SpARCS $ugr(y)z$ data release

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Abstract

This documents described the reduction of CFHT multi-color ugriz data overlapping with SWIRE. Co-added images, weights, sum images and multi-color catalogs for ∼35 deg^2 are provided.

I. Survey description

SWIRE is the Spitzer Wide-area InfraRed Extragalactic Legacy Survey, covering ∼ 50 square degrees in all 7 infrared wavelength bands available on Spitzer (3.6, 4.5, 5.8, 8, 24, 70 and 160 μm). The survey is divided in six separate patches on the sky, as shown in Table 2.

SpARCS, the Spitzer Adaptation of the Red-sequence Cluster Survey is a follow-up survey of the SWIRE fields in the z' band, using MegaCam on the 3.6m Canada France Hawaii Telescope for the Northern fields and and MOSAICII (on the 4m Blanco telescope) at CTIO for the Southern Fields.

All available archival and proprietary data from the CFHT archive were reduced for the four Northern Fields, with the total area and available filters described in Table 1.

II. Data reduction

The downloaded data were already ELIXIR processed[1], i.e. the instrumental signature was removed: CCD bias, bad pixels, flat-fielding etc. Data reduction was mostly based on the THELI pipeline, described in detail in [1].

Photometric calibration

The final, absolute photometric calibration was based on SDSS DR10. The median magnitude of stellar objects was shifted by the amount required to match the same magnitudes of the same objects in SDSS DR10.

Catalog creation

SExtractor was run in dual image mode, with r-band data serving as the detection band (in average, the r-band was deepest). All images were convolved to the same seeing for each pointing. BPZ was then used to estimate photometric redshifts.

The provided catalogues are in the FITS LDAC format. For a comprehensive list of the keys present in the main table, "OBJECTS", check Appendix 1.

III. Data release

This data release represents 35 square degrees of CFHT data overlapping SpARCS northern fields. 6 more square degrees of overlapping data have been reduced by the CFHTLS Wide collaboration.

[1] CFHT proprietary data reduction pipeline

Website and files

The data release website address is: <http://www.astro.uni-bonn.de/~tudorica/webpages/SpARCS/>.

For each field a zommable/pannable color image is available on the left side of the page. Below each image (which can be changed by clicking on the corresponding link on the left), a few statistics are available in a small table: for each filter, the measured seeing, total exposure time, number of exposures used in coaddition and magnitude zeropoint are provided for a quick quality inspection.

On the left side of the page, there is a table that contains for all fields and filters the coaddition, weights and sum images (FITS format), the multicolor catalog containing the values for all parameters in the appendix (LDAC FITS format), the mask files (in DS9 format, both X,Y and RA,DEC), and finally a link to the systematics plots check-page (opens in new window).

At the bottom of the table, bash scripts for download of the whole dataset (based on wget) are also provided for convenience.

Check-plots explanation

For each field, a systematics plots page is available. In the order they are arranged on the pages:

- First row: geometric distortion for the filters g, r, u, z
- Second row: $5\sigma/1$" circular aperture depth maps for the same filters (g, r, u, z)
- Third row:
  - fgroups plot, showing the stars from an extrenal catalog, the instrument footprint and the matches between the standard star (SDSS DR7 or 2MASS) and the internal catalog
  - $gr - ug$ color-color plot of galaxies in the field, showing with red the selected u-dropouts
  - $rz - gr$ color-color plot of galaxies in the field, showing with red the selected g-dropouts
  - comparison between the SDSS DR10 spectroscopic redshifts and the BPZ photometric redshifts for galaxies in the field
- Fourth row:
  - g-dropouts numbercounts
  - u-dropouts numbercounts
  - r-band PSF ellipitcity before correction
  - r-band PSF residual ellipticity after correction
- Fifth row: difference between the SDSS DR10 and SExtractor measured magnitude for the stars common to both catalogs
- Sixth row: difference between the SDSS DR10 and SExtractor measured magnitude for the galaxies common to both catalogs
- Seventh row: stellar evolution models color-color predictions and measurements for stars in the field
- Eighth row: numbercounts of stars and galaxies in the field as a function of magnitude

References

[1] Erben, T., Schirmer, M., Dietrich, J. P., et al., *GaBoDS: The Garching-Bonn Deep Survey. IV. Methods for the image reduction of multi-chip cameras demonstrated on data from the ESO Wide-Field Imager*. Astronomische Nachrichten, 326, 432, 2005

Field name	Filters	Total area deg^2
XMM-LSS	$ugriz$	9
Lockmann	$ugrz$	15
ELAIS-N1	$ugrz$	12
ELAIS-N2	$ugrz$	5
Total		41

