Rev. Mexicana Astron. Astrof., 15, 107-116 (1987)

ON THE NATURE OF THE PHL OBJECTS. IDENTIFICATION CHARTS OF PHL OBJECTS IN A FIELD OF APPROXIMATELY 40 SQUARE DEGREES CENTERED AT 0^h53^m AND $-11^\circ.5$ (1950)

G. Haro
Instituto de Astronomía
Universidad Nacional Autónoma de México

E. Chavira
Instituto Nacional de Astrofísica, Optica y Electrónica
Tonantzintla, Pue., México

Received 1987 April 30

RESUMEN

Se insiste indicando la distinta naturaleza que comprende la lista de los objetos descubiertos por Haro y Luyten usando la Cámara Schmidt de 48″ de Monte Palomar en la dirección del Polo Galáctico Sur y, además, se mencionan entre otros trabajos, especialmente los presentados en 1964 en Estrasburgo, Francia, sobre el tema de estrellas azules débiles y los de Sandage y Sandage y Luyten que se basan en fotometría, espectroscopía y movimientos propios, determinando la gran variedad de objetos estelares en las listas PHL. Especialmente, se enfatiza la existencia de un buen número de QSO (Quasi Stellar Objects) en el catálogo PHL y el creciente número de galaxias compactas descubiertas y estudiadas hasta fines de 1986.

Para el caso de los objetos encontrados en la placa obtenida con la Cámara Schmidt de Monte Palomar con centro en 0^h53^m y $-11^\circ.5$ (1950) se proporcionan los números correspondientes y las coordenadas aproximadas así como cartas de identificación. Se espera que, por lo menos para los objetos PHL más ultravioletas y azules, algunos astrónomos se interesen en obtener datos espectroscópicos, fotométricos y movimientos propios. En el futuro intentaremos publicar cartas de identificación para otros centros del catálogo PHL, publicado hace aproximadamente veinticinco años.

ABSTRACT

It is emphasized that the list of stars discovered by Haro and Luyten, on Palomar Schmidt plates, in the direction of the South Galactic Pole (PHL) contains objects of diverse types. The same can be said about similar lists by other authors, presented at the Strasbourg Conference on Faint Blue Stars. Photometric, spectroscopic and proper motion data have shown the existence of a great variety of objects in the PHL lists. We also note the increasing number of objects in that Catalogue which turn out to be compact galaxies. Special emphasis is placed on the existence of a good number of QSO (Quasi Stellar Objects) in the PHL catalogue and the increasing number of compact galaxies discovered and studied up to the end of 1986.

For the objects found in the plate obtained with the Mount Palomar Schmidt Camera, centered on 0^h53^m and $-11^\circ.5$ (1950), the corresponding numbers, the approximate coordinates and the identification charts are given. It is expected that, at least for the more ultraviolet and blue PHL objects, some astronomers will be interested in obtaining spectroscopic and photometric data and proper motions. We intend to publish, in the future, identification charts for other centers of the PHL catalogue, which had appeared approximately twentyfive years ago.

Keywords: **STARS-BLUE – QUASARS**

I. INTRODUCTION AND A BRIEF HISTORY

Since the examination of the three-image multiple exposure plates (*U,B,V*) taken in Mount Palomar with the 48-inch Schmidt telescope and the preparation of the PHL catalogue by Haro and Luyten (1962) these authors realized that among the very blue, blue and bluish or white objects listed, a quite heterogeneous class of stellar types was present: for instance, main-sequence B and A type stars, white dwarfs, subdwarfs, planetary nebulae, eruptive variables of the U Geminorum and Z Camelopardalis types, flare stars, etc. Previous experience and observations (Haro 1956) led us to suggest that

the lists contained very compact and semi-stellar blue galaxies.

As a natural consequence of the PHL catalogue and some other searches on faint blue stars, the First Conference on Faint Blue Stars was organized by Haro, Luyten and Zwicky, and took place at the Strasbourg Observatory in August 1964. The Proceedings were published by the Observatory of the University of Minnesota, 1965, edited by W.J. Luyten. The participants were, in alphabetical order: E. Chavira, O. Eggen, J.L. Greenstein, G. Haro, G. Herbig, B. Iriarte, R.P. Kraft, P. Lacroute, W.J. Luyten, K. Aa. Strand, and F. Zwicky.

