ESO Phase 3 Data Release Description

| Data Collection | KiDS |
|-----------------|----------------|
| Release Number | 5.0 |
| Data Provider | Konrad Kuijken |
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ESO Phase 3 Data Release Description Abstract Overview of Observations Imaging products and single-band source lists 10-band source catalogue Data Reduction, Calibration and Photometry DR5 fits files and format Format of coadded images Catalogue Columns Acknowledgements

Abstract

This data release constitutes the fifth public release by the Kilo-Degree Survey (KiDS). KiDS is an ESO public survey carried out with the VLT Survey Telescope and OmegaCAM camera, that has imaged 1347 square degrees in four filters (u, g, r, i). Single epoch observations are provided in (u,g,r). Multi-epoch imaging is provided in the i-band, with the two observations, denoted i_1 and i_2 , typically separated by several years. KiDS was designed as a weak lensing tomography survey, with a core science driver to map and constrain the properties of the evolving large-scale matter distribution in the Universe. The median r-band 5 σ limiting magnitude is 24.8 with median seeing 0.7". Additional science cases are manifold, ranging from galaxy evolution to Milky Way structure, and from the detection of white dwarfs to high-redshift quasars.

This document summarises the KiDS-ESO-DR5 release, which builds from the fourth KiDS data release with a 34% areal extension as well as a second pass over the full survey area in the i band (effectively doubling the i band integration time for every tile). For each of the 1347 square-degree survey tiles, the data release includes calibrated stacked images in u,g,r, i_1 and i_2 filters, their corresponding weights and masks, and single-band source lists extracted from the stacks. A multi-band ugri₁ i_2 ZYJHK_s source catalogue incorporating near-IR photometry from the companion VIKING survey with VISTA is also provided. This catalogue encompasses the combined 1347 square degree area of this data release, with PSF-homogenised and

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aperture-matched photometry, and derived photometric redshift and stellar mass estimates. We refer the reader to <u>Wright et al 2024</u> (hereafter <u>W24</u>) for a detailed discussion of this data release.

The VST data included in KiDS-ESO-DR5 were taken under ESO programme IDs: 60.A-9038(A), 0103.A-0181(A), 177.A-3016(A to U), 177.A-3016(W), 177.A-3017(A) and 177.A-3018(A). The VISTA data used in this data release are taken from VIKING DR4, released on March 17, 2020.



Figure 1: Location of the 1347 KiDS-ESO-DR5 tiles. The area covered in DR4 is shown in green, while the yellow tiles are new additions. Pointings that were originally included in the 1500 deg² KiDS footprint, but which were subsequently descoped due to the limited area observed by VIKING, are shown in dark purple (top: KiDS-North; bottom: KiDS-South).

Full resolution Hierarchical Progressive Surveys (HiPS) zoomable colour images of the KiDS-ESO-DR5 VST data can be viewed at the following addresses: <u>https://alasky.cds.unistra.fr/KiDS/CDS_P_KiDS_DR5_color-gri/</u> (g/r/i), and <u>https://alasky.cds.unistra.fr/KiDS/CDS_P_KiDS_DR5_color-ug/</u> (u/u+g/g), as well as in the Aladin sky viewer and other HiPS-aware clients.

Overview of Observations

The KiDS-ESO-DR5 data release consists of the co-added images, weight maps, masks and source lists for 1347 square degree survey tiles observed with OmegaCAM on the VST in u, g, r and i bands between August 9, 2011 and May 3, 2019 (see the DR5 footprint in Figure 1). In addition we release a 10-band $ugri_1i_2ZYJHK_s$ source catalogue. The DR5 data products supersede all previous KiDS releases.

DR5 provides an additional 341 survey tiles to the KiDS DR4 footprint, along with a full second i-band pass of the full footprint. These tiles have been processed in a similar way to DR4, adopting the same masking, astrometric calibration and photometric calibration algorithms. DR5 updates relative to the previous DR4 release are as follows

- The masking algorithm for the r-band was improved (see section 3.5.3 of W24).
- We reviewed the u-band DR4 astrometric distortion solution, noting that the paucity of stars (per chip) in the u-band can occasionally lead to a poorly constrained 3rd order polynomial fit. This led to unphysical distortion solutions for some chips. For DR5, u-band exposures with more than a 1 arcsecond chip-corner distortion residual have therefore been re-processed using a linear order polynomial fit. This impacts 307 tiles, as listed in Table D1 of W24.
- The photometric calibration, using stellar locus regression, was updated to include the new i₂ photometry (see section 3.5.2 of W24). Any DR4 data products that were otherwise unchanged by our DR5 re-analysis have only been updated with this revised zero-point calibration information.

