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OGLE Collection of Star Clusters. New Objects in the Magellanic Bridge and the Outskirts of the Small Magellanic Cloud

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ABSTRACT

The Magellanic System (MS) encompasses the nearest neighbors of the Milky Way, the Large (LMC) and Small (SMC) Magellanic Clouds, and the Magellanic Bridge (MBR). This system contains a diverse sample of star clusters. Their parameters, such as the spatial distribution, chemical composition and age distribution yield important information about the formation scenario of the whole Magellanic System. Using deep photometric maps compiled in the fourth phase of the Optical Gravitational Lensing Experiment (OGLE-IV) we present the most complete catalog of star clusters in the Magellanic System ever constructed from homogeneous, long time-scale photometric data. In this second paper of the series, we show the collection of star clusters found in the area of about 360 square degrees in the MBR and in the outer regions of the SMC. Our sample contains 198 visually identified star cluster candidates, 75 of which were not listed in any of the previously published catalogs. The new discoveries are mainly young small open clusters or clusters similar to associations.

Key words: *Catalogs – Galaxies: star clusters: general – Surveys*

1. Introduction

The Magellanic System (MS) provides an excellent astrophysical laboratory for studying the structure and evolution of stellar systems (Skowron *et al.* 2014, Piatti *et al.* 2015, Jacyszyn-Dobrzeniecka *et al.* 2016). Star clusters are one of the tools for such studies. However, a complete collection of star clusters is needed to conduct such a research derived from homogeneous observational data, preferably from a single photometric survey. For more details of the scientific rationale of this research, see the Introduction in Sitek *et al.* (2016, hereafter referred to as Paper I).

To date, the largest catalog of extended objects in the Magellanic System was prepared by Bica *et al.* (2008) as a compilation of all the previously published catalogs. The important contribution to this sample was taken from the OGLE-II star clusters catalogs (Pietrzyński *et al.* 1998, 1999). These catalogs, however, covered only the central parts of the LMC and SMC: 5.8 and 2.5 square degrees (Udalski *et al.* 1997) respectively – only 1.5–2% of the area observed toward these regions during the current OGLE-IV phase (Udalski, Szymański and Szymański 2015). The Magellanic Bridge has never been systematically observed at such scale before, both in terms of the area, time range and cadence. The MBR coverage in the OGLE-IV is 185 square degrees.

This paper presents the second part of the star cluster collection based on the OGLE-IV data. The central part of the SMC has already been observed or analyzed by many other projects (Piatti and Bica 2012, Piatti 2016). Thus, we decided to start our exploration from the outer parts of the galaxy. We have also analyzed the whole area of the MBR covered by the OGLE-IV survey.

2. Observations and Data Reduction

The photometric data of the SMC and MBR fields analyzed in this paper are based on the images gathered during the first five years (2010–2015) of the fourth phase of the OGLE project (Udalski, Szymański and Szymański 2015).

We have used the "deep photometric maps" – catalogs of all objects detected on the deep images of all observed fields. For details we refer the reader to Paper I. For all 120 observed SMC fields (which were analyzed in this paper) and 132 MBR fields, the number of the stacked images used for the deep images is between 55 and 100 (86 on average), depending on the overall number of good seeing individual images in the *I*-band available for any given field. For the *V*-band, which is observed less frequently, the deep images were constructed from 2 to 100 individual images with the mean value of 13. For comparison, the reference images for 41 OGLE-III SMC fields (Udalski *et al.* 2008) were constructed using 4–15 images.

The star detection limit of the deep photometric maps of the SMC and MBR reaches $I \approx 23.5$ mag and $V \approx 24$ mag. The maps are complete to about 22–23 mag in the *I*-band and 22.5–23.5 mag in the *V*-band, depending on the location

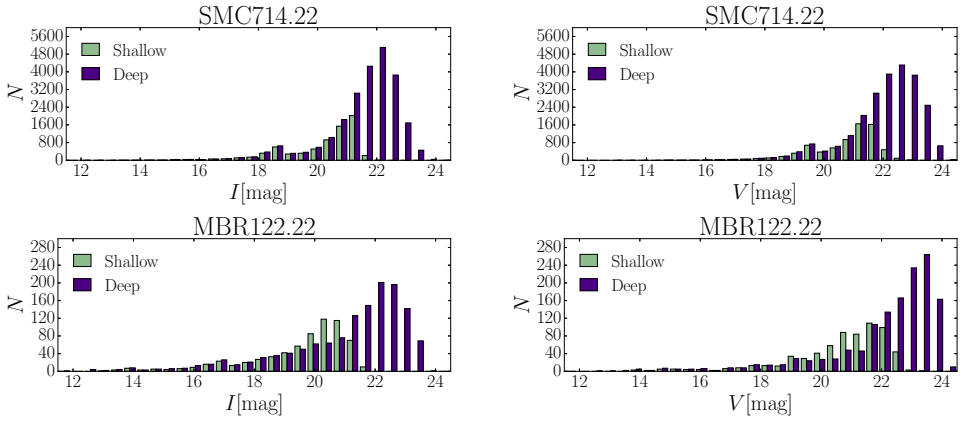

Fig. 1. Histograms of brightness (*left panels* are *I*-band and *right panels* are *V*-band) for two OGLE-IV subfields SMC714.22 (*top panels*) and MBR122.22 (*bottom panels*).

and crowding of the field. These limits are determined from the histograms of the mean magnitudes of the stars by estimating the value where the numbers start to deviate from the systematic growth (Fig. 1). All the details about observations, data reductions and construction of the deep photometric maps can be found in Paper I.

3. Search for Clusters

The method used in this paper is well established. The first automated search of star clusters was performed by Zaritsky *et al.* (1997) and has been used ever since. We used Zaritsky's method with small modifications which are described in Paper I (Section 3). Here, we present the analysis of the fields located outside the central part of the SMC and the MBR (Fig. 2).

The examined area of 353 square degrees contains 252 OGLE-IV fields (each field has 32 subfields what gives 8064 single subfields). All analyzed fields are shown in Fig. 2 as black polygons. The 10 gray polygons mark the central SMC fields which have not been analyzed here. The list of all analyzed SMC and MBR fields and their central coordinates are available on the OGLE Web page[1] together with other supplementary information.

Exemplary density maps are presented in Figs. 3 and 4 for both MBR and SMC subfields, respectively. As in Paper I, we constructed a false-color composition of images taken in the *I*- and *V*-bands (Fig. 5) and plotted a photometric map of the region 400×400 pixels ($1\farcm7 \times 1\farcm7$) around each star cluster candidate detected by our algorithm (see an example in Fig. 6).

Maps presented in Fig. 6 were made for the same object named OGLE-MBR-CL-0033 which is presented in Fig. 5 and shown on the density map in Fig. 3.