The proceedings edited by Luyten (1965) contain apart from interesting and brief discussions and communications, several lectures dealing with the subject of the Early History of the Faint Blue Star Programs by Fritz Zwicky, who presented several data, starting with the only three white dwarfs which were known in 1917. These were 40 Eridani B, Sirius B and van Maanen 2. By 1950 a total of 111 white dwarfs had been discovered and 267 probably white dwarfs were identified, reaching nearly 1000 at the time of the Strasbourg Conference. Zwicky also discussed the "blue pygmy stars" and the *neutron stars* in various stages much fainter than the common white dwarfs. The search which Zwicky initiated in 1938 in a way "led to the discovery of all kinds of blue stars in high galactic latitudes, covering a range of 20 absolute magnitudes or more". Many other investigators were interested in the faint blue stars and finally Zwicky stated that Haro and Luyten had carried out a very fruitful 3-image survey of the South Galactic Pole area, presenting a total of 8746 blue or bluish stars. Zwicky's extensive statistical analysis of the distribution of the Haro-Luyten stars led to two important results: a) these blue stars occupy a volume extending way out to the farthest limits of the Halo of the Milky Way System, and b) these faint stars do not form anywhere pronounced swarms or condensations. Zwicky predicted that in the near future, more pygmy stars would be found and that they would be of two kinds: 1) dense stars of small radius (1000 km and less), and 2) very hot stars of equally small radius but composed of non-degenerate matter.

During the discussion of Zwicky's presentation, extremely fruitful comments were made. Greenstein, for instance, informed that for the Humason-Zwicky stars photoelectric colors were found in the range from $-0^{m}.35$ to $+0^{m}.25$ in $B-V$ and from $-1^{m}.25$ to $+0^{m}.4$ in $U-V$.

The range from very blue with a strong ultraviolet to definitely yellow, with an unusual amount of ultraviolet excess in the color-color diagram includes typical white dwarfs of type DA and stars with spectral types close to DO. Also, some objects have composite spectra of an unresolved B or A star plus an F or K. Some are O, B or A stars of the horizontal branch. Greenstein emphasized that the main-sequence stars run up to $-1^{m}.35$ for $U-V$ and that in the case of these extremely blue stars it is not possible to be certain whether we have a white dwarf, a hot subdwarf or a main-sequence star.

At the Strasbourgh Conference many topics were mentioned. The most difficult one was, and still is, the one that refers to the absolute magnitude of the faint blue stars. If we accept that in the 18th or 19th magnitude range there are some main-sequence B stars, then this will mean that our galactic corona extends at least as far as the Magellanic Clouds. Greenstein, among others, opposed to this possibility arguing that if these 18th magnitude stars have zero absolute luminosities, they could not be runaway stars but must have been formed essentially *in situ*, stating also that if stars of absolute magnitude zero could be found at 14th apparent magnitude it did not necessarily follow that such stars could be found at considerably fainter magnitudes, although he did not doubt about the possibility of finding individual stars out to very great distances; the trouble, Greenstein remarked, " is that if we also believe in nuclear physics and the presently known energy sources, the stars must have left the galactic plane with very high velocities". It is hard to image how a normal B star can live to reach modulus 20 (100 000 parsecs). Even at 100 km s^{-1}, it would take of the order of 2×10^{9} years; and that is too long for a luminous normal main-sequence B type star. In the discussion it was pointed out that a normal B star of absolute magnitude -2 and apparent luminosity $+13$ (that is, 10000 parsecs) may exist in the direction of the Galactic Poles but that case would be exceedingly rare: the volume at 10000 parsecs from the galactic plane is very large and although the existence of runaway stars cannot be ignored they must be possibly traversing the halo but are not halo stars.

It seems that the participants of the First Conference on Faint Blue Stars unanimously agreed with Greenstein's general remarks mentioned above. Notwithstanding, the possibility was suggested that some kind of umbilical cord may exist between our galactic halo and the Magellanic Clouds. Later on, Professor Oort made, to one of the present writers, the tentative suggestion of searching in the region of the Southern Galactic Pole, for faint blue stars that might be members of a Magellanic stream.