The new DR5 10-band ugri₁i₂ZYJHK_s source catalogue spans all survey tiles in the data release. It contains list-driven, aperture- and PSF-matched <u>GAaP photometry</u> (Kuijken et al 2015) from the stacked VST images, and VISTA images taken as part of the near-IR VIKING survey. Derived parameters include star-galaxy classifiers, photometric redshifts from the <u>BPZ algorithm</u> (Benitez 2000) and stellar mass estimates from the <u>LePhare</u> algorithm (Arnouts et al 1999). Sources are detected on a separate reduction of the r-band stacks with the <u>THELI</u> pipeline (Erben et al 2005), optimised for the weak lensing analysis. These r-band detection images are also included in the data release, superseding their DR4 equivalent owing to the use of an improved Gaia-based astrometric solution.

Imaging products and single-band source lists

A list of the 1347 tiles for which imaging data products and single-band source lists are provided for <u>KiDS-ESO-DR5</u> is online.

Each tile was observed in the u, g, r, and i band. The final footprint of each tile is slightly larger than 1 square degree due to the dithering scheme: 61.9x65.4 arcminutes in u; 62.3x66.8 arcminutes in g, r and i. The total unique sky coverage of the KiDS footprint is 1331 square degrees, which reduces to 1014 square degrees when applying the KiDS-recommended masks in both the VST and VIKING filters (see Table 12 of W24).

As the OmegaCAM CCD mosaic consists of 32 individual CCDs, the sky covered by a single exposure has gaps. In order to fill in these gaps, KiDS tiles are built up from 5 dithered observations in g, r and i and 4 in u. The dithers form a staircase pattern with dither steps of 25" in X (RA) and 85" in Y (DEC), bridging the inter-CCD gaps (see Figure 3 of <u>de Jong et al.</u>, 2015). The tile centres are based on a tiling strategy that tiles the full sky efficiently for



VST/OmegaCAM. Neighbouring dithered stacks have an overlap in RA of 5% and in DEC of 10%.

Figure 2: Tile-by-tile raw data quality parameters for KiDS-ESO-DR5. Left: average PSF size (FWHM) distributions; right: limiting magnitude distributions (5σ AB in 2" aperture). The distributions are per filter: from top to bottom u, g, r, and then the multi-epoch i1 and i2 bands. See Section 3.1.3 of W24 for details.

In Figure 2 the obtained seeing (FWHM), and limiting magnitude (5 σ AB in 2" aperture) distributions per filter are shown, to illustrate the obtained data quality. In the case of filters observed during dark time (u, g, r), the FWHM distributions reflect the different observing constraints, with r-band taking the best conditions. As the i-band is the only filter observed in bright time, we recover a large range of seeing conditions in this filter. The wide range of i-band limiting magnitudes is caused by the larger range in seeing and moon phase and thus sky brightness. We note that the second-pass i-band imaging does not suffer from the poor baffling of the VST in the period up to May 2015 that particularly affected the i-band sky background.

The VST-PSF is quite round and shows little variation across the focal plane: seeing ellipticities (defined as e = 1-b/a, where a and b are the major and minor axes of the PSF, respectively) across all KiDS VST observations are consistently less than $\langle e \rangle = 0.08$ per exposure (see Appendix G of W24 for details).

The flux scales in the images correspond to the nightly zeropoints, with the post-processing calibration zeropoints reported in the image header. The single-band source lists were extracted from the calibrated, stacked images for each tile and filter separately, using the Astro-WISE processing system (see Section 3.5.5 in W24). These catalogues are provided to

the public largely 'as-is'; they have not gone through the same rigorous quality control and testing as the 10-band catalogues discussed in the next section.

For a full overview of the data quality parameters for each observation we refer to the following online table: <u>http://kids.strw.leidenuniv.nl/DR5/data_table.php</u>. This data release consists of 26,940 files of single-band data, totalling 20.8TB (image, weight, mask and source list).

10-band source catalogue

The KiDS-ESO-DR5 $ugri_1i_2ZYJHK_s$ source catalogue combines VST and VISTA observations over the complete KiDS footprint.

