

GLOBULAR CLUSTERS AND PLANETARY NEBULAE DISCOVERED ON THE NATIONAL GEOGRAPHIC SOCIETY-PALOMAR OBSERVATORY SKY SURVEY

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As the National Geographic Society-Palomar Observatory Sky Survey¹ nears completion, preliminary lists are being compiled of some of the many new objects discovered. These lists include more than seventy new planetary nebulae and about a dozen star clusters that are believed to be globular.

The Sky Survey covers the entire sky north of -27 degrees declination on both red- and blue-sensitive photographs obtained with the 48-inch Schmidt telescope of the Palomar Observatory. The part of the sky to be surveyed has now been photographed completely, although some fields still must be repeated to obtain plates good enough to meet the high standards set for the survey.

The blue exposures are on the Eastman 103a-O emulsion and the red exposures on the Eastman 103a-E emulsion in combination with a red Plexiglas filter. The exposure times are chosen to reach the faintest stars which can be recorded by the instrument under average observing conditions. The limiting photographic magnitude of the blue exposures is about 21.1. The computed loss in limiting magnitude due to vignetting in the extreme corners of the $14'' \times 14''$ plates is less than 0.2 magnitude. The image scale is 67.1 seconds of arc per millimeter.

Thirteen star clusters have been found on the survey photographs which appear to be globular. They are listed in Table I. Positions of five of these clusters have been published previously; references are noted in the table. Tabulated for each cluster are its equatorial and galactic co-ordinates, its apparent diameter on the Schmidt plates, an estimate of the photographic magnitude of its brightest stars, and an estimate of its concentration class.² Nos. 2, 3, 10, 11, and 13 on the list were discovered by A. G. Wilson, No. 4 independently by Hubble and Wilson, No. 5 independently by Baade and Wilson, No. 12 by Harrington and Zwicky, and the others by the writer.

TABLE I
GLOBULAR CLUSTERS

No.	α	1950	δ	l	b	Diam.	Br. Stars	Conc.	Remarks
1	3 ^h 25 ^m 7		+79°28'	97°	+20°	1.3	19	XII	
2	4 43.1		+31 23	137	-9	1.7	—	IX	
3	10 3.0		+0 18	209	+43	2.2	19.5	XII	Highly obscured *
4	11 26.6		+29 15	170	+73	1.5	19	XII	*
5	15 13.5		+0 5	329	+44	10.3	17	XII	Very loose†*
6	17 40.6		-26 12	330	0	1.8	20	XI	Highly obscured
7	18 8.0		-7 14	349	+4	6.0	18.5-19	XII	Rich; highly obscured
8	18 38.5		-19 52	342	-8	1.6	19	X	
9	18 52.2		-22 46	341	-12	2.6	16.5	VIII	
10	19 16.0		+18 28	20	+1	3.1	20	XII	Highly obscured
11	19 42.6		-8 9	0	-17	2.8	17-18	XI	
12	21 43.7		-21 28	359	-49	2.1	16.5-17	XII	‡
13	23 4.2		+12 28	56	-43	1.8	19-19.5	XII	*

* A. G. Wilson, *Pub. A.S.P.*, 67, 27, 1955.

† L. Rosino, *Mem. Soc. Astr. Ital. (NS)*, 22, 309, 1951.

‡ *Ann. Rpt., Mt. W. and Palomar Obs.*, 1953-54, p. 23.

TABLE II

PLANETARY NEBULAE

No.	α	1900	δ	No.	α	1900	δ
1	0 ^h 7 ^m 2		+68° 36'	38	18 ^h 55 ^m 2		-18° 21'
2	0 39.6		+57 21	39	18 56.7		+48 20
3	2 4.6		+63 40	40	19 0.1		+17 49
4	2 45.3		+50 11	41	19 1.8		+ 6 15
5	2 50.6		+64 5	42	19 4.4		+22 49
6	4 58.7		-15 43	43	19 5.2		- 2 31
7	4 59.7		+39 1	44	19 8.1		+ 2 43
8	5 22.3		+35 58	45	19 12.6		+ 1 30
9	5 59.5		+ 3 57	46	19 13.0		+25 26
10	6 5.6		+11 46	47	19 13.8		-12 28
11	6 34.6		+61 57	48	19 14.3		+19 24
12	6 43.8		- 9 26	49	19 16.2		+46 3
13	6 51.2		- 2 45	50	19 28.6		+10 24
14	6 54.3		+14 46	51	19 37.6		+16 51
15	7 17.8		+ 1 57	52	19 40.6		+ 5 19
16	7 23.5		+13 27	53	19 51.7		-21 52
17	7 45.8		+ 3 27	54	19 53.4		+ 2 47
18	8 33.7		+58 36	55	19 55.8		+21 46
19	8 35.9		-20 34	56	20 16.3		+38 6
20	8 48.8		+ 9 17	57	20 27.8		- 8 0
21	9 11.1		+ 4 19	58	20 29.1		+47 1
22	9 34.2		- 2 21	59	20 45.3		+13 11
23	9 40.8		-12 43	60	20 53.9		+57 11
24	12 48.2		-22 20	61	21 12.4		+23 44
25	13 35.2		-19 22	62	21 24.8		- 3 15
26	13 59.0		-16 47	63	21 28.7		+55 27
27	16 23.5		+28 8	64	21 31.1		+31 15
28	16 42.7		-20 50	65	22 22.4		+54 20
29	17 23.3		-15 9	66	22 30.6		+51 55
30	17 25.9		- 8 13	67	22 41.5		+79 56
31	17 48.9		+10 39	68	23 40.9		+56 30
32	18 24.5		-16 48	69	23 41.8		+54 11
33	18 24.8		-11 41	70	23 42.8		+50 50
34	18 27.3		+26 51	71	23 49.1		+66 56
35	18 30.2		- 0 19	72	23 54.1		+61 54
36	18 37.5		- 3 19	73	23 56.5		+70 9
37	18 48.1		- 6 35				

Six of the new clusters, Nos. 1, 3, 4, 5, 12, and 13, are inconspicuous and barely recognizable because of their great distance. However, plates obtained with the 200-inch telescope by Sandage reveal that they are bona fide globular clusters.

The other seven clusters all lie at low galactic latitudes and suffer considerable obscuration. They appear to be globular on the survey plates, but confirmation is not yet available. In particular, Nos. 6, 10, and 11 may conceivably be very rich galactic clusters.

In Table II are listed preliminary positions (accurate to within a few minutes of arc) for seventy-three new planetary nebulae found on the Sky Survey plates by A. G. Wilson and the writer. No. 26 is I.C. 972 and No. 67 is I.C. 1454, neither of which was previously recognized as a planetary. These are all nebulae of comparatively low surface brightness. The 48-inch Schmidt is ideally suited for the discovery of this type of extended faint object. However, with the scale of the Schmidt, nebulae with diameters less than about ten seconds of arc appear too nearly stellar to be easily detected.

These planetary nebulae are currently being investigated, and more complete data and descriptions will be published in the near future.

¹ A. G. Wilson, *Trans. I.A.U.*, **8**, 335, 1952.

² H. Shapley, *Star Clusters* (New York: McGraw-Hill Book Company, Inc., 1930), p. 11.