Apart from a more or less extensive discussion on halo eruptive variable stars (SS Cygni, U Geminorum and Z Camelopardalis type variables) the existence was emphasized of O and B subdwarfs in the halo and Eggen emphatically pointed out the fact that we do not know of any star in the halo that is not of the globular cluster population.

It is rather difficult to synthesize all the information and contributions presented at the Strasbourg Conference but it is quite recommendable to go back to the corresponding proceedings edited by Luyten (1965) and references contained therein.

The summary and outlook of the topics treated were presented by Zwicky who made special emphasis on the existence of the different types of blue stars in the range of perhaps 20 absolute magnitudes, from pygmies to giants and a variety of variable and eruptive stars as well as remnants of novae and supernovae, planetary nebulae, blue compact galaxies and quasi-stellar radio sources with blue stars listed by Haro and Luyten. A striking example was the blue Tonantzintla star PHL 2871 which coincides with the quasi-stellar radio source 3C9 for which M. Schmidt measured the largest red shift known at the time of the conference [$\Delta\lambda/\lambda = 2.01$].

The proceedings edited by Luyten (1965) of the First Conference on Faint Blue Stars ended with an appendix containing the list and identification charts of the original Humason-Zwicky stars. It would be of interest to mention here that nearly one quarter of a century after the Strasbourg Conference a "Second Conference on Faint Blue Stars" has been announced and will take place in Tucson, AZ, USA in June 1-5, 1987 (IAU Colloquium No. 95).

Soon after the Strasbourg Conference, Sandage (1965) published an exciting paper dealing with what he called "the existence of a Major New Constituent of the Universe: the quasi-stellar galaxies". Based on evidence from photometry, spectroscopy and number counts, he tried to demonstrate that most of the blue star-like objects fainter than $m_{pg} = 16$ in the PHL catalogue were extragalactic and represented an entirely new class of objects: quasi-stellar galaxies (QSG) or quasi-stellar objects (QSO). According to Sandage, this particular type of extremely compact galaxies can be found at great distances due to their high luminosity.

It did not take Sandage very long to modify his 1965 statements and in 1966, together with Luyten (1967) analyzed via photometry, proper motions and spectra of the blue PHL objects in a field at $1^h36^m+6^\circ$, finding that in a complete sample of 69 PHL objects, out of 22 of Table II (Very Definitely Blue Stars) only 5 were QSG or QSO and the remaining 17 were white dwarfs, some of types DA and DB and only two of HB type. Of the remaining 31 objects in PHL Table III (Blue Stars), they found only 3 QSO's and the rest were classified as subdwarfs with only one of the HB class. Of the remaining 16 stars (Table IV PHL Catalogue, Bluish or White Stars) all were classified as subdwarfs with the exception of one HB and another probable RR Lyrae. It might be useful to recall that all the objects of the 69 PHL sample were as faint or fainter than visual magnitude 15.50.

The $U-B$ versus $B-V$ diagram constructed by Sandage and Luyten (1967) shows two striking features (Figure 1 of their paper): a) the absence of blue stars near the normal main-sequence with $B-V < 0.0$; and b) the large number of F and G subdwarfs with $B-V > 0.40$.

Sandage and Luyten emphasized on the objects scattered around the black-body line in the color-color diagram and attempted to establish some kind of relation between the position of the objects either near, on, or above, the black-body line with the characteristics of extremely compact galaxies (QSO,QSG, QSS). We believe that a straightforward relation in this respect may not necessarily exist. Later on Sandage and Luyten (1969), based on a more extended sample of faint blue stars, pursued their study on the nature of faint blue objects at intermediate to high galactic latitudes and, with a sample of 301 blue objects, arrived essentially at the same conclusions (Sandage and Luyten 1967). Figure 1 of this second paper (1969) is quite illustrative. They insisted that most candidates which lie near, on or above the black-body line are quasi-stellar objects.