[1] *http://ogle.astrouw.edu.pl*

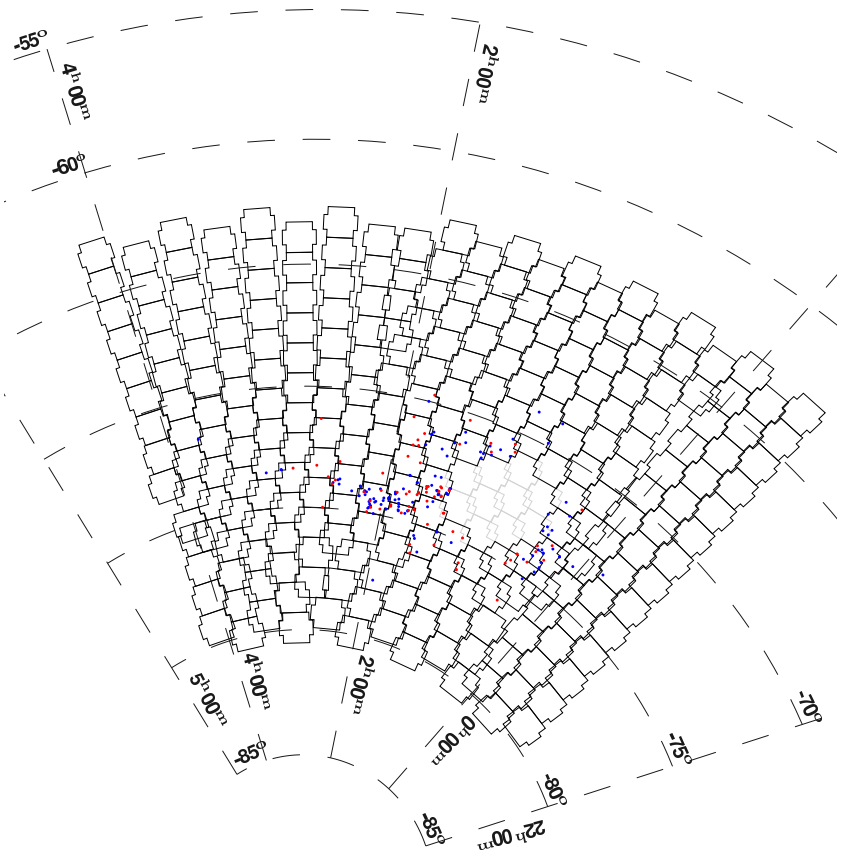

Fig. 2. OGLE-IV fields in the SMC and MBR region. All outer black polygons were analyzed in this paper. Red and blue dots mark the location of newly discovered and the previously known star clusters, respectively (see Section 4).

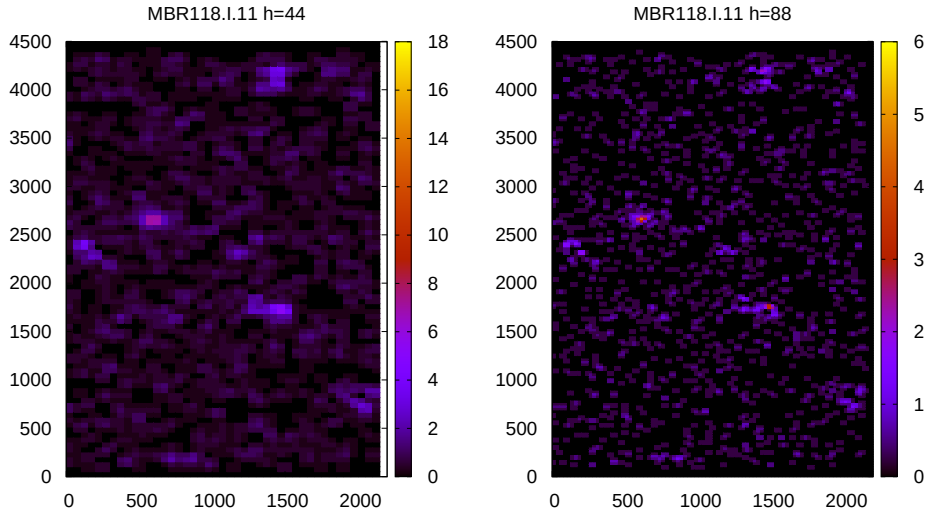

Fig. 3. Stellar density maps of the MBR118.11 subfield for two different cell sizes. The field contains new cluster: OGLE-MBR-CL-0033, which is located around (630,2680).

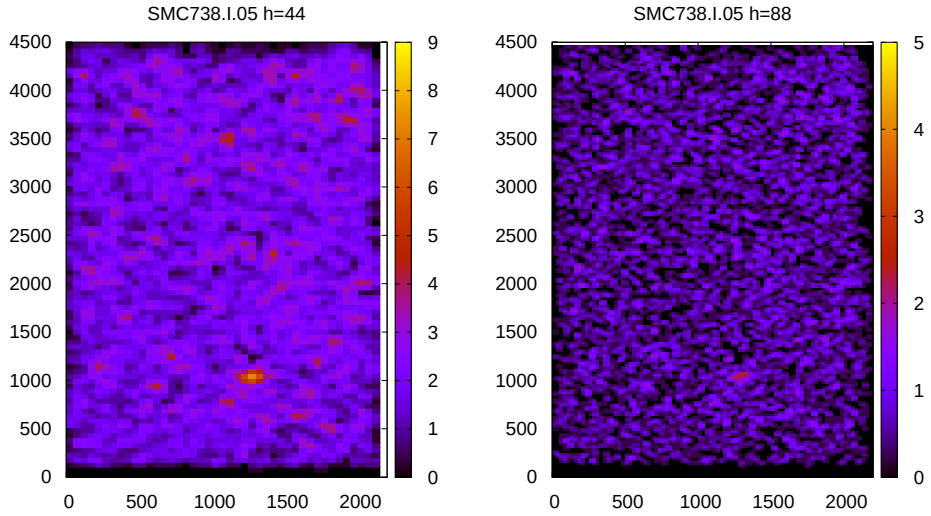

Fig. 4. Stellar density maps of a subfield SMC738.05 with object OGLE-SMC-CL-0242 located around (1335,1090). This is a new candidate for star cluster.