The detection catalogue was generated from the r-band images reduced with the THELI pipeline described in section 3.2 of W24. These images form the basis for weak lensing shape measurements, and this choice ensures that the definition of the sources in the photometric catalogue is consistent with the lensing catalogue. The complementary shear catalogue will be released on the KiDS website after the publication of the DR5 cosmic shear analysis (see Wright et al 2025 and Stolzner et al 2025).

Photometric calibration for the 10-band source catalogue uses stellar-locus regression, anchored to a combination of Gaia photometry (in the white-light G-band, blue GBP-band, and red GRP-band). Section 3.5.2 of W24 describes the calibration process, and how the second i-band pass is used to estimate the systematic uncertainty introduced in the calibration of the ugr-bands by variations in the quality of the i-band data. The KiDS reduction and calibration of the NIR VIKING imaging is described in Section 4 of W24.

We report forced (list-driven) 'Gaussian Aperture and PSF (GAaP)' photometry (Kuijken et al. 2015) on the Astro-WISE ugri VST images, and the ZYJHKs VISTA images. For details see section 3.6 of W24. GAaP photometry requires the same aperture to be specified across all bands, and this aperture must not be smaller than the seeing. To accommodate occasional poor seeing in one of the 10 bands, GAaP photometry is recorded for two choices of a minimum Gaussian aperture rms radius: 0.7" and 1.0". When the seeing is good in all bands the smaller setting will yield the most accurate measurements, but for a band where the seeing is poor, the larger aperture may yield a more accurate flux, or the smaller aperture may not yield a flux measurement at all. The optimal choice of aperture radius is made source by source.

During our weak lensing analysis we discovered systematic failures in the DR5 astrometric solution used in the THELI calibration of r-band images. These were identified from the measurement of two statistics

1. The difference between the centroids of all sources extracted from AstroWISE and THELI co-added images, matched within 2" and computed in 1'x1' bins on sky (max_dRADec_AW)

 The difference between the centroids of point-like high signal-to-noise objects extracted from individual THELI exposures, also matched within 2" and computed in 1'x1' bins on sky (max_dRADec_THELI)

Using the measurement of B-modes in the cosmic shear signal as a metric of systematic contamination from these astrometric errors, we empirically determined criteria to remove problematic regions in our images. The catalogues include ast_flag, which is set to 1 if the object is safe to use with max_dRADec_AW $\leq 0.06/3600$ and max_dRADec_THELI $\leq 0.2/3600$. This selection rejects 46.6 square degrees of data from the masked KiDS-DR5 footprint. If your analysis of the KiDS-DR5 10-band catalogue requires very accurate astrometry and photometry, we recommend either using ast_flag in your object selection, or optimising your own criteria using the centroid-differences that are provided. Healpix masks of the DR5 footprint that include the ast_flag effective selection mask are available from the KiDS website.

The 10-band catalogue contains a total of 138,812,117 unique sources, with accurate photometry measurements in all 10 bands for a subset of 100,197,893. The catalogue constitutes 1348 files (1347 data files and 1 metadata file), and has a total data volume of 212 GB. An additional 4041 THELI data products (totalling 4.1TB) are also provided (image, weight, 10-band mask).

Data Reduction, Calibration and Photometry

The KiDS-ESO data reduction and calibration pipeline is detailed in this series of papers

- The Astro-WISE optical pipeline: McFarland et al. (2013, ExA 35, 45)
- KiDS-ESO-DR1/2: <u>de Jong et al. 2015, A&A, 582, A62</u>
- KiDS-ESO-DR3: de Jong et al, 2017, A&A, 604, A134
- KiDS-VIKING: Wright et al, 2019, A&A, 632, A34
- KiDS-ESO-DR4: Kuijken et al. 2019, A&A, 625, A2
- KiDS-ESO-DR5: Wright et al 2024 (W24)

Section 3.5 of W24 documents the DR5-specific changes in the Astro-WISE reduction and calibration relative to DR4: an improved astrometric solution for 307 u-band co-adds, newly derived cross-talk coefficients for the later DR5 observations, calibration updates to account for the second i-band pass, improved r-band masks and the addition of careful manual masking for a handful of problematic fields. The DR5 data products supersede all previous KiDS releases.

