J/A+A/639/A136 The Fornax Deep Survey with the VST. IX. (Cantiello+, 2020)

The Fornax Deep Survey with the VST. IX. The catalog of sources in the FDS area, with an example study for globular clusters and background galaxies.

Cantiello M., Venhola A., Grado A., Paolillo M., D'Abrusco R., Raimondo G., Quintini M., Hilker M., Mieske S., Tortora C., Spavone M., Capaccioli M., Iodice E., Peletier R., Barroso J.F., Limatola L., Napolitano N., Schipani P., van de Ven G., Gentile F., Covone G.

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=2020A&A...639A.136C (SIMBAD/NED BibCode)

ADC_Keywords: Clusters, galaxy ; Galaxies, photometry ; Photometry, SDSS ; Morphology ; Clusters, globular

Keywords: galaxies: elliptical and lenticular, cD - galaxies: star clusters: general - galaxies: individual: NGC 1316, NGC 1399 - galaxies: clusters: individual: Fornax - galaxies: evolution - galaxies: stellar content

Abstract:

A possible pathway for understanding the events and the mechanisms involved in galaxy formation and evolution is an in-depth comprehension of the galactic and inter-galactic fossil sub-structures with long dynamical times-scales: stars in the field and in stellar clusters.

This paper continues the series of the Fornax Deep Survey (FDS). Following the previous studies dedicated to extended Fornax cluster members, in this paper we present the catalogs of compact stellar systems in the Fornax cluster as well as extended background sources and point-like sources.

We derive ugri photometry of ~1.7 million sources over the ~21 square degree area of FDS centered on the bright central galaxy NGC1399. For a wider area, of ~27 square degrees extending in the direction of NGC1316, we provide gri photometry for ~3.1 million sources. To improve the morphological characterization of sources we generate multi-band image stacks by coadding the best seeing gri-band single exposures with a cut at FWHM≤0.9". We use the multi-band stacks as master detection frames, with a FWHM improved by ~15% and a FWHM variability from field to field reduced by a factor of ~2.5 compared to the pass-band with best FWHM, namely the r-band. The identification of compact sources, in particular of globular clusters (GC), is obtained from a combination of photometric (e.g. colors, magnitudes) and morphometric (e.g. concentration index, elongation, effective radius) selection criteria, by also taking as reference the properties of sources with well-defined classification from spectroscopic or high-resolution imaging data.

Using the FDS catalogs, we present a preliminary analysis of globular cluster (GC) distributions in the Fornax area. The study confirms and extends further previous results which were limited to a smaller survey area. We observe the inter-galactic population of GCs, a population of mainly blue GCs centered on NGC1399, extends over ~0.9Mpc, with an ellipticity ~0.65 and a small tilt in the direction of NGC1336. Several sub-structures extend over ~0.5Mpc along various directions. Two of these structures do not cross any bright galaxy; one of them appears to be connected to NGC1404, a bright galaxy close to the cluster core and particularly poor of GCs. Using the gri catalogs we analyze the GC distribution over the extended FDS area, and do not find any obvious GC sub-structure bridging the two brightest cluster galaxies, NGC1316 and NGC1399. Although NGC1316 is more than twice brighter of NGC1399 in optical bands, using gri data, we estimate a factor of ~3-4 richer GC population around NGC1399 compared to NGC1316, out to galactocentric distances of ~40' or ~230kpc

Description:

We derive ugri photometry of ~1.7 million sources over the ~21 square degree area of the Fornax Deep Survey (FDS) centered on the bright galaxy NGC1399 (fds.dat). For a wider area, of ~27 square degrees extending in the direction of NGC1316, we provide gri photometry for ~3.1 million sources (fdsex.dat). The identification of compact sources, globular clusters (GC) and ultra compact dwarf galaxies (UCD), is obtained from a combination of photometric and morphometric selection criteria taking as reference the properties of confirmed GCs and UCDs in the literature. The master tables of GC and UCD are also provided.