Table 1: *SpARCS reduced Northern fields*

Field name	RA HH:MM:SS	Dec DD:MM:SS	SWIRE 3.6 μm deg^2	SpARCS deg^2	Usable Area deg^2
ELAIS-S1	00:38:30	-44:00:00	7.1	8.3	6.5
XMM-LSS	02:21:20	-04:30:00	9.4	11.7	7.3
Chandra-DFS	03:32:00	-28:16:00	8.1	7.9	7.1
Lockmann	10:45:00	+58:00:00	11.6	12.9	9.7
ELAIS-N1	16:11:00	+55:00:00	9.8	10.3	4.3
ELAIS-N2	16:36:48	+41:01:45	4.4	4.3	3.4
Total			50.4	55.4	41.9

Table 2: *SWIRE and SpARCS fields*

IV. Appendix 1

List of keys present in the FITS LDAC tables:

Key name	**Key description**	**Key units**
FIELD_POS	Reference number to field parameters	
SeqNr	Running object number	
FLUX_ISO	Isophotal flux	count
FLUXERR_ISO	RMS error for isophotal flux	count
MAG_ISO	Isophotal magnitude	mag
MAGERR_ISO	RMS error for isophotal magnitude	mag
FLUX_ISOCOR	Corrected isophotal flux	count
FLUXERR_ISOCOR	RMS error for corrected isophotal flux	count
MAG_ISOCOR	Corrected isophotal magnitude	mag
MAGERR_ISOCOR	RMS error for corrected isophotal magnitude	mag
FLUX_APER	Flux vector within fixed circular aperture(s)	count
FLUXERR_APER	RMS error vector for aperture flux(es)	count
MAG_APER	Fixed aperture magnitude vector	mag
MAGERR_APER	RMS error vector for fixed aperture mag.	mag
FLUX_AUTO	Flux within a Kron-like elliptical aperture	count
FLUXERR_AUTO	RMS error for AUTO flux	count
MAG_AUTO	Kron-like elliptical aperture magnitude	mag
MAGERR_AUTO	RMS error for AUTO magnitude	mag
FLUX_BEST	Best of FLUX_AUTO and FLUX_ISOCOR	count
FLUXERR_BEST	RMS error for BEST flux	count
MAG_BEST	Best of MAG_AUTO and MAG_ISOCOR	mag
MAGERR_BEST	RMS error for MAG_BEST	mag
KRON_RADIUS	Kron apertures in units of A or B	
BackGr	Background at centroid position	count
Level	Detection threshold above background	count
MU_THRESHOLD	Detection threshold above background	mag * arcsec**(-2)
MaxVal	Peak flux above background	count
MU_MAX	Peak surface brightness above background	mag * arcsec**(-2)
NPIX	Isophotal area above Analysis threshold	pixel**2
ISOAREA_WORLD	Isophotal area above Analysis threshold	deg**2
XMIN_IMAGE	Minimum x-coordinate among detected pixels	pixel
YMIN_IMAGE	Minimum y-coordinate among detected pixels	pixel
XMAX_IMAGE	Maximum x-coordinate among detected pixels	pixel
YMAX_IMAGE	Maximum y-coordinate among detected pixels	pixel
Xpos	Object position along x	pixel
Ypos	Object position along y	pixel
X_WORLD	Barycenter position along world x axis	deg
Y_WORLD	Barycenter position along world y axis	deg
XPEAK_IMAGE	x-coordinate of the brightest pixel	pixel
YPEAK_IMAGE	y-coordinate of the brightest pixel	pixel
XPEAK_WORLD	World-x coordinate of the brightest pixel	deg
YPEAK_WORLD	World-y coordinate of the brightest pixel	deg
ALPHA_SKY	Right ascension of barycenter (native)	deg
DELTA_SKY	Declination of barycenter (native)	deg

