area equal to the GOODS-South CANDELS field, including all the 19 passbands used in the CANDELS survey (all images have HST pixel-scale of 0.06”/pix);
- a wide field of area 1 sq.deg., i.e. comparable to a half the COSMOS wide survey area, including *HST H*160, ground-based and *Spitzer* passbands (all images have a pixel-scale of 0.15”/pix, as in Capak+2007);
- a simulated Euclid FOV (~0.7° per side) composed of 4 dithered single exposures, each in the 4 Euclid passbands (16 images in total, each of $\sim 28000^2$ pixels, at the VIS pixel-scale of 0.1”/pix).

3. GOODS-South and COSMOS Wide

For the GOODS-South simulations, the limit magnitudes in 1 FWHM for all bands where computed from the nominal ones given in Guo+2014, as $m_{limit} = m_{1\sigma} = m_{5\sigma,CANDELS} + 2.5log5$ (with minor adjustments for "cosmetics"):

CTIO_U=28.4 (true: 28.38), VIMOS_U=29.5 (true: 29.72), ACS_f435=30.5 (true: 30.70), ACS_f606=30.5 (true: 31.10), ACS_f775=30.5 (true: 30.30), ACS_f814=30.5 (true: 30.60), ACS_f850=30.5 (true: 30.30), ACS_f098=30.5 (true: 30.52), WFC3_f105=30.5 (true: 29.20), WFC_f125=30.5 (true: 29.40),

WFC3_f140=30.5 (true: 29.40), WFC3_f160=30.5 (true: 29.11), ISAAC_Ks=26.85 (true:26.83), HawkI_Ks=28.2 (true: 28.20), IRAC1=27.15 (true: 27.15), IRAC2=27.15 (true: 27.15), IRAC3=25.5 (true: 25.50), IRAC4=25.5 (true: 25.47).
FWHM were taken as follows:
CTIO_U=1.35", VIMOS_U=0.8", ACS_f435=0.1", ACS_f606=0.1", ACS_f775=0.1", ACS_f814=0.1", ACS_f850=0.1", ACS_f098=0.13", WFC3_f105=0.15", WFC3_f125=0.16", WFC3_f140=0.17", WFC3_f160=0.17", ISAAC_Ks=0.48", HawkI_Ks=0.4", IRAC1=1.66 ", IRAC2=1.7 ", IRAC13=1.9", IRAC4=2.0".

The simulation covers an area of 0.048 sq.deg, i.e. 172.8 sq.arcmin, equal to the GOODS-South field area (actually both the Deep and the Wide area of the CANDELS survey).