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
fds.dat	524	1682503	Sources position, ugri photometry and morphometry for ~1.7 million sources in ~21 sq. degree area of FDS
fdsex.dat	424	3112605	Sources position, gri photometry and morphometry for ~3.1 million sources in ~27 sq. degree area of FDSex
mastergc.dat	167	3263	*Reference GCs catalog
masteruc.dat	158	68	*Reference UCDs catalog

Note on mastergc.dat: with positions, ugri photometry, morphometry of the collection of GC with well-defined classification from spectroscopic or high-resolution imaging data.
Note on masteruc.dat: with positions, ugri photometry, morphometry of the collection of UCDs with well-defined classification from spectroscopic data.

See also:
J/A+A/608/A142 : FDS with VST. III. LSB galaxies (Venhola+, 2017)
J/A+A/620/A165 : FDS with VST. IV. dwarf galaxies (Venhola+, 2018)
J/A+A/623/A1 : FDS with VST. V. Isophote fit (Iodice+, 2019)

Byte-by-byte Description of file: fds.dat

Bytes	Format	Units	Label	Explanations
1- 23	A23	---	ID	Source identification based on the IAU naming rules, FDSJHHMMSS.ss+DDMMSS.ss
25- 33	F9.6	deg	RAdeg	Right ascension (J2000.0)
35- 44	F10.6	deg	DEdeg	Declination (J2000.0)
46- 51	F6.3	mag	umag	u-band PSF corrected magnitude
53- 57	F5.3	mag	e_umag	Error on u-band PSF corrected magnitude
59- 64	F6.3	mag	gmag	g-band PSF corrected magnitude
66- 70	F5.3	mag	e_gmag	Error on g-band PSF corrected magnitude
72- 77	F6.3	mag	rmag	r-band PSF corrected magnitude
79- 83	F5.3	mag	e_rmag	Error on r-band PSF corrected magnitude
85- 90	F6.3	mag	imag	i-band PSF corrected magnitude
92- 96	F5.3	mag	e_imag	Error on i-band PSF corrected magnitude
98-102	F5.3	---	CS	SExtractor CLASS_STAR from the multi-band 'a'-stacks
104-109	F6.3	---	CIn	Normalized concentration index from 'a'-stacks
111-116	E6.2	arcsec	FR	SExtractor Flux radius from the multi-band 'a'-stacks
118-123	F6.2	arcsec	FWHM	Source FWHM from the multi-band 'a'-stacks
125-131	E7.5	deg	Aw	SExtractor Profile RMS along major axis from 'a'-stacks
133-139	E7.5	deg	Bw	SExtractor Profile RMS along minor axis from 'a'-stacks
141-145	F5.2	---	Elo	Elongation, major-to-minor axis ratio from 'a'-stacks
147-148	I2	---	Flags	Flags, based on SExtractor flags coding rules
150-156	F7.3	---	Sharp	DAOphot sharpness parameter from the 'a'-stacks
158-171	E14.10	---	CSu	?=-99 [0/1] u-band SExtractor CLASS_STAR
173-177	F5.3	---	CIun	?=-99 u-band normalized concentration index
179-185	F7.3	---	Sharpu	?=-99 u-band DAOphot sharpness parameter