For detailed information about the data reduction and calibration we refer the user to the publications listed above. This reference table is designed to help you quickly find the information you seek.

| Торіс | Location | | |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--|--|
| Survey area for different mask values | W24 Table 12 | | |
| 10-band area, magnitude limits, exposure times | W24 Table 1 | | |
| Image de-trending | de Jong et al 2015, Section 4.1 | | |
| DR5 Cross-talk coefficients | W24 Table 5 | | |
| Astrometry | W24 Sect 3.2.1, Figs 8-12 and Appendix C | | |
| Automated Masks | W24 Sect 3.5.3, Fig 16 <u>de Jong et al 2015</u> , Sect 4.4 | | |
| Manual Masks | W24 Sect 3.5.5, Fig 17 | | |
| VST Baffle configurations: pre May 2015 data can suffer from scattered light and reflections | <u>de Jong et al 2017</u> , Table 4 | | |
| SExtractor source extraction parameters | W24 Table 4 | | |
| GAaP photometry algorithm | W24 Sect 3.6 and <u>Kuijken et al</u> <u>2019</u> , Sect 3.1.1 | | |
| Optimal GAaP photometry (0p7 or 1p0 flux) | Kuijken et al 2019, Sect 5, equations 9&10 & W24 Sect 6.2 | | |
| Zero-point calibration: stellar locus regression with SDSS DR16 and Gaia eDR3. | W24 Sect 3.5.2, Fig 13,15 | | |
| 10-band Mask bit values for the different filters | W24 Table 11 | | |
| Single Band Source Catalogues | Kuijken et al 2019 Table A.3 | | |
| Single Band Star/Gal classification via the 2DPHOT flag | <u>de Jong et al 2015</u> , Sect 4.5.1 | | |
| NIR Photometry comparison to 2MASS | Wright et al 2019, Figure 4 | | |
| Data Quality as a function of ra/dec | W24 Appendix B&E | | |
| Photometric Redshift estimation and quality | W24 Sect 6.3, Figure 25 & 26 | | |
| Stellar Mass estimation | Wright et al 2019, Sect 4.3 | | |

DR5 fits files and format

The naming convention used for all new data products is the following:

KiDS_DR5.0_R.R_D.D_F_TTT.fits,

where R.R and D.D are the RA and DEC of the tile centre in degrees (J2000.0) with 1 decimal place, F is the filter (u, g, r, i1, i2 for single-band data files, "ugri1i2ZYJHKs" for multi-band catalogue files), and TTT is the data product type (see column 4 of the Table below). For example: the u-band stacked image of the tile "KiDS_44.4_-29.2" is called KiDS_DR5.0_44.4_-29.2_u_sci.fits.

| Data product | ESO product category name | File type | ттт | F |
|--------------------------------|------------------------------|----------------------|---------|--------------------|
| Calibrated, stacked images | SCIENCE.IMAGE | FITS image | sci | u,g,r,i1,i2 |
| Weight frames | ANCILLARY.WEIGHTMAP | FITS image | wei | u,g,r,i1,i2 |
| Masks | ANCILLARY.MASK | FITS image | msk | u,g,r,i1,i2 |
| Single-band source lists | SCIENCE.SRCTBL | Binary FITS table | src | u,g,r,i1,i2 |
| Multi-band catalogue data file | SCIENCE.MCATALOG | Binary FITS table | cat | ugri1,i2Z YJHKs |
| THELI detection image | ANCILLARY.IMAGE | FITS image | det_sci | r |
| THELI weight image | ANCILLARY.IMAGE | FITS image | det_wei | r |
| Multi-band mask image | ANCILLARY.MASK | FITS image | msk | ugri1,i2Z YJHKs |

Format of coadded images

The final calibrated, coadded images from the Astro-WISE pipeline have a uniform pixel scale of 0.2 arcsec. The pixel units are fluxes relative to the flux corresponding to magnitude = 0, as based on nightly photometric calibrations. This means that the effective zero-point is equal to 0 and the magnitude m corresponding to a pixel value f is:

$$m = -2.5 \log_{10} f.$$

Subsequent photometric zeropoint corrections were derived from the catalogues and recorded in the image headers using the DMAG keyword, with the CALSTARS keyword recording the number of Gaia stars that were used in the calibration. For DR5, we calculate calibration values relative to both the i_1 and the new i_2 epoch image. We also use two photometric apertures, setting the GAaP MINAPER parameter to both 0.7 and 1.0 (see Appendix A.1.1 of Kuijken et al

<u>2019</u> for details). This results in the following set of keywords reported in the image and source list headers:

- DMAG_07_i1
- DMAG_10_i1
- DMAG_07_i2
- DMAG_10_i2
- CALSTARS_07_i1
- CALSTARS_10_i1
- CALSTARS_07_i2
- CALSTARS_10_i2

along with:

- DMAG
- CALSTARS

which are the "best" values to use (depending on the PSF size, so either 0.7 or 1.0 aperture as recorded with the CALMINAO keyword), and taking the average of i1 and i2.