II. THE SEARCH FOR QUASI-STELLAR OBJECTS

The first quasi-stellar object (3C48) was identified in 1960, and soon after the red-shift of several of these very compact galaxies was obtained. Probably the exciting Strasbourg Conference and the Sandage (1965) paper postulating that there exist a large number of QSO which are not mainly radio emitters (the radio-quiet QSO) enhanced interest in the subject; many new QSO's were identified and their red shifts measured. The first extensive Optical Catalogue of Quasi-Stellar Objects was published by Burbidge, Crowne, and Smith (1977) containing 663 QSO's and four BL Lac objects. This was followed by a revised version in 1980 (Hewitt and Burbidge 1980) containing 1549 QSO's. Later, there appeared the Catalogue of Quasars and Active Nuclei by Véron-Cetty and Véron (1984) and a Second Edition of it in April 1985. Quite recently, Hewitt and Burbidge (1987) published a compilation of all the known quasi-stellar objects with measured red-shifts, complete to September 1986. This new catalogue contains 3681 entries including 87 BL Lac-type galaxies. We may state that at the time of this writing the Hewitt-Burbidge Catalogue summarizes all the information already known to date. However, we have the feeling that still there may exist a number of QSO's within the limiting photographic magnitude reached by the catalogues mentioned above. If not so, it seems that the expected number of dwarfs of various types to visual magnitude $\sim$19.5 and with colors appropriate to locate them near, on, or above, the black-body line in the color-color ($U-B$, $B-V$) diagram, must be very large.

III. THE PHL OBJECTS AND THE QSO's

Taking as a fundamental reference the Optical Catalogue of Quasi-Stellar Objects of Hewitt and Burbidge (1987), we found that apart from the 71 Palomar Haro-Luyten objects listed in their Table 2 (pags. 242–243) there are at least 15 additional PHL entries that very

probably coincide with the listed QSO's. We need to bear in mind that the equatorial coordinates of Haro-Luyten are very rough because they were estimated by using grids drawn on tracing paper and the errors in the position may be in many instances of the order of $0^m.2$ in right ascension and 2′ in declination. In Table 1 we listed these additional PHL numbers of the objects that very probably correspond to known QSO's. In the same table we used the QSO-names given by Véron-Cetty and Véron (1985).

As can be seen readily, the majority of the PHL objects in the New Optical Catalogue of Quasi-Stellar Objects (Hewitt and Burbidge 1987) appear also in the Haro-Luyten list of Very Definitely Blue Stars (54 PHL objects, Table II) which have been recognized as QSO's; 23 PHL stars are listed in Table III of blue stars, and even 9 PHL stars are contained in Table IV (Bluish or White Stars). Thus a total of 86 PHL objects out of the list of 8746 blue stars in the region of the South Galactic Pole have already been identified as QSOs; a small percentage indeed, especially if we take into account that from photographic magnitude 16 up to 19.5, there are a total of 7076 PHL objects (see Table V in the paper by Haro and Luyten 1962).

IV. IDENTIFICATION CHARTS OF PHL OBJECTS IN A FIELD CENTERED AT 0^h53^m AND $-11^\circ.5$ (1950)

From the very beginning of our work on the three-image plates with the 48-inch Mount Palomar Schmidt telescope, the main purpose of the authors (Haro and Luyten 1962) was to provide a large number of faint blue stars for statistical studies, and further, to obtain photoelectric magnitudes and colors, proper motions and spectra. We realized, however, that it would require an enormous labor and expense to prepare and print identification charts of all the 49 centers observed; instead we offered to supply identification charts upon request to those who would wish to observe any of the faint blue "stars" photoelectrically, spectroscopically or in radio waves. In fact, a good number of identification charts were provided, especially to radio astronomers. As mentioned earlier, Sandage and Luyten (1967) worked on several centers and especially on the PHL field $1^h36^m + 6^\circ$.

As an attempt to meet the interest of astronomers in this subject, we are presenting the list of stars and the corresponding identification charts for the very blue, blue and bluish objects found in the PHL field centered at 0^h53^m and $-11^\circ.5$ (1950).