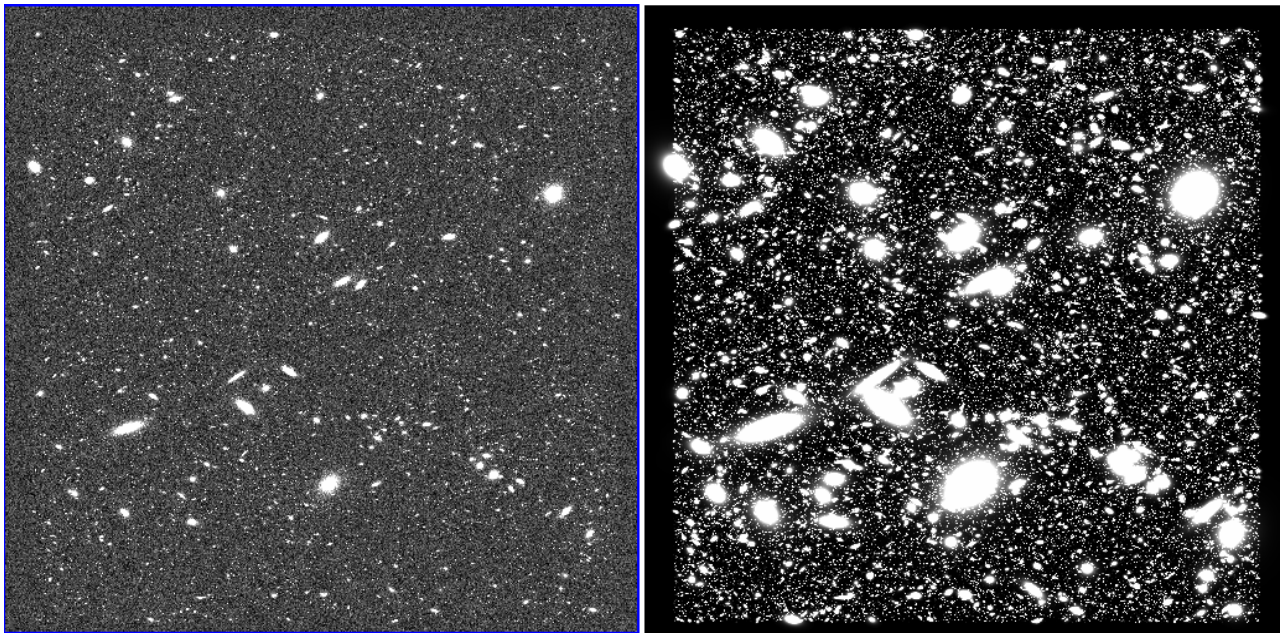

Fig. 1 – Full simulated GOODS-South WFC3_f160w field: science image (left) and noise-subtracted image (right). Note that the final area of the simulated region is larger than the input area, to fully include objects at the borders. (Left: simulated IRAC1 GoodsS field; right: corresponding no-noise image)

We proceed in a similar way for the COSMOS simulation, taking as limiting magnitudes and FWHMs the ones given in Capak+2007, Sanders+2007 and Ilbert+2010 (again with small adjustments for cosmetics). We simulated the ground-based broad pass-bands, together with the *Spitzer* CH1 and CH2 and a detection *HST H*160 image:
WFC3_f160=29.25 (FWHM=0.2"), Subaru_B=29.0 (FWHM=0.5"), Subaru_g+=28.75 (FWHM=1.5"), Subaru_V=28.4 (FWHM=1.0"), Subaru_r+=28.5 (FWHM=0.6"), Subaru_i+=28.0 (FWHM=0.7"), Subaru_z+=27.0 (FWHM=0.8"), UKIRT_J=25.45 (FWHM=1.5"), CFHT_K=25.45 (FWHM=1.5"), IRAC1=26.65 (FWHM=1.66"), IRAC2=24.9 (FWHM=1.7"). The simulated area is 1 sq.deg., i.e. half of the full COSMOS wide survey.

Both these two simulated datasets were entirely created using the passband response curves included in the EGG database. The zero points were fixed to 23.9, so the images are in μJy units; the exposure time is fixed to 10000 sec.