The r-band detection images, which result from a reduction using THELI, specifically designed for optimal image shape measurement and small astrometric reductions, are the basis of the multi-band catalogue. They have a pixel scale that is closer to the native OmegaCAM pixel size of 0.213".

Catalogue Columns

For a description and catalogue column list we refer the reader to:

- Single-band source lists: Table A.3 of Kuijken et al 2019
- Multi-band catalogue: Table I.1 of $\underline{W24}$ which we also repeat below for completeness.

Each detected source has been assigned an ID of the form e.g *KiDSDR5 J112250.874-005830.69* where the number encodes the RA and Dec as: J{ra_hour:2}{ra_min:2}{ra_sec:2.3}{dec_sign}{dec_degree:2}{dec_min:2}{dec_sec:2.2}. The example ID *KiDSDR5 J112250.874-005830.69* is at RA 11h 22m 50.874s and Dec -00 58m 30.69s

With improvements in our astrometric solution for both KiDS-DR4 and KiDS-DR5, a source that is detected in each data release, will have a slightly different ID.

- Sources detected in the first three data releases use the source identifier KiDS.
- Sources detected in the fourth data release use the source identifier KiDSDR4.
- Sources detected in the fifth data release use the source identifier KiDSDR5.

We recommend catalogue users update their KiDS data to use only sources with the KiDSDR5 identifier as this supersedes all previous releases.

| Label | Unit | Format | Description |
|---------------------------------------------|--------------------------|------------|----------------------------------------------------------|
| Identifiers per source and Pointing on-sky: | | | |
| ID | | 30A | ESO ID |
| KIDS_TILE | | 16A | Name of the pointing in Astro-WISE convention |
| THELI_NAME | | 16A | Name of the pointing in THELI convention |
| SeqNr | | 1J | Running object number within the catalogue |
| SLID | | 1J | Astro-WISE Source list ID |
| SID | | 1J | Astro-WISE Source ID within the source list |
| F | Parameters de | rived fror | n the THELI r-band detection image: |
| FLUX_AUTO | Jy | 1E | r-band flux |
| FLUXERR_AUTO | Jy | 1E | Error on FLUX_AUTO |
| MAG_AUTO | mag | 1E | r-band magnitude |
| MAGERR_AUTO | mag | 1E | Error on MAG_AUTO |
| KRON_RADIUS | pixel | 1E | Scaling radius of the ellipse for magnitude measurements |
| BackGr | Jy | 1E | Background counts at centroid position |
| Level | Jy | 1E | Detection threshold above background |
| MU THRESHOLD | mag.arcsec ⁻² | 1E | Detection threshold above background |
| MaxVal | Jy | 1E | Peak flux above background |
| | | 45 | |
| | mag.arcsec ⁻ | 1E 4E | Peak surface brightness above background |
| ISOAREA_WORLD | deg ² | 1E | Isophotal area above analysis threshold |
| Xpos | pixei | 1E | |
| Ypos | pixel | 1E | Centroid y position in the THELI image |
| RAJ2000 | deg | 1D | Centroid sky position right ascension (J2000) |
| DECJ2000 | deg | 1D | Centroid sky position declination (J2000) |
| A_WORLD | deg | 1E | Profile RMS along major axis |
| B_WORLD | deg | 1E | Profile RMS along minor axis |
| THETA_J2000 | deg | 1E | Position angle (West of North) |
| THETA_WORLD | deg | 1E | Position angle (Counterclockwise from world x-axis |
| ERRA_WORLD | deg | 1E | World RMS position error along major axis |
| ERRB_WORLD | deg | 1E | World RMS position error along minor axis |
| ERRTHETA_J2000 | deg | 1E | Error on THETA_J2000 |
| ERRTHETA_WORLD | deg | 1E | Error on THETA_WORLD |
| FWHM_IMAGE | pixel | 1E | FWHM assuming a Gaussian object profile |
| FWHM_WORLD | deg | 1E | FWHM assuming a Gaussian object profile |
| Flag | | 11 | SExtractor extraction flags |
| FLUX_RADIUS | pixel | 1E | Half-light radius |
| CLASS_STAR | | 1E | Star-galaxy classifier |
| MAG_ISO | mag | 1E | r-band isophotal Magnitude |
| MAGERR_ISO | mag | 1E | Error on MAG_ISO |
| FLUX_ISO | Jy | 1E | r-band isophotal Flux |
| FLUXERR_ISO | Jy | 1E | Error on FLUX_ISO |
| MAG_ISOCOR | mag | 1E | r-band corrected Isophotal Magnitude |
| MAGERR_ISOCOR | mag | 1E | Error on MAG_ISOCOR |