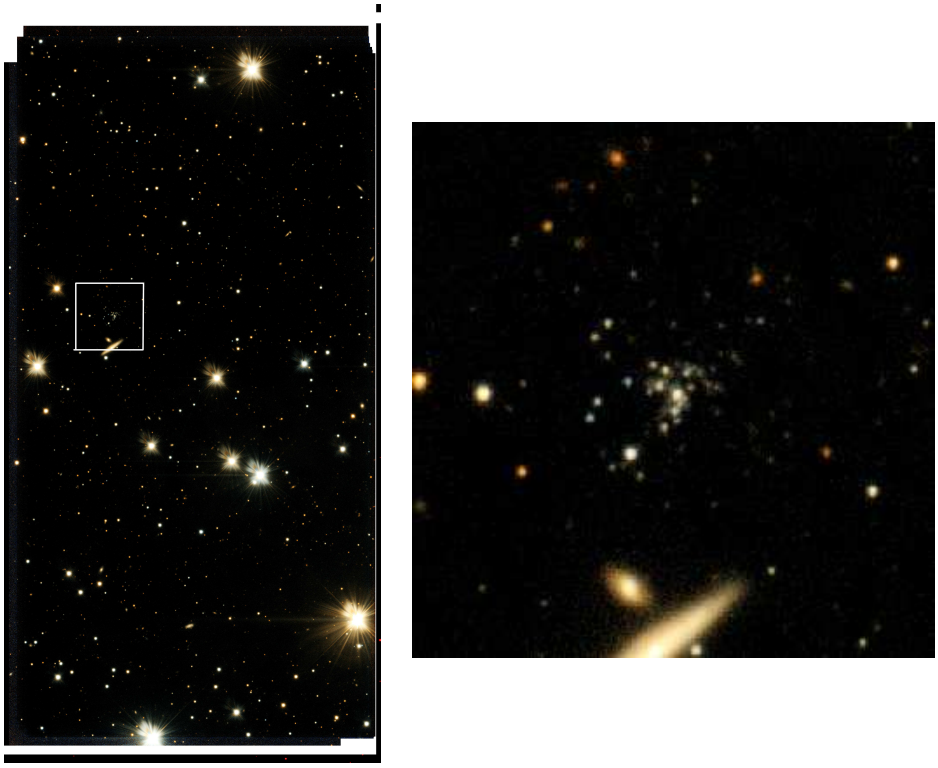

Fig. 5. Color image of the subfield MBR118.11. The white square ($1\farcm7 \times 1\farcm7$) is enlarged in the *right panel*, clearly showing the cluster OGLE-MBR-CL-0033 which is a new object.

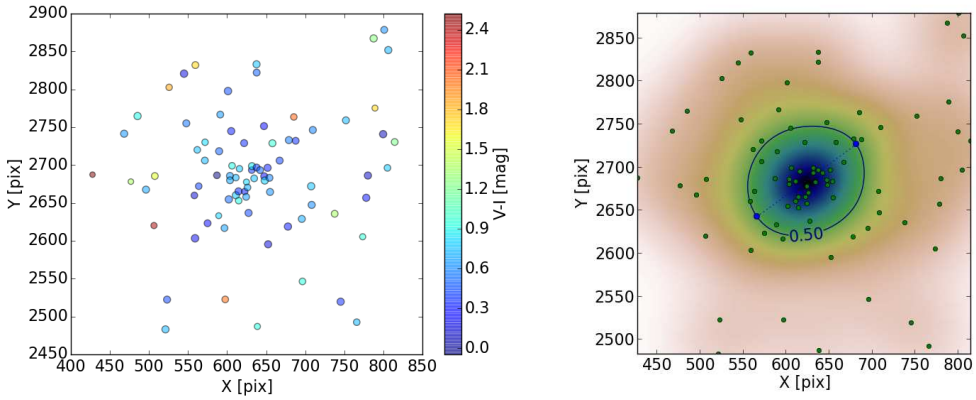

Fig. 6. Deep photometric map of the cluster OGLE-MBR-CL-0033 with the same size as in Fig. 5 – $1\farcm7 \times 1\farcm7$. *Left panel* – size of each point is proportional to the brightness of a star in the *I*-band, and the color represents the $V-I$ index of each star. *Right panel* – deep photometric map with standard KDE distribution which was used to estimate the object's centroid.

For all regions found by our algorithm to be denser than the median value for a given subfield we made a visual inspection, as described in Paper I. For all objects which passed the visual inspection based on six different images, the reliability index was assigned: 34% cluster candidates received the maximum value of 1, 28% – 0.9, 17% – 0.8, 12% – 0.7 and 9% – 0.6. This index depends on the quantity of images the object was identified on. The object received the reliability index equal 1 if it was found on every image. The index was reduced by 0.1 each time the object was not found on the image from the inspected group. Object which was found only on two from six images was rejected. All pictures (images in the *V*- and *I*- bands, color images and a photometric map) of the accepted star clusters are shown on the Web page (Section 4).

All the centroids were calculated in XY coordinates of the field and then converted to the equatorial coordinates. The estimation of the approximate size of star cluster candidate was made using Kernel Density Estimation (KDE) contour line at half maximum value (see an example in Fig. 6. right panel). The calculations are the same as in Paper I. Table 1 presents the cluster parameters for the new objects and Table 2 for the already known objects.

4. The OGLE Collection of Star Clusters in the Outer Regions of the SMC and in the MBR

We have found 198 star clusters in the outer regions of the SMC and in the MBR. Among these, we have found 35 new star clusters in the 185 square degrees area of the MBR and 40 new star clusters in the 168 square degrees area of the outer

regions of the SMC, based on observations collected by the OGLE-IV survey. Their on-sky locations are shown in Fig. 1 with red dots. The remaining 123 objects were identified in previously published catalogs – 121 objects were listed in the Bica catalog and two objects in Piatti (2017). They are marked in Fig. 1 with blue dots. As some extended objects cannot be unambiguously classified, we have performed a cross-match of our sample to both star clusters and associations from the Bica *et al.* (2008) catalog. Some of their A-type objects (associations) were found by our algorithm as clusters (the classification is shown in column 6 in Table 2). Almost all previously known objects located in the area of the analyzed OGLE fields were detected by our algorithm, proving its effectiveness and the completeness of the sample. There were eight Bica objects (three star clusters and five clusters similar to associations) which were not detected by our algorithm. Those which have Bica C-type were on the edge of a subfield, and those classified as CA by Bica are not visible in our data. There was also one cluster from Piatti (2017), Field16-02, which was found on the edge of our subfield but rejected after visual inspection. All undetected objects are listed in Table 3.

All discovered cluster candidates were numbered according to the OGLE-IV naming scheme, which was presented in Paper I. The name is constructed as OGLE-MBR-CL-NNNN for the Magellanic Bridge and OGLE-SMC-CL-NNNN for the Small Magellanic Cloud, where NNNN is an object number. To make the numbering consistent with the OGLE-II catalog (Pietrzyński *et al.* 1998), we started it with 0239 for the SMC. The MBR was not observed during previous OGLE phases so for the MBR we started numbering with 0001.

Table 1 presents the OGLE collection of new candidates for star clusters. Column 1 contains the OGLE identification number, column 2 shows the field name, in columns 3 and 4 we list the equatorial coordinates (J2000) of the cluster center, column 5 contains the size of the cluster (radius) in arcseconds and the last column contains the reliability index.

Table 2 presents the OGLE collection of star clusters, which were already known. We cross-matched our detections with the Bica catalog of star clusters as well as with the catalog of associations (both are part of the Bica *et al.* 2008). Column 1 contains the OGLE identification number, column 2 shows the field name. Columns 3 and 4 give our estimations of the center equatorial coordinates (J2000). Column 5 shows our estimation of the size in arcseconds (radius), in column 6 we list the cross-identification of extended objects. Column 7 contains the object type from Bica *et al.* (2008): C – ordinary cluster, CN – cluster in nebula, CA – cluster similar to association, A – ordinary association, AC – association similar to cluster. Some of the objects have more than one name or type because of problems with unambiguous cross-identification. Data in Tables 1 and 2 show exactly the same parameters as in Paper I to make our collection self consistent.