ALPHA_J2000	Right ascension of barycenter (J2000)	deg
DELTA_J2000	Declination of barycenter (J2000)	deg
XM2	Variance along x	pixel**2
YM2	Variance along y	pixel**2
Corr	Covariance between x and y	pixel**2
X2_WORLD	Variance along X-WORLD (alpha)	deg**2
Y2_WORLD	Variance along Y-WORLD (delta)	deg**2
XY_WORLD	Covariance between X-WORLD and Y-WORLD	deg**2
CXX_IMAGE	Cxx object ellipse parameter	pixel**(-2)
CYY_IMAGE	Cyy object ellipse parameter	pixel**(-2)
CXY_IMAGE	Cxy object ellipse parameter	pixel**(-2)
CXX_WORLD	Cxx object ellipse parameter (WORLD units)	deg**(-2)
CYY_WORLD	Cyy object ellipse parameter (WORLD units)	deg**(-2)
CXY_WORLD	Cxy object ellipse parameter (WORLD units)	deg**(-2)
A	Profile RMS along major axis	pixel
B	Profile RMS along minor axis	pixel
A_WORLD	Profile RMS along major axis (world units)	deg
B_WORLD	Profile RMS along minor axis (world units)	deg
Theta	Position angle (CCW/x)	deg
THETA_WORLD	Position angle (CCW/world-x)	deg
THETA_SKY	Position angle (east of north) (native)	deg
THETA_J2000	Position angle (east of north) (J2000)	deg
ELONGATION	A_IMAGE/B_IMAGE	
ELLIPTICITY	1 - B_IMAGE/A_IMAGE	
ERRX2_IMAGE	Variance of position along x	pixel**2
ERRY2_IMAGE	Variance of position along y	pixel**2
ERRXY_IMAGE	Covariance of position between x and y	pixel**2
ERRX2_WORLD	Variance of position along X-WORLD (alpha)	deg**2
ERRY2_WORLD	Variance of position along Y-WORLD (delta)	deg**2
ERRXY_WORLD	Covariance of position X-WORLD/Y-WORLD	deg**2
ERRCXX_IMAGE	Cxx error ellipse parameter	pixel**(-2)
ERRCYY_IMAGE	Cyy error ellipse parameter	pixel**(-2)
ERRCXY_IMAGE	Cxy error ellipse parameter	pixel**(-2)
ERRCXX_WORLD	Cxx error ellipse parameter (WORLD units)	deg**(-2)
ERRCYY_WORLD	Cyy error ellipse parameter (WORLD units)	deg**(-2)
ERRCXY_WORLD	Cxy error ellipse parameter (WORLD units)	deg**(-2)
ERRA_IMAGE	RMS position error along major axis	pixel
ERRB_IMAGE	RMS position error along minor axis	pixel
ERRA_WORLD	World RMS position error along major axis	pixel
ERRB_WORLD	World RMS position error along minor axis	pixel
ERRTHETA_IMAGE	Error ellipse position angle (CCW/x)	deg
ERRTHETA_WORLD	Error ellipse pos. angle (CCW/world-x)	deg
ERRTHETA_SKY	Native error ellipse pos. angle (east of north)	deg
ERRTHETA_J2000	J2000 error ellipse pos. angle (east of north)	deg
FWHM_IMAGE	FWHM assuming a gaussian core	pixel
FWHM_WORLD	FWHM assuming a gaussian core	deg
ISO0	Isophotal area at level 0	pixel**2

ISO1	Isophotal area at level 1	pixel**2
ISO2	Isophotal area at level 2	pixel**2
ISO3	Isophotal area at level 3	pixel**2
ISO4	Isophotal area at level 4	pixel**2
ISO5	Isophotal area at level 5	pixel**2
ISO6	Isophotal area at level 6	pixel**2
ISO7	Isophotal area at level 7	pixel**2
Flag	Extraction flags	
FLUX_RADIUS	Fraction-of-light radii	pixel
IMAFLAGS_ISO	FLAG-image flags OR'ed over the iso. profile	
NIMAFLAGS_ISO	Number of flagged pixels entering IMAFLAGS_ISO	
CLASS_STAR	S/G classifier output	
EXTINCTION		mag
MAG_ISO_r	Isophotal magnitude	mag
MAG_ISOCOR_r	Corrected isophotal magnitude	mag
MAG_AUTO_r	Kron-like elliptical aperture magnitude	mag
MAG_APER_r	Fixed aperture magnitude vector	mag
MAGERR_ISO_r	RMS error for isophotal magnitude	mag
MAGERR_ISOCOR_r	RMS error for corrected isophotal magnitude	mag
MAGERR_AUTO_r	RMS error for AUTO magnitude	mag
MAGERR_APER_r	RMS error vector for fixed aperture mag.	mag
FLUX_ISO_r	Isophotal flux	count
FLUX_ISOCOR_r	Corrected isophotal flux	count
FLUX_AUTO_r	Flux within a Kron-like elliptical aperture	count
FLUX_APER_r	Flux vector within fixed circular aperture(s)	count
FLUXERR_ISO_r	RMS error for isophotal flux	count
FLUXERR_ISOCOR_r	RMS error for corrected isophotal flux	count
FLUXERR_AUTO_r	RMS error for AUTO flux	count
FLUXERR_APER_r	RMS error vector for aperture flux(es)	count
IMAFLAGS_ISO_r	FLAG-image flags OR'ed over the iso. profile	
MAG_LIM_r		
EXTINCTION_r		mag
MAG_ISO_u	Isophotal magnitude	mag
MAG_ISOCOR_u	Corrected isophotal magnitude	mag
MAG_AUTO_u	Kron-like elliptical aperture magnitude	mag
MAG_APER_u	Fixed aperture magnitude vector	mag
MAGERR_ISO_u	RMS error for isophotal magnitude	mag
MAGERR_ISOCOR_u	RMS error for corrected isophotal magnitude	mag
MAGERR_AUTO_u	RMS error for AUTO magnitude	mag
MAGERR_APER_u	RMS error vector for fixed aperture mag.	mag
FLUX_ISO_u	Isophotal flux	count
FLUX_ISOCOR_u	Corrected isophotal flux	count
FLUX_AUTO_u	Flux within a Kron-like elliptical aperture	count
FLUX_APER_u	Flux vector within fixed circular aperture(s)	count
FLUXERR_ISO_u	RMS error for isophotal flux	count
FLUXERR_ISOCOR_u	RMS error for corrected isophotal flux	count
FLUXERR_AUTO_u	RMS error for AUTO flux	count