| FLUX_ISOCOR | Jy | 1E | r-band corrected Isophotal Flux |
|--------------------------------------------------|--------------------|----|-----------------------------------------------------------|
| FLUXERR_ISOCOR | Jy | 1E | Error on FLUX_ISOCOR |
| NIMAFLAGS_ISO | | 11 | Number of flagged pixels over the isophotal profile |
| IMAFLAGS_ISO | | 11 | FLAG-image flags ORed over the isophotal profile |
| XMIN_IMAGE | pixel | 11 | Minimum x-coordinate among detected pixels |
| YMIN_IMAGE | pixel | 11 | Minimum y-coordinate among detected pixels |
| XMAX_IMAGE | pixel | 11 | Maximum x-coordinate among detected pixels |
| YMAX_IMAGE | pixel | 11 | Maximum y-coordinate among detected pixels |
| X_WORLD | deg | 1D | Barycentre position along world x axis |
| Y_WORLD | deg | 1D | Barycentre position along world y axis |
| X2_WORLD | deg ² | 1E | Variance of position along X_WORLD (alpha) |
| Y2_WORLD | deg ² | 1E | Variance of position along Y_WORLD (delta) |
| XY_WORLD | deg ² | 1E | Covariance of position X_WORLD,Y_WORLD |
| ERRX2_WORLD | deg ² | 1E | Error on X2_WORLD |
| ERRY2_WORLD | deg ² | 1E | Error on Y2_WORLD |
| ERRXY_WORLD | deg ² | 1E | Error on XY_WORLD |
| CXX_WORLD | deg ⁻² | 1E | SExtractor Cxx object ellipse parameter |
| CYY_WORLD | deg ⁻² | 1E | SExtractor Cyy object ellipse parameter |
| CXY_WORLD | deg ⁻² | 1E | SExtractor Cxy object ellipse parameter |
| ERRCXX_WORLD | deg ⁻² | 1E | Error on CXX_WORLD |
| ERRCYY_WORLD | deg ⁻² | 1E | Error on CYY_WORLD |
| ERRCXY_WORLD | deg ⁻² | 1E | Error on CXY_WORLD |
| A_IMAGE | pixel | 1D | Profile RMS along x-axis |
| B_IMAGE | pixel | 1D | Profile RMS along y-axis |
| ERRA_IMAGE | pixel | 1E | Error on A_IMAGE |
| ERRB_IMAGE | pixel | 1E | Error on B_IMAGE |
| S_ELLIPTICITY | | 1E | SExtractor ellipticity (1-B_IMAGE/A_IMAGE) |
| S_ELONGATION | | 1E | SExtractor elongation (A_IMAGE/B_IMAGE) |
| MAG_APER_4 | mag | 1E | r-band magnitude within a circular aperture of 4 pixels |
| MAGERR_APER_4 | mag | 1E | Error on MAG_APER_4 |
| FLUX_APER_4 | Jy | 1E | r-band flux within a circular aperture of 4 pixels |
| FLUXERR_APER_4 | Jy | 1E | Error on FLUX_APER_4 |
| Similarly for radii 6, 8, 10, 14, 20, 30, 40, 60 | | | |
| MAG_APER_100 | mag | 1E | r-band magnitude within a circular aperture of 100 pixels |
| MAGERR_APER_100 | mag | 1E | Error on MAG_APER_100 |
| FLUX_APER_100 | Jy | 1E | r-band flux within a circular aperture of 100 pixels |
| FLUXERR_APER_100 | Jy | 1E | Error on FLUX_APER_100 |
| ISO0 | pixel ² | 11 | Isophotal area at level 0 |
| ISO1 | pixel ² | 11 | Isophotal area at level 1 |
| ISO2 | pixel ² | 11 | Isophotal area at level 2 |
| ISO3 | pixel ² | 11 | Isophotal area at level 3 |
| ISO4 | pixel ² | 11 | Isophotal area at level 4 |
| ISO5 | pixel ² | 11 | Isophotal area at level 5 |
| ISO6 | pixel ² | 11 | Isophotal area at level 6 |