T a b l e 1

New star clusters

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	reliability
OGLE-MBR-CL-0001	MBR100.32	$1^h46^m02\overset{s}{.}68$	$-69°42'29\overset{''}{.}9$	32	0.7
OGLE-MBR-CL-0002	MBR101.04	$1^h50^m17\overset{s}{.}42$	$-71°53'28\overset{''}{.}1$	49	0.7
OGLE-MBR-CL-0003	MBR101.05	$1^h48^m33\overset{s}{.}32$	$-71°38'22\overset{''}{.}0$	50	0.7
OGLE-MBR-CL-0004	MBR101.06	$1^h47^m25\overset{s}{.}41$	$-71°51'11\overset{''}{.}4$	48	0.7
OGLE-MBR-CL-0005	MBR101.15	$1^h46^m01\overset{s}{.}10$	$-71°19'14\overset{''}{.}9$	43	0.8
OGLE-MBR-CL-0006	MBR101.28	$1^h53^m12\overset{s}{.}39$	$-70°45'09\overset{''}{.}7$	29	0.9
OGLE-MBR-CL-0007	MBR102.15	$1^h44^m09\overset{s}{.}39$	$-72°31'21\overset{''}{.}2$	36	0.9
OGLE-MBR-CL-0008	MBR102.20	$1^h51^m37\overset{s}{.}98$	$-72°23'22\overset{''}{.}4$	34	0.7
OGLE-MBR-CL-0009	MBR103.10	$1^h52^m44\overset{s}{.}33$	$-73°55'34\overset{''}{.}7$	24	1
OGLE-MBR-CL-0010	MBR103.13	$1^h47^m29\overset{s}{.}34$	$-73°53'39\overset{''}{.}5$	37	0.9
OGLE-MBR-CL-0011	MBR103.13	$1^h45^m54\overset{s}{.}59$	$-73°46'50\overset{''}{.}0$	44	0.8
OGLE-MBR-CL-0012	MBR103.16	$1^h41^m06\overset{s}{.}00$	$-73°49'00\overset{''}{.}9$	22	0.9
OGLE-MBR-CL-0013	MBR103.25	$1^h40^m39\overset{s}{.}05$	$-73°43'05\overset{''}{.}8$	27	1
OGLE-MBR-CL-0014	MBR104.21	$1^h47^m29\overset{s}{.}66$	$-74°42'54\overset{''}{.}8$	33	1
OGLE-MBR-CL-0015	MBR104.26	$1^h54^m37\overset{s}{.}56$	$-74°32'42\overset{''}{.}9$	36	0.9
OGLE-MBR-CL-0016	MBR104.26	$1^h54^m46\overset{s}{.}63$	$-74°29'04\overset{''}{.}3$	27	0.9
OGLE-MBR-CL-0017	MBR104.31	$1^h43^m28\overset{s}{.}27$	$-74°31'45\overset{''}{.}7$	42	0.8
OGLE-MBR-CL-0018	MBR104.31	$1^h43^m50\overset{s}{.}47$	$-74°22'12\overset{''}{.}1$	38	0.8
OGLE-MBR-CL-0019	MBR104.32	$1^h40^m29\overset{s}{.}43$	$-74°26'05\overset{''}{.}3$	31	1
OGLE-MBR-CL-0020	MBR105.25	$1^h35^m04\overset{s}{.}87$	$-76°11'19\overset{''}{.}6$	21	0.9
OGLE-MBR-CL-0021	MBR108.13	$2^h03^m13\overset{s}{.}01$	$-73°16'49\overset{''}{.}3$	25	0.9
OGLE-MBR-CL-0022	MBR109.03	$2^h08^m40\overset{s}{.}16$	$-74°57'28\overset{''}{.}7$	45	0.7
OGLE-MBR-CL-0023	MBR109.04	$2^h06^m38\overset{s}{.}84$	$-74°45'17\overset{''}{.}0$	21	0.6
OGLE-MBR-CL-0024	MBR109.06	$2^h00^m45\overset{s}{.}78$	$-74°45'07\overset{''}{.}6$	35	0.8
OGLE-MBR-CL-0025	MBR109.11	$2^h07^m38\overset{s}{.}63$	$-74°29'42\overset{''}{.}8$	32	1
OGLE-MBR-CL-0026	MBR109.18	$2^h12^m11\overset{s}{.}91$	$-74°10'23\overset{''}{.}2$	28	0.6
OGLE-MBR-CL-0027	MBR109.31	$2^h02^m12\overset{s}{.}63$	$-73°59'32\overset{''}{.}5$	31	0.9
OGLE-MBR-CL-0028	MBR112.01	$2^h28^m02\overset{s}{.}11$	$-73°02'53\overset{''}{.}4$	23	0.8
OGLE-MBR-CL-0029	MBR113.08	$2^h31^m30\overset{s}{.}69$	$-73°59'26\overset{''}{.}9$	21	1
OGLE-MBR-CL-0030	MBR113.09	$2^h29^m53\overset{s}{.}33$	$-73°49'10\overset{''}{.}8$	25	1
OGLE-MBR-CL-0031	MBR117.27	$2^h39^m28\overset{s}{.}54$	$-71°19'02\overset{''}{.}7$	36	0.6
OGLE-MBR-CL-0032	MBR118.06	$2^h34^m08\overset{s}{.}09$	$-73°42'14\overset{''}{.}6$	19	0.8
OGLE-MBR-CL-0033	MBR118.11	$2^h41^m03\overset{s}{.}58$	$-73°15'12\overset{''}{.}4$	17	1
OGLE-MBR-CL-0034	MBR119.06	$2^h36^m38\overset{s}{.}95$	$-74°58'21\overset{''}{.}0$	24	0.6
OGLE-MBR-CL-0035	MBR123.29	$2^h54^m42\overset{s}{.}98$	$-73°22'17\overset{''}{.}4$	28	0.9 *
OGLE-SMC-CL-0239	SMC738.01	$1^h40^m38\overset{s}{.}72$	$-73°43'03\overset{''}{.}6$	28	1
OGLE-SMC-CL-0240	SMC738.02	$1^h37^m02\overset{s}{.}76$	$-73°28'18\overset{''}{.}6$	27	0.8

*Object OGLE-MBR-CL-0035 was detected on the edge of the known association ICA65ne.