187-200	E14.10	mag	umagex8	?=-99 u-band aperture magnitude within 8 pixels
202-215	E14.10	mag	e_umagex8	?=-99 Error on u-band aperture magnitude within 8 pixels
217-230	E14.10	mag	umagauto	?=-99 SExtractor automated u-band aperture magnitude MAG_AUTO and
232-245	E14.10	mag	e_umagauto	?=-99 Error on automated u-band aperture magnitude MAG_AUTO
247-260	E14.10	---	CSg	[0/1]?=-99 g-band SExtractor CLASS_STAR
262-267	F6.3	---	CIgn	g-band Normalized concentration index
269-275	F7.3	---	Sharpg	g-band DAOphot sharpness parameter
277-290	E14.10	mag	gmagex8	?=-99 g-band Aperture magnitude within 8 pixels
292-305	E14.10	mag	e_gmagex8	?=-99 Error on g-band Aperture magnitude within 8 pixels
307-320	E14.10	mag	gmagauto	?=-99 SExtractor g-band automated aperture magnitude MAG_AUTO
322-335	E14.10	mag	e_gmagauto	?=-99 Error on g-band automated aperture magnitude MAG_AUTO
337-350	E14.10	---	CSr	[0/1]?=-99 r-band SExtractor CLASS_STAR
352-357	F6.3	---	CIrn	r-band Normalized concentration index
359-365	F7.3	---	Sharpr	r-band DAOphot sharpness parameter
367-380	E14.10	mag	rmagex8	?=-99 r-band Aperture magnitude within 8 pixels
382-395	E14.10	mag	e_rmagex8	?=-99 Error on r-band Aperture magnitude within 8 pixels
397-410	E14.10	mag	rmagauto	?=-99 SExtractor automated r-band aperture magnitude MAG_AUTO
412-425	E14.10	mag	e_rmagauto	?=-99 Error on automated aperture r-band magnitude MAG_AUTO
427-440	E14.10	---	CSi	[0/1]?=-99 i-band SExtractor CLASS_STAR
442-447	F6.3	---	CIin	i-band Normalized concentration index
449-455	F7.3	---	Sharpi	i-band DAOphot sharpness parameter
457-470	E14.10	mag	imagex8	?=-99 Aperture i-band magnitude within 8 pixels
472-485	E14.10	mag	e_imagex8	?=-99 Error on Aperture i-band magnitude within 8 pixels
487-500	E14.10	mag	imagauto	?=-99 SExtractor automated aperture i-band magnitude MAG_AUTO
502-515	E14.10	mag	e_imagauto	?=-99 Error on automated aperture i-band magnitude MAG_AUTO
517-521	F5.3	mag	E(B-V)	Reddening from Schlafly & Finkbeiner (2011ApJ...737..103S)
523-524	I2	---	Field	[1/31] FDS field pointing ID