| ISO7 | pixel ² | 11 | Isophotal area at level 7 |
|--------------------------------------------------------------------|--------------------|---------------|---------------------------------------------------------------|
| ALPHA_J2000 | deg | 1D | SExtractor centroid right ascension (J2000) |
| DELTA_J2000 | deg | 1D | SExtractor centroid declination (J2000) |
| SG2DPHOT | | 11 | 2DPhot StarGalaxy classifier (1 for high confidence star) |
| НТМ | | 1J | Hierarchical Triangular Mesh (level 25) |
| FIELD_POS | | 11 | Reference number to field parameters |
| List-driven GAAP photo | metry on the A | AstroWIS | E co-added KiDS images and the pawprint VIKING images: |
| Agaper_0p7 | arcsec | 1E | Major axis of GAaP aperture MIN_APER 0.7 |
| Bgaper_0p7 | arcsec | 1E | Minor axis of GAaP aperture MIN_APER 0.7 |
| Agaper_1p0 | arcsec | 1E | Major axis of GAaP aperture MIN_APER 1.0 |
| Bgaper_1p0 | arcsec | 1E | Minor axis of GAaP aperture MIN_APER 1.0 |
| PAgaap | deg | 1E | Position angle of major axis of GAaP aperture (North of West) |
| and then for each band x | ∈ {u, g, r, i1, i2 | P, Z, Y, J, I | H, Ks} |
| FLUX_GAAP_0p7_x | Jy | 1E | GAaP flux in band x with MIN_APER =0.7 |
| FLUXERR_GAAP_0p7_x | Jy | 1E | Error on FLUX_GAAP_0p7_x |
| MAG_GAAP_0p7_x | mag | 1E | x-band GAaP magnitude with MIN_APER =0.7 |
| MAGERR_GAAP_0p7_x | mag | 1E | Error on MAG_GAAP_0p7_x |
| FLAG_GAAP_0p7_x | | 1J | GAaP Flag for x-band photometry with MIN_APER =0.7 |
| FLUX_GAAP_1p0_x | Jy | 1E | GAaP flux in band x with MIN_APER =1.0 |
| FLUXERR_GAAP_1p0_x | Jy | 1E | Error on FLUX_GAAP_1p0_x |
| MAG_GAAP_1p0_x | mag | 1E | x-band GAaP magnitude with MIN_APER =1.0 |
| MAGERR_GAAP_1p0_x | mag | 1E | Error on MAG_GAAP_1p0_x |
| FLAG_GAAP_1p0_x | | 1J | GAaP Flag for x-band photometry with MIN_APER =1.0 |
| Optimal-apertu | re GAaP 10-ba | and photo | ometry including interstellar extinction corrections |
| Agaper | arcsec | 1E | Major axis of GAaP aperture for optimal MIN_APER |
| Bgaper | arcsec | 1E | Minor axis of GAaP aperture for optimal MIN_APER |
| and then for each band $x \in \{u, g, r, i1, i2, Z, Y, J, H, Ks\}$ | | | |
| EXTINCTION_x | mag | 1E | Galactic extinction in band x |
| MAG_GAAP_x | mag | 1E | Corrected x-band GAaP magnitude with optimal MIN_APER |
| MAGERR_GAAP_x | mag | 1E | Error on MAG_GAAP_x |
| FLUX_GAAP_x | Jy | 1E | x-band GAaP flux with optimal MIN_APER |
| FLUXERR_GAAP_x | Jy | 1E | Error on FLUX_GAAP_x |
| FLAG_GAAP_x | | 11 | GAaP Flag for x-band photometry with optimal MIN_APER |
| MAG_LIM_x | mag | 1E | x-band limiting magnitude for optimal MIN_APER |
| 10-band photometric redshifts (BPZ) | | | |
| Z_B | | 1D | 10-band BPZ redshift estimate (posterior mode) |
| Z_B_MIN | | 1D | Lower bound of the 68% confidence interval of Z_B |
| Z_B_MAX | | 1D | Upper bound of the 68% confidence interval of Z_B |
| Т_В | | 1D | Spectral type corresponding to Z_B |
| ODDS | | 1D | Empirical ODDS of Z_B |
| Z_ML | | 1D | 10-band BPZ maximum likelihood redshift |
| T_ML | | 1D | Spectral type corresponding to Z_ML |
| CHI_SQUARED_BPZ | | 1D | chi squared value associated with Z_B |
| M_0 | mag | 1D | Reference magnitude for BPZ prior |