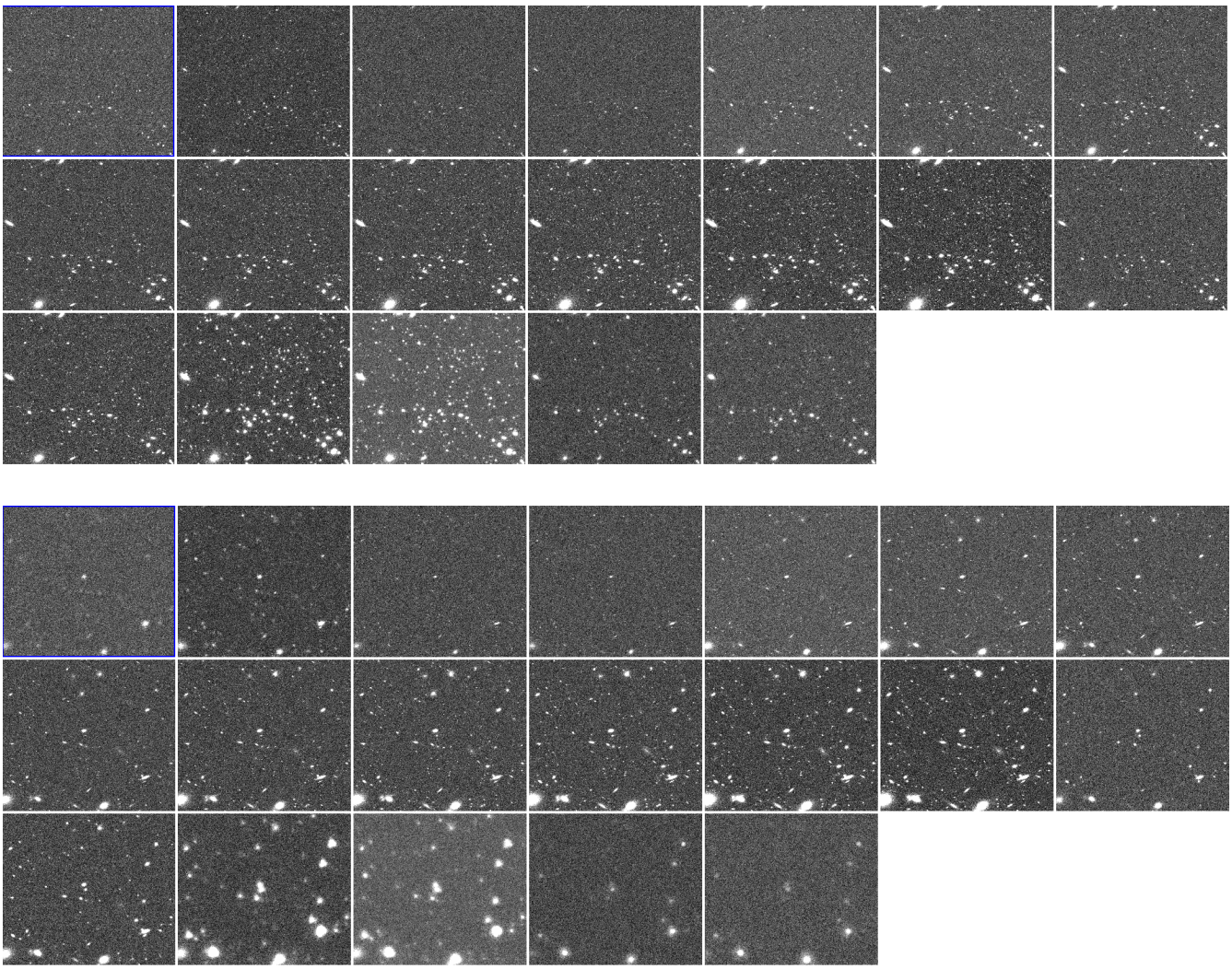

Fig. 2 – Regions within simulated GOODS-South images, at different magnifications. Both panels, left to right, top to bottom: CTIO_U, VIMOS_U, VIMOS_B, ACS_f435, ACS_f606, ACS_f775, ACS_f814, ACS_f850, ACS_f098, WFC3_f105, WFC3_f125, WFC3_f140, WFC3_f160, ISAAC_Ks, HawkI_Ks, IRAC1, IRAC2, IRAC3, IRAC4.

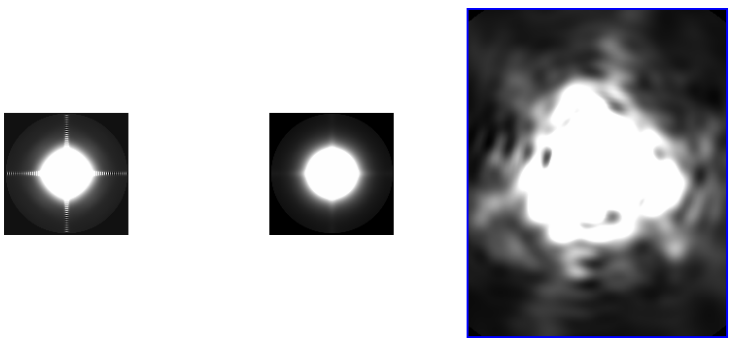

Fig. 3 – Three of the adopted PSFs. Left to right: HST WFC3_f160, HawkI_Ks, IRAC1.