T a b l e 1

New star clusters

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	reliability
OGLE-SMC-CL-0241	SMC738.03	$1^h36^m24\overset{s}{.}26$	$-73°36'30\overset{''}{.}8$	37	0.9
OGLE-SMC-CL-0242	SMC738.05	$1^h31^m13\overset{s}{.}45$	$-73°41'35\overset{''}{.}3$	26	1
OGLE-SMC-CL-0243	SMC738.07	$1^h27^m35\overset{s}{.}51$	$-73°33'58\overset{''}{.}2$	44	0.9
OGLE-SMC-CL-0244	SMC738.07	$1^h27^m41\overset{s}{.}17$	$-73°35'49\overset{''}{.}0$	48	0.6
OGLE-SMC-CL-0245	SMC738.10	$1^h37^m15\overset{s}{.}96$	$-73°22'53\overset{''}{.}8$	37	0.9
OGLE-SMC-CL-0246	SMC738.11	$1^h36^m19\overset{s}{.}48$	$-73°21'49\overset{''}{.}5$	44	0.8
OGLE-SMC-CL-0247	SMC738.14	$1^h28^m57\overset{s}{.}40$	$-73°14'55\overset{''}{.}7$	38	1
OGLE-SMC-CL-0248	SMC738.14	$1^h29^m49\overset{s}{.}16$	$-73°25'48\overset{''}{.}7$	45	0.8
OGLE-SMC-CL-0249	SMC738.14	$1^h29^m36\overset{s}{.}38$	$-73°13'39\overset{''}{.}7$	38	0.8
OGLE-SMC-CL-0250	SMC738.16	$1^h24^m33\overset{s}{.}75$	$-73°14'21\overset{''}{.}2$	44	0.9
OGLE-SMC-CL-0251	SMC738.16	$1^h24^m38\overset{s}{.}61$	$-73°12'57\overset{''}{.}6$	47	0.9
OGLE-SMC-CL-0252	SMC739.08	$1^h40^m30\overset{s}{.}50$	$-74°26'04\overset{''}{.}9$	28	1
OGLE-SMC-CL-0253	SMC739.25	$1^h23^m11\overset{s}{.}37$	$-74°12'06\overset{''}{.}0$	37	0.7
OGLE-SMC-CL-0254	SMC739.25	$1^h22^m52\overset{s}{.}99$	$-74°11'28\overset{''}{.}5$	50	0.7
OGLE-SMC-CL-0255	SMC739.28	$1^h34^m30\overset{s}{.}37$	$-73°56'59\overset{''}{.}9$	31	1
OGLE-SMC-CL-0256	SMC740.09	$1^h36^m41\overset{s}{.}78$	$-75°51'15\overset{''}{.}0$	24	1
OGLE-SMC-CL-0257	SMC740.24	$1^h21^m30\overset{s}{.}56$	$-75°33'15\overset{''}{.}2$	39	1
OGLE-SMC-CL-0258	SMC734.24	$1^h06^m44\overset{s}{.}77$	$-74°49'58\overset{''}{.}5$	32	1
OGLE-SMC-CL-0259	SMC735.24	$1^h01^m50\overset{s}{.}99$	$-76°06'38\overset{''}{.}4$	27	0.8
OGLE-SMC-CL-0260	SMC735.31	$1^h02^m36\overset{s}{.}01$	$-75°49'22\overset{''}{.}7$	34	0.6
OGLE-SMC-CL-0261	SMC728.01	$1^h01^m51\overset{s}{.}09$	$-76°06'35\overset{''}{.}2$	23	0.9
OGLE-SMC-CL-0262	SMC730.10	$1^h26^m31\overset{s}{.}46$	$-70°16'09\overset{''}{.}4$	23	0.9
OGLE-SMC-CL-0263	SMC722.14	$0^h28^m02\overset{s}{.}60$	$-76°21'12\overset{''}{.}3$	19	1
OGLE-SMC-CL-0264	SMC706.16	$0^h18^m22\overset{s}{.}14$	$-71°27'02\overset{''}{.}2$	18	1
OGLE-SMC-CL-0265	SMC708.08	$0^h25^m17\overset{s}{.}91$	$-73°52'10\overset{''}{.}6$	39	1
OGLE-SMC-CL-0266	SMC708.11	$0^h18^m56\overset{s}{.}07$	$-73°57'37\overset{''}{.}4$	52	0.7
OGLE-SMC-CL-0267	SMC708.17	$0^h26^m32\overset{s}{.}81$	$-73°38'07\overset{''}{.}2$	53	0.6
OGLE-SMC-CL-0268	SMC708.28	$0^h19^m48\overset{s}{.}95$	$-73°18'05\overset{''}{.}7$	34	1
OGLE-SMC-CL-0269	SMC714.01	$0^h34^m48\overset{s}{.}90$	$-74°42'18\overset{''}{.}5$	52	1
OGLE-SMC-CL-0270	SMC714.13	$0^h26^m04\overset{s}{.}88$	$-74°24'59\overset{''}{.}5$	50	0.9
OGLE-SMC-CL-0271	SMC714.19	$0^h33^m27\overset{s}{.}41$	$-74°21'42\overset{''}{.}3$	36	1
OGLE-SMC-CL-0272	SMC721.23	$0^h36^m31\overset{s}{.}49$	$-74°55'46\overset{''}{.}7$	39	1
OGLE-SMC-CL-0273	SMC721.32	$0^h33^m27\overset{s}{.}97$	$-74°21'45\overset{''}{.}5$	41	0.9
OGLE-SMC-CL-0274	SMC724.02	$1^h11^m23\overset{s}{.}08$	$-71°10'00\overset{''}{.}4$	47	0.9
OGLE-SMC-CL-0275	SMC724.09	$1^h13^m18\overset{s}{.}32$	$-70°50'45\overset{''}{.}7$	40	1
OGLE-SMC-CL-0276	SMC724.16	$1^h00^m46\overset{s}{.}51$	$-70°47'12\overset{''}{.}8$	40	1
OGLE-SMC-CL-0277	SMC724.24	$1^h02^m20\overset{s}{.}76$	$-70°29'08\overset{''}{.}4$	37	0.8
OGLE-SMC-CL-0278	SMC731.09	$1^h27^m30\overset{s}{.}34$	$-71°19'26\overset{''}{.}5$	36	0.9

Table 2

Already known star clusters

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	name	cluster type
OGLE-MBR-CL-0036	MBR100.23	$1^h48^m01\overset{s}{.}75$	$-70°00'13\overset{''}{.}1$	20	BS196	C
OGLE-MBR-CL-0037	MBR101.16	$1^h42^m29\overset{s}{.}05$	$-71°16'52\overset{''}{.}8$	17	HW85	C
OGLE-MBR-CL-0038	MBR102.05	$1^h47^m56\overset{s}{.}36$	$-73°07'38\overset{''}{.}7$	35	BS198	CA
OGLE-MBR-CL-0039	MBR103.01	$1^h56^m44\overset{s}{.}64$	$-74°13'09\overset{''}{.}9$	23	NGC796,L115,WG9,ESO30SC6	C
OGLE-MBR-CL-0040	MBR103.02	$1^h52^m57\overset{s}{.}31$	$-74°14'56\overset{''}{.}7$	29	BS207	C
OGLE-MBR-CL-0041	MBR103.03	$1^h50^m20\overset{s}{.}50$	$-74°21'10\overset{''}{.}3$	28	L114,WG4,ESO30SC5	C
OGLE-MBR-CL-0042	MBR103.03	$1^h50^m55\overset{s}{.}38$	$-74°10'43\overset{''}{.}3$	38	WG5se	CA
OGLE-MBR-CL-0043	MBR103.07	$1^h42^m23\overset{s}{.}53$	$-74°10'24\overset{''}{.}7$	42	HW86	C
OGLE-MBR-CL-0044	MBR103.10	$1^h53^m48\overset{s}{.}21$	$-73°56'09\overset{''}{.}3$	25	BS212	C
OGLE-MBR-CL-0045	MBR103.10	$1^h53^m34\overset{s}{.}18$	$-74°00'26\overset{''}{.}7$	38	BS210	A
OGLE-MBR-CL-0046	MBR103.10	$1^h53^m12\overset{s}{.}57$	$-73°58'39\overset{''}{.}6$	45	WG6	C
OGLE-MBR-CL-0047	MBR103.21	$1^h49^m30\overset{s}{.}93$	$-73°43'57\overset{''}{.}0$	52	L113,ESO30SC4	C
OGLE-MBR-CL-0048	MBR103.29	$1^h48^m01\overset{s}{.}05$	$-73°07'55\overset{''}{.}7$	23	BS198	CA
OGLE-MBR-CL-0049	MBR103.32	$1^h42^m53\overset{s}{.}16$	$-73°20'13\overset{''}{.}6$	21	WG1	C
OGLE-MBR-CL-0050	MBR104.17	$1^h57^m16\overset{s}{.}53$	$-74°42'32\overset{''}{.}0$	31	BS218	A
OGLE-MBR-CL-0051	MBR104.22	$1^h45^m14\overset{s}{.}28$	$-74°41'23\overset{''}{.}3$	30	WG2/BS195	CA/A
OGLE-MBR-CL-0052	MBR104.28	$1^h49^m43\overset{s}{.}75$	$-74°36'55\overset{''}{.}3$	26	WG3	CA
OGLE-MBR-CL-0053	MBR104.28	$1^h49^m25\overset{s}{.}56$	$-74°39'11\overset{''}{.}5$	26	BSBD3/BBDS2	CN/AN
OGLE-MBR-CL-0054	MBR104.28	$1^h49^m52\overset{s}{.}27$	$-74°28'49\overset{''}{.}0$	45	BS202	A
OGLE-MBR-CL-0055	MBR104.28	$1^h50^m18\overset{s}{.}00$	$-74°21'34\overset{''}{.}3$	20	L114,WG4,ESO30SC5	C
OGLE-MBR-CL-0056	MBR104.31	$1^h43^m50\overset{s}{.}16$	$-74°34'16\overset{''}{.}7$	41	BS192	CA
OGLE-MBR-CL-0057	MBR104.31	$1^h43^m53\overset{s}{.}64$	$-74°32'25\overset{''}{.}2$	36	BS193	C
OGLE-MBR-CL-0058	MBR109.03	$2^h08^m19\overset{s}{.}40$	$-74°48'11\overset{''}{.}2$	35	WG16	AC
OGLE-MBR-CL-0059	MBR109.03	$2^h07^m44\overset{s}{.}30$	$-74°45'44\overset{''}{.}4$	41	BS228	AC
OGLE-MBR-CL-0060	MBR109.04	$2^h06^m50\overset{s}{.}82$	$-74°41'31\overset{''}{.}4$	32	ICA11	A