| BPZ_FILT | | 1J | filters with good photometry (BPZ) |
|--------------------------------------------------------------|-----|-----------|------------------------------------------------------|
| NBPZ_FILT | | 1J | number of filters with good photometry (BPZ) |
| BPZ_NONDETFILT | | 1J | filters with faint photometry (BPZ) |
| NBPZ_NONDETFILT | | 1J | number of filters with faint photometry (BPZ) |
| BPZ_FLAGFILT | | 1J | flagged filters (BPZ) |
| NBPZ_FLAGFILT | | 1J | number of flagged filters (BPZ) |
| SG_FLAG | | 1E | Star/Gal Classifier |
| MASK | | 1J | 10-band mask information |
| | | PSF | estimates (lensfit) |
| PSF_e1 | | 1E | mean ellipticity of PSF, component 1 |
| PSF_e2 | | 1E | mean ellipticity of PSF, component 2 |
| PSF_Strehl_ratio | | 1E | Pseudo-Strehl ratio of PSF |
| PSF_Q11 | | 1E | model PSF moment Q11 |
| PSF_Q22 | | 1E | model PSF moment Q22 |
| PSF_Q21 | | 1E | model PSF moment Q21 |
| | S | tellar Ma | ss estimates (LePhare) |
| for each band x ∈ {u, g, r, i1, i2, Z, Y, J, H, Ks} | | | |
| MAGABS_GAAP_x | | 1D | rest-frame x-band magnitude |
| KCOR_x | | 1D | x-band k-correction |
| LUM_GAAP_r_bestfit | | 1D | r-band luminosity |
| mstar_bestfit | | 1D | stellar mass |
| mstar_med | | 1D | posterior median stellar mass |
| mstar_lower | | 1D | posterior 16 th percentile stellar mass |
| mstar_upper | | 1D | posterior 84 th percentile stellar mass |
| sfr_bestfit | | 1D | star-formation rate |
| sfr_med | | 1D | posterior median star-formation rate |
| sfr_lower | | 1D | posterior 16 th percentile star-formation |
| sfr_upper | | 1D | posterior 84 th percentile star-formation |
| | | THELI A | strometry Error Flags |
| max_dRADec_AW | deg | 1D | Max separation between THELI and AW coadd |
| max_dRADec_THELI | deg | 1D | Max internal separation exposure centroid and stack |
| ast_flag | | 1B | Fiducial astrometric accuracy selection |
| Dereddened colours based on optimal-aperture GAaP photometry | | | |
| COLOUR_GAAP_u_g | mag | 1E | u-g colour index (dereddened) |
| COLOUR_GAAP_g_r | mag | 1E | g-r colour index (dereddened) |
| COLOUR_GAAP_r_i1 | mag | 1E | r-i_1 colour index (dereddened) |
| COLOUR_GAAP_r_i2 | mag | 1E | r-i_2 colour index (dereddened) |
| COLOUR_GAAP_i1_Z | mag | 1E | i_1-Z colour index (dereddened) |
| COLOUR_GAAP_i2_Z | mag | 1E | i_2-Z colour index (dereddened) |
| COLOUR_GAAP_Z_Y | mag | 1E | Z-Y colour index (dereddened) |
| COLOUR_GAAP_Y_J | mag | 1E | Y-J colour index (dereddened) |
| COLOUR_GAAP_J_H | mag | 1E | J-H colour index (dereddened) |
| COLOUR_GAAP_H_Ks | mag | 1E | H-K_s colour index (dereddened) |
| DIFF_GAAP_i1_i2 | mag | 1E | i_1-i_2 i-band magnitude difference |

Acknowledgements

Users of data from this release should cite "Wright et al. (2024, A&A, 686, 170)".

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