4. Simulated images: EUCLID FoV

To simulate the EUCLID VIS images we followed the Euclid parameters describer in the Euclid *Redbook*; in this case we used the passband response curves kindly provided by the Euclid community. The adopted values for limiting magnitudes (in 3 FWHM) at 1σ are the following:
VIS=27.0 (FWHM=0.2”), NIR_Y=27.0 (FWHM=0.3”), NIR_J=25.75 (FWHM=0.3”), NIR_K=25.75 (FWHM=0.3”).
The zero points is 25.943 for all the images.

As for the PSFs, since internally generated PSFs have perfect circular simmetry we used them for all bands but for the IRAC ones in the GOODS and COSMOS simulations, because of the intrinsic strong asimmetry of the real *Spitzer* PSFs. For these images we therefore fed SkyMaker with “realistic” synthetic IRAC PSFs, generated using a Python script by the H. Ferguson and S. Lee within the CANDELS collaboration.

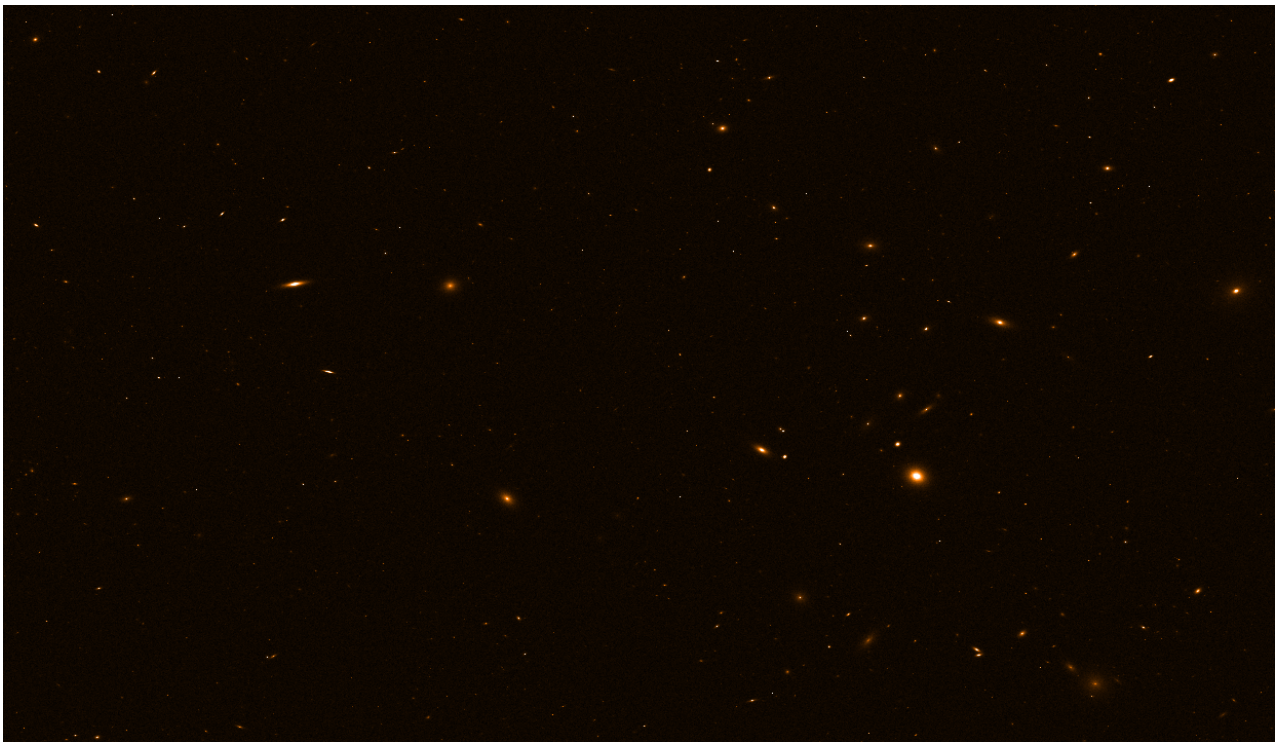

Fig. 4 – A small part of a simulated Euclid VIS image (~5% of the total area).