Table 2

Continued

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	name	cluster type
OGLE-MBR-CL-0061	MBR109.08	$2^h14^m38\overset{s}{.}91$	$-74°21'30\overset{''}{.}4$	22	BSBD4	C
OGLE-MBR-CL-0062	MBR109.11	$2^h08^m13\overset{s}{.}12$	$-74°31'48\overset{''}{.}3$	34	WG17	A
OGLE-MBR-CL-0063	MBR109.11	$2^h07^m47\overset{s}{.}97$	$-74°26'31\overset{''}{.}8$	26	BS229	C
OGLE-MBR-CL-0064	MBR109.11	$2^h07^m40\overset{s}{.}03$	$-74°37'47\overset{''}{.}1$	34	WG15	C
OGLE-MBR-CL-0065	MBR109.12	$2^h05^m40\overset{s}{.}86$	$-74°23'00\overset{''}{.}1$	36	BS226	C
OGLE-MBR-CL-0066	MBR109.13	$2^h04^m45\overset{s}{.}46$	$-74°30'57\overset{''}{.}6$	22	WG14	C
OGLE-MBR-CL-0067	MBR109.13	$2^h04^m02\overset{s}{.}81$	$-74°28'46\overset{''}{.}9$	38	BS223	C
OGLE-MBR-CL-0068	MBR109.14	$2^h00^m38\overset{s}{.}09$	$-74°33'30\overset{''}{.}8$	20	WG11	C
OGLE-MBR-CL-0069	MBR109.15	$1^h59^m59\overset{s}{.}09$	$-74°22'57\overset{''}{.}5$	45	WG10	AC
OGLE-MBR-CL-0070	MBR109.18	$2^h11^m49\overset{s}{.}50$	$-74°06'59\overset{''}{.}0$	31	BS235	C
OGLE-MBR-CL-0071	MBR109.19	$2^h10^m40\overset{s}{.}97$	$-74°09'20\overset{''}{.}6$	27	BS233	CA
OGLE-MBR-CL-0072	MBR109.19	$2^h11^m12\overset{s}{.}23$	$-74°16'44\overset{''}{.}9$	21	BS234	AC
OGLE-MBR-CL-0073	MBR109.24	$1^h59^m47\overset{s}{.}87$	$-74°16'30\overset{''}{.}4$	34	BS220	A
OGLE-MBR-CL-0074	MBR109.25	$1^h56^m55\overset{s}{.}40$	$-74°15'20\overset{''}{.}6$	30	BS216/BS217	C/A
OGLE-MBR-CL-0075	MBR109.25	$1^h56^m44\overset{s}{.}78$	$-74°13'08\overset{''}{.}1$	24	NGC796,L115,WG9,ESO30SC6/BS215	CA/A
OGLE-MBR-CL-0076	MBR109.25	$1^h56^m35\overset{s}{.}44$	$-74°16'58\overset{''}{.}3$	25	WG8	AC
OGLE-MBR-CL-0077	MBR109.28	$2^h09^m20\overset{s}{.}82$	$-74°01'38\overset{''}{.}3$	24	BS232/BS231	CA/A
OGLE-MBR-CL-0078	MBR109.30	$2^h02^m44\overset{s}{.}28$	$-73°56'16\overset{''}{.}0$	22	WG13	C
OGLE-MBR-CL-0079	MBR110.30	$2^h04^m21\overset{s}{.}20$	$-74°59'01\overset{''}{.}8$	34	ICA6	A
OGLE-MBR-CL-0080	MBR113.06	$2^h19^m28\overset{s}{.}70$	$-74°11'45\overset{''}{.}4$	31	BS243	A
OGLE-MBR-CL-0081	MBR113.08	$2^h31^m11\overset{s}{.}50$	$-73°55'51\overset{''}{.}0$	28	ICA57	A
OGLE-MBR-CL-0082	MBR113.10	$2^h27^m16\overset{s}{.}01$	$-73°45'38\overset{''}{.}6$	40	IDK2w,ICA45	A
OGLE-MBR-CL-0083	MBR113.10	$2^h27^m28\overset{s}{.}38$	$-73°58'29\overset{''}{.}4$	31	BS245	CA
OGLE-MBR-CL-0084	MBR113.10	$2^h28^m22\overset{s}{.}51$	$-73°48'05\overset{''}{.}4$	28	ICA49/ICA48	A/A
OGLE-MBR-CL-0085	MBR113.16	$2^h14^m50\overset{s}{.}33$	$-73°57'10\overset{''}{.}9$	31	BS240/ICA34	C/A

