

IDENTIFICATION OF DOUBLE AND MULTIPLE GALAXIES

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When classifying the double and multiple galaxies visible on glass prints of the National Geographic Society—Palomar Observatory Sky Survey plates, the writer noticed that nearly 30 percent of the systems included in Holmberg's *Catalogue*¹ do not appear to be systems of galaxies at all. The object listed in the catalog as the brighter or brightest is usually a galaxy, but the image of a fainter component may have the appearance of a star. It seems highly probable that these misidentifications were chiefly due to the effect of the strong chromatic aberration of the Heidelberg Bruce telescope on the plate material that Holmberg used. While the glass prints of the Palomar plates are somewhat contrasty, which causes occasional difficulties in identifying small round objects, the following simple statistics indicate that a substantial number of the objects listed in Holmberg's catalog as galaxies are, in fact, stars.

Table I, based entirely on Holmberg's data, classifies 699 double systems according to their position with respect to the galactic plane. The last four columns give the number and per-

TABLE I
FREQUENCY OF CIRCULAR GALAXIES AT INTERVALS OF
GALACTIC LATITUDE

Galactic Latitude Intervals	Number of Pairs	Circular Galaxies			
		Brighter Component		Fainter Component	
$\pm 10^\circ - \pm 30^\circ$	44	25	57%	34	77%
30 — 40	53	26	49	39	74
40 — 50	108	46	42	66	61
50 — 60	149	60	40	89	60
60 — 70	163	67	41	94	58
70 — 90	182	74	41	105	58

* On leave from Warsaw University Observatory.

centage of objects that the catalog describes as circular (that is, those with equal maximum and minimum diameters). It will be seen that, as the galactic latitude decreases (as the regions of the sky become richer in stars), the percentage of objects described as galaxies with circular images steadily increases. This is particularly marked for fainter components. Since real correlation between the percentage of circular galaxies and galactic latitude is hardly possible, it seems very probable that a large proportion of the objects listed in the catalog as galaxies with round images are, in reality, stars. In this case, at least some of the conclusions drawn by Holmberg and later investigators concerning double and multiple galaxies require reexamination and correction. To facilitate this, all questionable objects are listed in Table II according to their number in the Holmberg catalog. A revision of data for double and multiple galaxies is in progress.

TABLE II

LIST OF QUESTIONABLE OBJECTS IN THE HOLMBERG CATALOG

A. Objects listed as double galaxies that appear as a galaxy and a star

1	34	71	93	138	174	227	282	338	383	412
3	39	75	97	139	177	228	286	349	384	424
4	40	77	100	149	192	239	296	350	385	428
5	43	78	103	150	202	245	299	352	388	434
9	44	80	104	157	203	247	307	358	389	456
20	47	81	106	158	207	267	316	362	390	457
22	48	82	118	159	208	274	317	364	392	460
25	56	83	119	163	209	278	321	366	400	465
27	63	84	127	166	210	279	322	372	404	
32	69	92	133	167	220	281	330	378	410	
466	506	559	591	634	652	678	713	743	773	812
467	507	562	592	636	654	679	716	745	774	814
471	508	564	596	637	656	681	717	746	780	817
473	512	567	599	642	659	689	718	754	785	819
479	515	574	605	644	662	695	720	756	791	822
493	516	578	615	646	664	696	724	761	793	827
497	520	583	617	647	670	702	730	763	797	
503	539	586	619	648	672	707	731	764	799	
504	547	589	620	649	673	709	733	767	801	
505	553	590	625	650	676	712	739	771	806	

TABLE II (*Continued*)

B. Objects listed as multiple systems in which at least one presumed member appears as a star

23 a, c	111 b	237 c	540 b, c	715 c
28 b, c	128 b, c	262 c	560 d	737 c, d
37 c, d	130 c	264 c	585 c	741 c
41 c, d	144 e	272 c	597 c	752 c
45 c	151 f	275 c	600 c	765 c
54 c	154 b	297 c	633 b, c	795 d, h, i
61 c	169 c	367 b, c	655 c	
68 b	201 b, c	403 h	677 b, c	
98 c	211 b, c	433 c	699 b, c	
109 b, c	222 c	498 c	703 c	

C. Objects not found on Sky Survey prints

12	72	178	394	509	581	675	768	824
18	73	188	416	517	582	687	772	
19	74	194	419	525	593	690	776	
24	88	196	444	530	603	691	778	
35	95	197	450	531	618	698	779	
38	107	205	464	537	624	701	782	
50	122	219	475	551	627	723	783	
51	126	265	481	566	666	750	786	
52	168	291	489	569	669	762	787	
60	171	343	491	570	671	766	789	

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NEW MEASUREMENTS OF STEEP LUNAR SLOPES

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Recent U , B , V investigations of the moon from phase angles of -25° to $+25^\circ$, using the Mount Wilson 60-inch