The four EUCLID simulated bands have been released and can be found in:
ftp://ftp.astrodeep.eu/EUCLID/ (password protected)
In the following figures we show jpeg of the final fits images that can be found on the Astrodeep repository.

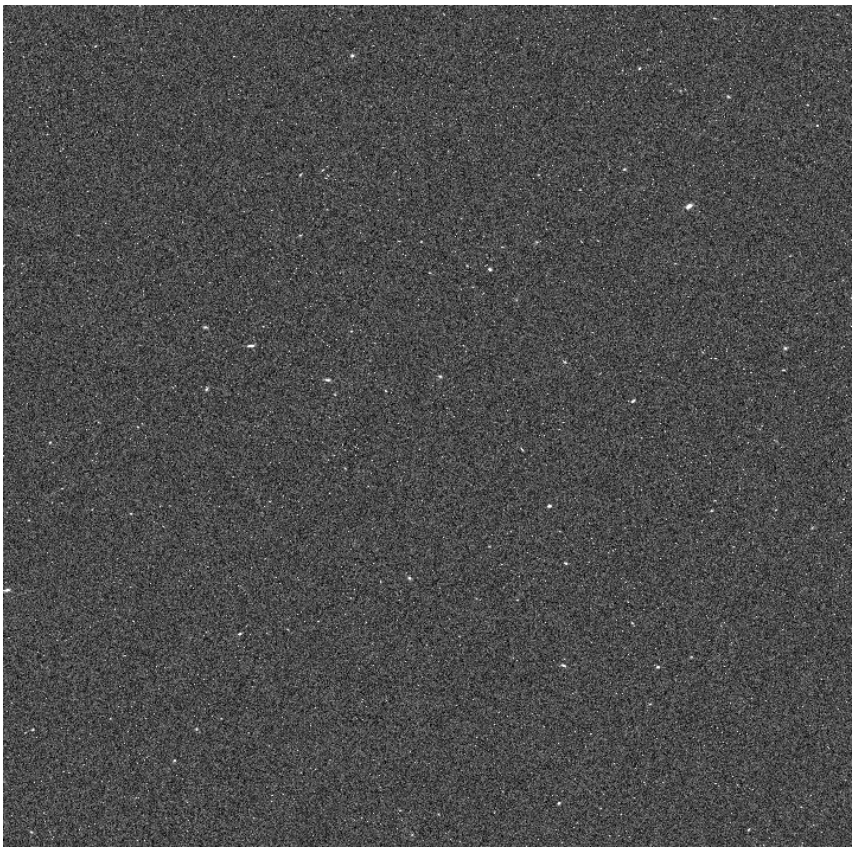

Figure 5: VIS

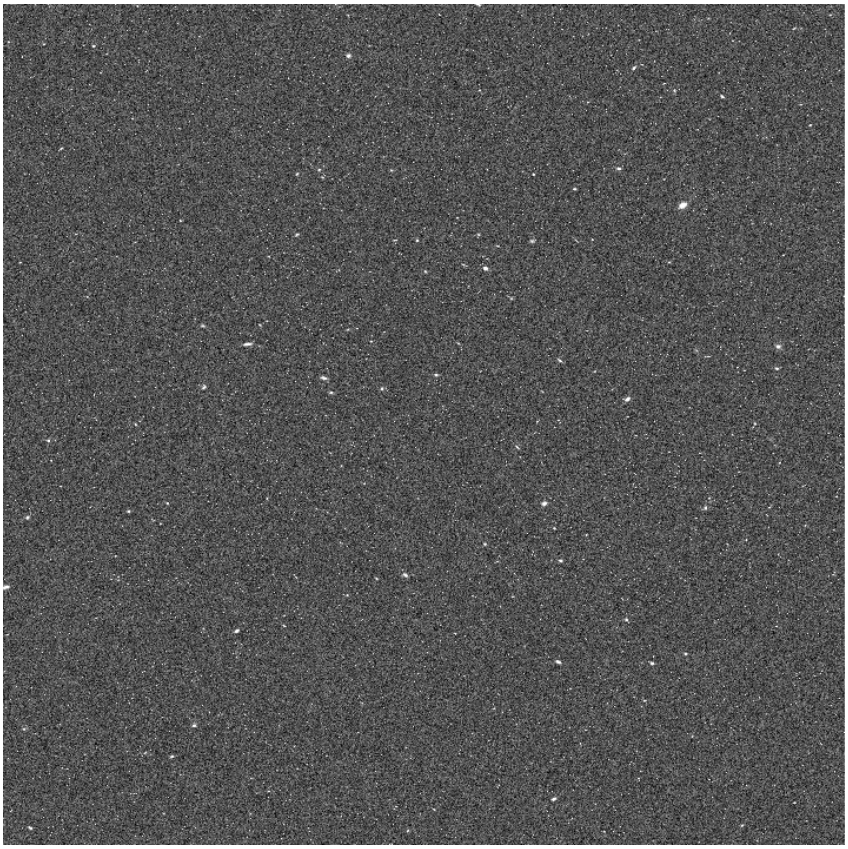

Figure 6: NIR_H

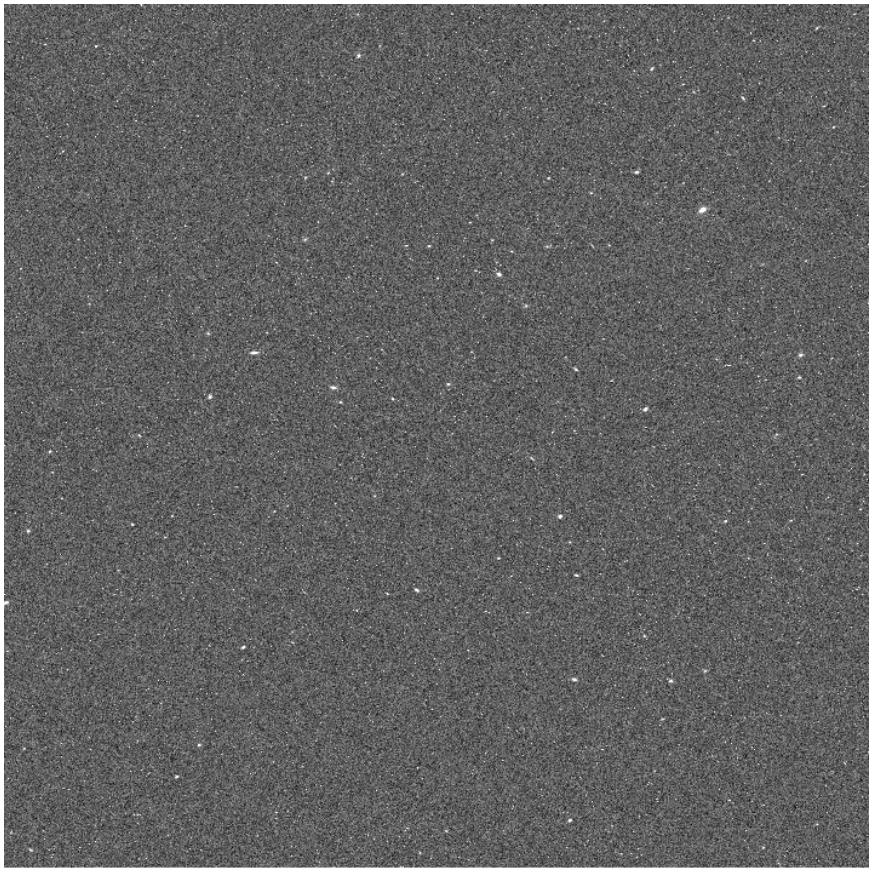

Figure 7: NIR_J

Figure 8: NIR_Y