Table 2

Continued

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	name	cluster type
OGLE-MBR-CL-0086	MBR113.16	$2^h14^m34\overset{s}{.}80$	$-73°58'56\overset{''}{.}6$	28	BS239/ICA34	CA/A
OGLE-MBR-CL-0087	MBR123.26	$3^h01^m33\overset{s}{.}52$	$-73°25'08\overset{''}{.}5$	24	ICA71	A
OGLE-MBR-CL-0088	MBR128.03	$3^h10^m22\overset{s}{.}86$	$-73°30'07\overset{''}{.}5$	18	BS247	AC
OGLE-MBR-CL-0089	MBR128.15	$3^h01^m33\overset{s}{.}27$	$-73°25'08\overset{''}{.}2$	24	ICA71	A
OGLE-MBR-CL-0090	MBR141.07	$3^h44^m26\overset{s}{.}41$	$-71°40'50\overset{''}{.}2$	47	NGC1466,SL1,LW1,ESO54SC16,KMHK1	C
OGLE-MBR-CL-0091	MBR160.11	$1^h55^m36\overset{s}{.}02$	$-77°39'15\overset{''}{.}5$	17	L116,ESO13SC25	C
OGLE-SMC-CL-0279	SMC738.06	$1^h29^m27\overset{s}{.}77$	$-73°31'56\overset{''}{.}5$	27	B164	C
OGLE-SMC-CL-0280	SMC738.06	$1^h29^m34\overset{s}{.}82$	$-73°33'29\overset{''}{.}4$	34	GHK24/GHK29/GKH22/GHK51/NGC602,L105,ESO29SC43,H-A68	C/C/C/C/DAN
OGLE-SMC-CL-0281	SMC738.06	$1^h29^m14\overset{s}{.}50$	$-73°32'02\overset{''}{.}1$	36	SGDH-cluster-A	C
OGLE-SMC-CL-0282	SMC738.08	$1^h42^m53\overset{s}{.}34$	$-73°20'15\overset{''}{.}3$	25	WG1	C
OGLE-SMC-CL-0283	SMC738.12	$1^h34^m41\overset{s}{.}19$	$-73°16'27\overset{''}{.}2$	29	H86-213	C
OGLE-SMC-CL-0284	SMC738.13	$1^h31^m08\overset{s}{.}83$	$-73°24'51\overset{''}{.}1$	41	L107,H-A69	AC
OGLE-SMC-CL-0285	SMC738.13	$1^h30^m49\overset{s}{.}89$	$-73°25'45\overset{''}{.}2$	43	B165	C
OGLE-SMC-CL-0286	SMC738.13	$1^h30^m33\overset{s}{.}40$	$-73°25'20\overset{''}{.}7$	46	BS186	A
OGLE-SMC-CL-0287	SMC738.16	$1^h25^m25\overset{s}{.}86$	$-73°22'58\overset{''}{.}1$	46	BS282/L104/H-A67	C/AN/DAN
OGLE-SMC-CL-0288	SMC738.16	$1^h24^m30\overset{s}{.}28$	$-73°24'41\overset{''}{.}9$	46	H86-211	C
OGLE-SMC-CL-0289	SMC738.16	$1^h24^m09\overset{s}{.}76$	$-73°09'27\overset{''}{.}2$	62	HW81	CN
OGLE-SMC-CL-0290	SMC738.16	$1^h24^m25\overset{s}{.}25$	$-73°10'31\overset{''}{.}2$	46	HW82	C
OGLE-SMC-CL-0291	SMC738.16	$1^h24^m25\overset{s}{.}37$	$-73°10'30\overset{''}{.}4$	57	BS176/HCD99-1	C/C
OGLE-SMC-CL-0292	SMC738.21	$1^h34^m25\overset{s}{.}67$	$-72°52'21\overset{''}{.}8$	45	L110,ESO29SC48	C
OGLE-SMC-CL-0293	SMC738.22	$1^h31^m01\overset{s}{.}36$	$-72°51'03\overset{''}{.}1$	28	BS187	CA
OGLE-SMC-CL-0294	SMC739.20	$1^h33^m12\overset{s}{.}46$	$-74°10'02\overset{''}{.}7$	24	L109,ESO29SC46	C
OGLE-SMC-CL-0295	SMC739.29	$1^h31^m11\overset{s}{.}93$	$-73°53'35\overset{''}{.}6$	45	B166	C
OGLE-SMC-CL-0296	SMC740.03	$1^h30^m38\overset{s}{.}30$	$-76°03'15\overset{''}{.}3$	28	L106,ESO29SC44	C
OGLE-SMC-CL-0297	SMC740.18	$1^h34^m55\overset{s}{.}99$	$-75°33'17\overset{''}{.}1$	38	NGC643,L111,ESO29SC50	C

Table 2

Continued

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	name	cluster type
OGLE-SMC-CL-0298	SMC740.18	$1^h35^m58\overset{s}{.}27$	$-75°27'26\overset{''}{.}0$	23	L112	C
OGLE-SMC-CL-0299	SMC740.31	$1^h22^m44\overset{s}{.}71$	$-75°00'30\overset{''}{.}4$	39	HW79	C
OGLE-SMC-CL-0300	SMC737.14	$1^h31^m38\overset{s}{.}99$	$-71°56'49\overset{''}{.}4$	29	L108	C
OGLE-SMC-CL-0301	SMC737.17	$1^h43^m52\overset{s}{.}43$	$-71°44'51\overset{''}{.}9$	31	BS190	CA
OGLE-SMC-CL-0302	SMC737.21	$1^h35^m11\overset{s}{.}61$	$-71°44'15\overset{''}{.}5$	37	BS188	C
OGLE-SMC-CL-0303	SMC737.32	$1^h30^m11\overset{s}{.}16$	$-71°20'19\overset{''}{.}7$	27	BS184	CA
OGLE-SMC-CL-0304	SMC736.01	$1^h42^m27\overset{s}{.}76$	$-71°16'47\overset{''}{.}8$	20	HW85	C
OGLE-SMC-CL-0305	SMC736.02	$1^h41^m40\overset{s}{.}48$	$-71°09'53\overset{''}{.}2$	30	HW84	C
OGLE-SMC-CL-0306	SMC734.08	$1^h22^m49\overset{s}{.}14$	$-75°00'04\overset{''}{.}9$	41	HW79	C
OGLE-SMC-CL-0307	SMC734.12	$1^h12^m04\overset{s}{.}82$	$-75°11'40\overset{''}{.}1$	38	HW66,ESO29SC36	C
OGLE-SMC-CL-0308	SMC717.25	$0^h48^m50\overset{s}{.}91$	$-69°52'08\overset{''}{.}7$	40	L38,ESO51SC3	C
OGLE-SMC-CL-0309	SMC716.10	$0^h58^m58\overset{s}{.}01$	$-68°54'54\overset{''}{.}0$	23	ESO51SC9	C
OGLE-SMC-CL-0310	SMC710.26	$0^h47^m24\overset{s}{.}56$	$-68°55'15\overset{''}{.}1$	25	L32,ESO51SC2	C
OGLE-SMC-CL-0311	SMC706.12	$0^h26^m52\overset{s}{.}99$	$-71°32'56\overset{''}{.}6$	46	NGC121,K2,L10,ESO50SC12	C
OGLE-SMC-CL-0312	SMC703.01	$0^h12^m57\overset{s}{.}34$	$-73°29'30\overset{''}{.}6$	30	L2	C
OGLE-SMC-CL-0313	SMC703.05	$0^h03^m47\overset{s}{.}83$	$-73°28'43\overset{''}{.}4$	24	L1,ESO28SC8	C
OGLE-SMC-CL-0314	SMC715.28	$0^h22^m42\overset{s}{.}73$	$-75°04'33\overset{''}{.}8$	23	L5,ESO28SC16	C
OGLE-SMC-CL-0315	SMC761.02	$23^h48^m59\overset{s}{.}38$	$-72°56'43\overset{''}{.}6$	16	AM-3,ESO28SC4	C
OGLE-SMC-CL-0316	SMC707.01	$0^h28^m31\overset{s}{.}18$	$-73°00'40\overset{''}{.}4$	50	BS2	C
OGLE-SMC-CL-0317	SMC707.03	$0^h24^m57\overset{s}{.}18$	$-73°01'48\overset{''}{.}4$	40	B4	CA
OGLE-SMC-CL-0318	SMC707.09	$0^h27^m44\overset{s}{.}16$	$-72°46'46\overset{''}{.}9$	46	K7,L11,ESO28SC22	C
OGLE-SMC-CL-0319	SMC707.11	$0^h24^m44\overset{s}{.}77$	$-72°47'45\overset{''}{.}0$	50	K3,L8,ESO28SC19	C
OGLE-SMC-CL-0320	SMC707.17	$0^h31^m03\overset{s}{.}58$	$-72°20'21\overset{''}{.}1$	37	HW5	C
OGLE-SMC-CL-0321	SMC707.29	$0^h21^m30\overset{s}{.}47$	$-71°56'03\overset{''}{.}5$	35	BOLOGNA-A	C