Byte-by-byte Description of file: fdsex.dat

Bytes	Format	Units	Label	Explanations
1- 23	A23	---	ID	Source identification based on the IAU naming rules, FDSJHHMMSS.ss+DDMMSS.ss
25- 33	F9.6	deg	RAdeg	Right ascension (J2000.0)
35- 44	F10.6	deg	DEdeg	Declination (J2000.0)
46- 51	F6.3	mag	gmag	g-band PSF corrected magnitude
53- 57	F5.3	mag	e_gmag	Error on g-band PSF corrected magnitude
59- 64	F6.3	mag	rmag	r-band PSF corrected magnitude
66- 70	F5.3	mag	e_rmag	Error on r-band PSF corrected magnitude
72- 77	F6.3	mag	imag	i-band PSF corrected magnitude
79- 83	F5.3	mag	e_imag	Error on i-band PSF corrected magnitude
85- 89	F5.3	---	CS	SExtractor CLASS_STAR from the multi-band 'a'-stacks
91- 98	F8.3	---	CIn	Normalized concentration index from 'a'-stacks
100-105	E6.2	arcsec	FR	SExtractor Flux radius from the multi-band 'a'-stacks
107-112	E6.2	arcsec	FWHM	Source FWHM from the multi-band 'a'-stacks
114-120	E7.3	deg	Aw	SExtractor Profile RMS along major axis from 'a'-stacks
122-128	E7.3	deg	Bw	SExtractor Profile RMS along minor axis from 'a'-stacks
130-134	F5.2	---	Elo	Elongation, major-to-minor axis ratio from 'a'-stacks
136-137	I2	---	Flags	Flags, based on SExtractor flags coding rules
139-145	F7.3	---	Sharp	DAOphot sharpness parameter from the 'a'-stacks
147-160	E14.10	---	CSg	?=-99 g-band SExtractor CLASS_STAR
162-167	F6.3	---	CIgn	g-band Normalized concentration index
169-175	F7.3	---	Sharpg	g-band DAOphot sharpness parameter
177-190	E14.10	mag	gmagex8	?=-99 g-band Aperture magnitude within 8 pixels
192-205	E14.10	mag	e_gmagex8	?=-99 Error on g-band Aperture magnitude within 8 pixels
207-220	E14.10	mag	gmagauto	?=-99 g-band SExtractor automated aperture magnitude MAG_AUTO
222-235	E14.10	mag	e_gmagauto	?=-99 g-band Error on automated aperture magnitude MAG_AUTO
237-250	E14.10	---	CSr	?=-99 r-band SExtractor CLASS_STAR
252-257	F6.3	---	CIgr	r-band Normalized concentration index
259-265	F7.3	---	Sharpr	r-band DAOphot sharpness parameter
267-280	E14.10	mag	rmagex8	?=-99 r-band Aperture magnitude within 8 pixels
282-295	E14.10	mag	e_rmagex8	?=-99 Error on r-band Aperture magnitude within 8 pixels
297-310	E14.10	mag	rmagauto	?=-99 r-band SExtractor automated aperture magnitude MAG_AUTO
312-325	E14.10	mag	e_rmagauto	?=-99 r-band Error on automated aperture magnitude MAG_AUTO
327-340	E14.10	---	CSi	?=-99 i-band SExtractor CLASS_STAR
342-347	F6.3	---	CIin	i-band Normalized concentration index
349-355	F7.3	---	Sharpi	i-band DAOphot sharpness parameter
357-370	E14.10	mag	imagex8	?=-99 i-band Aperture magnitude within 8 pixels
372-385	E14.10	mag	e_imagex8	?=-99 Error on i-band Aperture magnitude within 8 pixels
387-400	E14.10	mag	imagauto	?=-99 i-band SExtractor automated aperture magnitude MAG_AUTO
402-415	E14.10	mag	e_imagauto	?=-99 i-band Error on automated aperture magnitude MAG_AUTO
417-421	F5.3	mag	E(B-V)	Reddening from Schlafly & Finkbeiner (2011ApJ...737..103S)
423-424	I2	---	Field	[1/31] FDS field pointing ID

Byte-by-byte Description of file: mastergc.dat

Bytes	Format	Units	Label	Explanations
1- 23	A23	---	ID	Source identification based on the IAU naming rules, FDSJHHMMSS.ss+DDMMSS.ss
25- 33	F9.6	deg	RAdeg	Right ascension (J2000.0)
35- 44	F10.6	deg	DEdeg	Declination (J2000.0)
46- 51	F6.3	mag	umag	u-band PSF corrected magnitude
53- 57	F5.3	mag	e_umag	error on u-band PSF corrected magnitude
59- 64	F6.3	mag	gmag	g-band PSF corrected magnitude
66- 70	F5.3	mag	e_gmag	error on g-band PSF corrected magnitude
72- 77	F6.3	mag	rmag	r-band PSF corrected magnitude
79- 83	F5.3	mag	e_rmag	error on r-band PSF corrected magnitude
85- 90	F6.3	mag	imag	i-band PSF corrected magnitude
92- 96	F5.3	mag	e_imag	error on i-band PSF corrected magnitude
98-102	F5.3	---	CS	SExtractor CLASS_STAR from the multi-band 'a'-stacks
104-109	F6.3	---	CIn	Normalized concentration index from 'a'-stacks
111-117	F7.2	arcsec	FR	SExtractor Flux radius from the multi-band 'a'-stacks
119-123	F5.2	arcsec	FWHM	Source FWHM from the multi-band 'a'-stacks
125-128	F4.2	---	Elo	Elongation, major-to-minor axis ratio - from 'a'-stacks
130-135	F6.3	---	Sharp	DAOphot sharpness parameter from the 'a'-stacks
137-141	F5.3	mag	E(B-V)	Reddening from Schlafly & Finkbeiner (2011ApJ...737..103S)
143-144	I2	---	Field	FDS field pointing ID
146-148	I3	---	FCC	[47/335]? Fornax cluster catalog ID of the host galaxy
150-153	F4.2	---	pGC	[0/1]? pGC likelihood from Jordan et al. (2015ApJS..221...13J, Cat. J/ApJS/221/13)
155-159	F5.3	arcsec	rh2	? Mean g and z GC half light radius
161-163	A3	---	Phot	[Yes/No] GC identified from ACSFCS imaging data
165-167	A3	---	Spect	[Yes/No] GC identified through spectroscopic data

