Photometric Catalogs of Abell Cluster galaxies

A754, A2399, 2670, A3558, A3574, A3659, and A3716 in *u*, *g*, and *r*

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Proposals



Dark Energy Camera in Chile

- 4m Blanco telescope at CTIO
- ~3 deg² FoV
- 62 x (4k x 2k CCD)
- ugrizYVRN964
- f/2.7



http://www.fnal.gov/pub/today/images12/CTIO-aerial-mr.jpg



Observation in 2013 and 2014 at CTIO (PI: Dr. Sheen)

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 Table 1. CTIO DECam Observations Summary

Cluster ID	$R.A.^a$	$\mathrm{Decl.}^{a}$	$\operatorname{Redshift}^{a}$	Filter t_{exp}^{b}		Date^{b}		
	(J2000)	(J2000)			(s)			
A754	09:09:08.4	-09:39:58	0.05420	$u\prime$	300/3600	2013 Apr 11/11		
mergi	ng			$g\prime$	300/7200	2013 Apr 11/11		
				$r\prime$	300/10800	2013 Apr $10/10$		
A2399	21:57:25.8	$-07{:}47{:}41$	0.05790	$u\prime$	300/6000	2014 Aug $20/20,\!21$		
SDSS	& GALEX			$g\prime$	60/4200	2014 Aug 19/22		
				$r\prime$	300/10500	2014 Aug 19/19,20		
A2670	23:54:13.7	-10:25:08	0.07619	$u\prime$	300/6300	2014 Aug $21/21,\!22$		
massiv	ve, subst	ructure,	SDSS &	GALE	X 60/4200	$2014 { m Aug} { m 21/22}$		
				$r\prime$	300/9000	2014 Aug 19/19–21		
A3558	13:27:57.5	-31:30:09	0.04800	$u\prime$	300/3600	2013 Apr 11/11		
Shaple	ey 8 clus [:]	ter		$g\prime$	300/7200	2013 Apr 11/11		
mergi	ng			$r\prime$	300/10800	2013 Apr $10/10$		
A3574	13:49:19.3	-30:18:34	0.01600	$u\prime$	300/900	2013 Apr 11/11		
KYDIS	SC			$g\prime$	300/2700	2013 Apr 11/11		
				$r\prime$	300/3600	2013 Apr $10/10$		
A3659	20:02:37	-30:07.6	0.09070	$u\prime$	300/900	2013 Apr 11/11		
KYDISC				$g\prime$	300/900	2013 Apr 11/11		
				$r\prime$	300/1200	2013 Apr 11/11		
A3716	20:51:16	-52:41.7	0.04620	$u\prime$	300/3300	2014 Aug $21/21,\!22$		
				$g\prime$	300/2700	2014 Aug $21/21,\!22$		
				$r\prime$	300/4800	2014 Aug 19/19–22		

NOTE—(a) Source: NASA/IPAC Extragalactic Database^a (b) The first number and date is for *best* single-exposure mosaic

single image (300s, bright sources)







deep image (10800s, faint sources)

What are in the catalogs

- v1.0: Sources in *r*-band single image (300s) + deep (stacked, ~10,000s) image with m_r < 25 (m_u and m_g if matched within 1" radius) (in prep)
- + <u>README</u>, FITS images, DS9 region files, plots (comp. w/ ref., hist., CMD), RGB mosaics (*in prep*)

What are in the catalogs

#######################################															
#	1	NUMBER	Run	ning ob	ject nur	mber						#			
#	2	ALPHA_J2000	Rig	ht asce	nsion o	f bary	center (J	12000)			[deg]	#			
#	3 DELTA_J2000		Dec	Declination of barycenter (J2000)						[deg]	#				
#	4	4 A_WORLD		Profile RMS along major axis (world units)							[arcse	c]#			
#	5	5 B_WORLD		Profile RMS along minor axis (world units)						[arcse	c] #				
#	6 CLASS_STAR		S/G	S/G classifier output							#				
#	7 MAG_AUTO_u		Kro	Kron-like elliptical aperture magnitude in u band						[mag]	#				
#	8 MAGERR_AUT0_u		RMS	RMS error for AUTO magnitude in u band						[mag]	#				
#	9	MAG_AUT0_g	Kro	n—like	ellipti	cal ap	erture ma	agnitude	e in g ba	and	[mag]	#			
#	10	MAGERR_AUT0_g	RMS	error	for AUT	0 magn	itude in	g band			[mag]	#			
#	11	MAG_AUTO_r	Kro	n—like	ellipti	cal ap	erture ma	agnitude	e in r ba	and	[mag]	#			
#	12	MAGERR_AUT0_r	RMS	error	for AUT	0 magn	itude in	r band			[mag]	#			
#	13	FROM_WHERE_u	Sou	rce of	MAG_AUT	0_u	[0:sing	jle, 1:s	tacked,	2:no m	atch]	#			
#	14	FROM_WHERE_g	Sou	rce of	MAG_AUT	0_g	[0:sing	jle, 1:s	tacked,	2:no m	atch]	#			
#	15	FROM_WHERE_r	Sou	rce of	MAG_AUT	0_r	[0:sing	jle, 1:s	tacked,	2:no m	atch]	#			
#######################################															
	1	358.5569941 -10.4	190212	6.834	6.008	0.03	17.735	0.010	15.399	0.00	2 14.3	360	0.001	0	0
	2	358.8899047 -9.6	547153	9.539	4.599	0.03	17.741	0.011	999.000	999.00	0 14.0	643	0.001	0	2
	3	358.6047728 -11.0	039646	18.357	3.716	0.03	21.652	0.080	19.574	0.02	1 14.7	711	0.012	0	0
	4	358.5612458 -10.1	657062	18.888	12.350	0.03	18.125	0.007	16.792	0.00	5 14.9	951	0.001	1	0
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Photometric calibration



Aperture Correction at a diameter 14.8" to get maper

 Linearly fitted how much mags need to be added as a function of seeing



Calibrating *single* images using standard-star observations

- Multiple standard star (ss) fields were observed on each day
- m_{ss} $m_{aper} (\Delta m) = a + b * Z$ (airmass)



Calibrating *deep* (stacked) images using *single* images

 $m_{\text{single}} - m_{\text{deep}} (\Delta m) = a$



Source counts in u, g, and r for 7 clusters

- I will put magnitude limit ($m_r < 25$)
- SExtractor finds faint bogus sources in one of multiple tiles for some reason (2_{nd} peak).



Comparing our cat. to SDSS Galaxy cat.



CMD

 Red sequences are shown at g-r ~ 1 and u-r ~ 3



CMD

- Red sequences on preliminary result seem to be on top of each other
- Redshift is the main reason behind the spread?
 - K-corrections are not done



Future work: Post-merger feature fraction (radius, dynamical status, and so on...)



Take-away

- Merged photometric catalogs of galaxy sources in single or deep DECam u, g, and r mosaics of A754, 2399, 2670, 3558, 3574 and 3716 are generated.
- Please contact me (<u>dhkim@kasi.re.kr</u>) or Dr. Sheen to use it.
- Study of post-merger feature of galaxies will be followed.