Table 2

Concluded

OGLE-IV name	OGLE-IV field	RA	DEC	R_{KDE} [″]	name	cluster type
OGLE-SMC-CL-0322	SMC708.03	$0^h19^m19\overset{s}{.}65$	$-74°06'23\overset{''}{.}3$	36	B1	C
OGLE-SMC-CL-0323	SMC708.04	$0^h18^m25\overset{s}{.}79$	$-74°19'07\overset{''}{.}0$	22	L3,ESO28SC13	C
OGLE-SMC-CL-0324	SMC714.31	$0^h24^m39\overset{s}{.}57$	$-73°45'11\overset{''}{.}9$	45	K5,L7,ESO28SC18	C
OGLE-SMC-CL-0325	SMC708.10	$0^h21^m31\overset{s}{.}25$	$-73°45'27\overset{''}{.}1$	45	K1,L4,ESO28SC15	C
OGLE-SMC-CL-0326	SMC708.18	$0^h23^m03\overset{s}{.}83$	$-73°40'09\overset{''}{.}5$	37	K4,L6,ESO28SC17	C
OGLE-SMC-CL-0327	SMC708.19	$0^h21^m27\overset{s}{.}97$	$-73°44'54\overset{''}{.}1$	41	K1,L4,ESO28SC15	C
OGLE-SMC-CL-0328	SMC708.23	$0^h12^m55\overset{s}{.}25$	$-73°29'27\overset{''}{.}9$	29	L2	C
OGLE-SMC-CL-0329	SMC708.29	$0^h18^m23\overset{s}{.}44$	$-73°23'40\overset{''}{.}5$	36	HW1	CA
OGLE-SMC-CL-0330	SMC714.12	$0^h28^m39\overset{s}{.}66$	$-74°23'55\overset{''}{.}6$	51	B6	C
OGLE-SMC-CL-0331	SMC714.16	$0^h19^m18\overset{s}{.}10$	$-74°34'26\overset{''}{.}2$	25	B2	C
OGLE-SMC-CL-0332	SMC714.22	$0^h25^m26\overset{s}{.}81$	$-74°04'30\overset{''}{.}9$	40	K6,L9,ESO28SC20	C
OGLE-SMC-CL-0333	SMC724.03	$1^h10^m43\overset{s}{.}92$	$-71°16'50\overset{''}{.}2$	51	BS144	A
OGLE-SMC-CL-0334	SMC724.07	$1^h02^m01\overset{s}{.}10$	$-71°01'11\overset{''}{.}5$	40	B111	C
OGLE-SMC-CL-0335	SMC724.09	$1^h13^m03\overset{s}{.}80$	$-70°57'46\overset{''}{.}1$	35	HW67	C
OGLE-SMC-CL-0336	SMC724.12	$1^h07^m41\overset{s}{.}73$	$-70°56'08\overset{''}{.}4$	26	HW56	C
OGLE-SMC-CL-0337	SMC724.31	$1^h04^m24\overset{s}{.}97$	$-70°20'32\overset{''}{.}3$	26	L73	C
OGLE-SMC-CL-0338	SMC731.08	$1^h30^m11\overset{s}{.}68$	$-71°20'17\overset{''}{.}5$	33	BS184	CA
OGLE-SMC-CL-0339	SMC731.15	$1^h16^m24\overset{s}{.}75$	$-71°19'36\overset{''}{.}1$	33	HW73	C
OGLE-SMC-CL-0340	SMC731.16	$1^h14^m54\overset{s}{.}34$	$-71°32'32\overset{''}{.}6$	48	NGC458,K69,L96,ESO51SC26	C
OGLE-SMC-CL-0341	SMC731.16	$1^h14^m44\overset{s}{.}48$	$-71°20'54\overset{''}{.}3$	38	L95	C
OGLE-SMC-CL-0342	SMC731.20	$1^h24^m55\overset{s}{.}87$	$-71°11'13\overset{''}{.}3$	26	IC1708,L102,ESO52SC2	C
OGLE-SMC-CL-0343	SMC731.27	$1^h26^m42\overset{s}{.}70$	$-70°46'58\overset{''}{.}8$	24	B168	C
OGLE-SMC-CL-0344	SMC739.05	$1^h29^m52\overset{s}{.}83$	$-74°50'48\overset{''}{.}2$	28	Field12-01	-
OGLE-SMC-CL-0345	SMC734.21	$1^h13^m42\overset{s}{.}75$	$-74°45'14\overset{''}{.}4$	28	Field16-01	-

T a b l e 3

Undetected objects form Bica *et al.* (2008) and Piatti (2017)

Name	Bica type	Comment
BS6	CA	not visible
H86-197	C	edge
BS127	CA	not visible
HW20	C	edge
B44	C	edge
BS173	CA	not visible
BS1	CA	not visible
BS189	CA	not visible
Field16-02	–	edge

The OGLE star cluster collection, the list of all analyzed SMC and MBR fields and all the graphical materials are avaliable on the OGLE web page:
http://ogle.astrouw.edu.pl

5. Conclusions

We have presented a catalog of star clusters in the Magellanic Bridge and the outer regions of the Small Magellanic Cloud based on the OGLE-IV deep photometric maps. We found a total of 198 star clusters, including 75 new objects which were not listed in any of the previous catalogs, 121 clusters listed in Bica *et al.* (2008) and two clusters listed in Piatti (2017). For all of them the equatorial coordinates and cross-identification with the Bica *et al.* catalog are provided. The detection method presented in this paper is very effective. With our algorithm we found more than 95% of previously known clusters in this characteristic sparse region of the SMC and in the whole MBR, increasing the total number of these objects by 40%. This paper is the second of a series of publications. In the next one we will present clusters found in the central regions of the LMC and SMC, thus concluding the complete collection of star clusters in the whole Magellanic System observed by the OGLE survey.

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