Byte-by-byte Description of file: masteruc.dat

Bytes	Format	Units	Label	Explanations
1- 23	A23	---	ID	Source identification based on the IAU naming rules, FDSJHHMMSS.ss+DDMMSS.ss
25- 33	F9.6	deg	RAdeg	Right ascension (J2000.0)
35- 44	F10.6	deg	DEdeg	Declination (J2000.0)
46- 51	F6.3	mag	umag	u-band PSF corrected magnitude
53- 57	F5.3	mag	e_umag	error on u-band PSF corrected magnitude
59- 64	F6.3	mag	gmag	g-band PSF corrected magnitude
66- 70	F5.3	mag	e_gmag	error on g-band PSF corrected magnitude
72- 77	F6.3	mag	rmag	r-band PSF corrected magnitude
79- 83	F5.3	mag	e_rmag	error on r-band PSF corrected magnitude
85- 90	F6.3	mag	imag	i-band PSF corrected magnitude
92- 96	F5.3	mag	e_imag	error on i-band PSF corrected magnitude
98-102	F5.3	---	CS	SExtractor CLASS_STAR from the multi-band 'a'-stacks
104-108	F5.3	---	CIn	Normalized concentration index from 'a'-stacks
110-113	F4.2	arcsec	FR	SExtractor Flux radius from the multi-band 'a'-stacks
115-118	F4.2	arcsec	FWHM	Source FWHM from the multi-band 'a'-stacks
120-123	F4.2	---	Elo	Elongation, major-to-minor axis ratio from 'a'-stacks
125-130	F6.3	---	Sharp	DAOphot sharpness parameter from the 'a'-stacks
132-136	F5.3	mag	E(B-V)	Reddening from Schlafly & Finkbeiner (2011ApJ...737..103S)
138-139	I2	---	Field	[6/16] FDS field pointing ID
141-147	F7.2	km/s	HV	Heliocentric velocity from the literature
149-154	F6.2	km/s	e_HV	Error on heliocentric velocity
156-158	A3	---	r_HV	Reference for the heliocentric velocity (1)

Note (1): References as follows:
K99: Kissler-Patig et al. (1999AJ....117.1206K)
M04: Mieske et al. (2004A&A...418..445M, Cat. J/A+A/418/445)
F07: Firth et al. (2007MNRAS.382.1342F, Cat. J/MNRAS/382/1342)
B07: Bergond et al. (2007A&A...464L..21B, Cat. J/A+A/464/L21)
M08: Mieske et al. (2008A&A...487..921M)
G09: Gregg et al. (2009AJ....137..498G, Cat. J/AJ/137/498)
S10: Schuberth et al. (2010A&A...513A..52S, Cat. J/A+A/513/A52)
P18: Pota et al. (2018MNRAS.481.1744P)

Acknowledgements:
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References:
Iodice et al., Paper I 2016ApJ...820...42I
Iodice et al., Paper II 2017ApJ...839...21I
Venhola et al., Paper III 2017A&A...608A.142V, Cat. J/A+A/608/A142
Venhola et al., Paper IV 2018A&A...620A.165V, Cat. J/A+A/620/A165
Iodice et al., Paper V 2019A&A...623A...1I, Cat. J/A+A/623/A1
Venhola et al., Paper VI 2019A&A...625A.143V
Raj et al., Paper VII 2019A&A...628A...4R
Spavone et al., Paper VIII 2019A&A...639A..14S

(End) Patricia Vannier [CDS] 25-May-2020

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