FLUXERR_APER_u	RMS error vector for aperture flux(es)	count
IMAFLAGS_ISO_u	FLAG-image flags OR'ed over the iso. profile	
MAG_LIM_u		
EXTINCTION_u		mag
MAG_ISO_g	Isophotal magnitude	mag
MAG_ISOCOR_g	Corrected isophotal magnitude	mag
MAG_AUTO_g	Kron-like elliptical aperture magnitude	mag
MAG_APER_g	Fixed aperture magnitude vector	mag
MAGERR_ISO_g	RMS error for isophotal magnitude	mag
MAGERR_ISOCOR_g	RMS error for corrected isophotal magnitude	mag
MAGERR_AUTO_g	RMS error for AUTO magnitude	mag
MAGERR_APER_g	RMS error vector for fixed aperture mag.	mag
FLUX_ISO_g	Isophotal flux	count
FLUX_ISOCOR_g	Corrected isophotal flux	count
FLUX_AUTO_g	Flux within a Kron-like elliptical aperture	count
FLUX_APER_g	Flux vector within fixed circular aperture(s)	count
FLUXERR_ISO_g	RMS error for isophotal flux	count
FLUXERR_ISOCOR_g	RMS error for corrected isophotal flux	count
FLUXERR_AUTO_g	RMS error for AUTO flux	count
FLUXERR_APER_g	RMS error vector for aperture flux(es)	count
IMAFLAGS_ISO_g	FLAG-image flags OR'ed over the iso. profile	
MAG_LIM_g		
EXTINCTION_g		mag
MAG_ISO_z	Isophotal magnitude	mag
MAG_ISOCOR_z	Corrected isophotal magnitude	mag
MAG_AUTO_z	Kron-like elliptical aperture magnitude	mag
MAG_APER_z	Fixed aperture magnitude vector	mag
MAGERR_ISO_z	RMS error for isophotal magnitude	mag
MAGERR_ISOCOR_z	RMS error for corrected isophotal magnitude	mag
MAGERR_AUTO_z	RMS error for AUTO magnitude	mag
MAGERR_APER_z	RMS error vector for fixed aperture mag.	mag
FLUX_ISO_z	Isophotal flux	count
FLUX_ISOCOR_z	Corrected isophotal flux	count
FLUX_AUTO_z	Flux within a Kron-like elliptical aperture	count
FLUX_APER_z	Flux vector within fixed circular aperture(s)	count
FLUXERR_ISO_z	RMS error for isophotal flux	count
FLUXERR_ISOCOR_z	RMS error for corrected isophotal flux	count
FLUXERR_AUTO_z	RMS error for AUTO flux	count
FLUXERR_APER_z	RMS error vector for aperture flux(es)	count
IMAFLAGS_ISO_z	FLAG-image flags OR'ed over the iso. profile	
MAG_LIM_z		
EXTINCTION_z		mag
MASK	mask value (addmask)	
Z_B		
Z_B_MIN		
Z_B_MAX		
T_B		

ODDS		
Z_ML		
T_ML		
CHI_SQUARED_BPZ		
M_0		
MAGABS_u		
MAGABS_g		
MAGABS_r		
MAGABS_i		
MAGABS_y		
MAGABS_z		
MAGABS_u_SDSS		
MAGABS_g_SDSS		
MAGABS_r_SDSS		
MAGABS_i_SDSS		
MAGABS_z_SDSS		
MAGABS_U		
MAGABS_B		
MAGABS_V		
MAGABS_R		
MAGABS_I		
log_m_star		
BPZ_FILT	filters with good photometry (BPZ)	
NBPZ_FILT	number of filters with good phot. (BPZ)	
BPZ_NONDETFILT	filters with faint photometry (BPZ)	
NBPZ_NONDETFILT	number of filters with faint phot. (BPZ)	
BPZ_FLAGFILT	flagged filters (BPZ)	
NBPZ_FLAGFILT	number of flagged filters (BPZ)	