Tables 2, 3 and 4 contain the corresponding blue or bluish objects with the original PHL numbers, approximate coordinates (1950) and magnitudes, taken from the 3 different tables of Haro and Luyten paper (1962). The last column in each of the mentioned tables gives the number of the figure (from 1 to 12) in which the different stars are marked. It must be noted that a considerable overlap exists among the figures. To guide the

TABLE 1

PHL OBJECTS THAT ARE PROBABLY QUASI STELLAR OBJECTS

PHL Nos.	Name
373	UM 657
600	PKS 2355-106
833	NGC 253
856	PKS 0048−09
912	Ton. S 180
1195	MC 0148−202
1447	PKS 241+011
1742	2143−156
2191	PKS 2314−116
2278	PKS 2320−035
2565	WEE 1
2981	CS 37
3029	CS 65
4226	UM 676
5225	PKS 2227−08

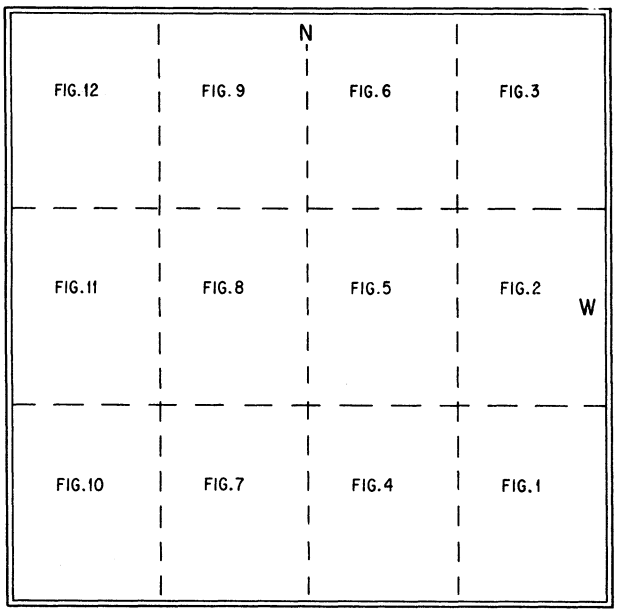

Fig. I. A rough diagram showing the distribution of the figures or charts which cover the whole field of the Mount Palomar 48-inch Schmidt telescope, centered at 0^h53^m and $-11^\circ.5$ (1950). It is convenient to emphasize that there exists a big overlap between the 12 different figures. In all cases North is at the top and West to the right.

TABLE 2

VERY DEFINITELY BLUE STARS

PHL Nos.	RA (1950)	Dec.	*l*	*b*	m_{pg}	B–V	*U–B*	Fig.
812	00 40.6	-09 03	116.4	-71.5	13.9	-0.2	-0.3	3
814	00 41.3	-10 17	116.5	-72.7	14.6	-0.2	-0.3	3
820	00 42.4	-12 45	116.6	-75.2	15.7	-0.2	-0.4	1
826	00 43.9	-14 36	117.4	-77.1	17.9	-0.1	-0.3	1
831	00 44.9	-11 28	119.3	-74.0	17.8	-0.1	-0.3	2
843	00 46.1	-12 48	120.1	-75.3	18.2	-0.1	-0.4	1
849	00 46.8	-13 43	120.7	-76.3	18.2	-0.2	-0.4	1
852	00 47.6	-14 28	121.4	-77.0	18.5	-0.1	-0.3	1
856	00 48.2	-09 43	122.3	-72.3	15.0	-0.2	-0.4	6
869	00 49.3	-11 16	123.2	-73.8	18.1	-0.2	-0.2	5
875	00 49.9	-13 52	123.9	-76.4	17.1	-0.2	-0.5	4
879	00 50.4	-08 50	124.0	-71.4	18.3	-0.2	-0.3	6,9
883	00 51.1	-11 42	124.8	-74.2	17.8	-0.2	-0.4	5
887	00 51.7	-10 03	125.2	-72.6	18.3	-0.1	-0.3	9
888	00 51.7	-11 37	125.4	-74.2	18.3	-0.1	-0.3	5
904	00 53.3	-09 02	126.3	-71.6	16.4	-0.3	-0.5	6,9
905	00 53.4	-09 53	126.5	-72.4	18.4	-0.2	-0.2	6,9
914	00 55.2	-09 02	127.8	-71.5	17.9	-0.1	-0.3	6
917	00 55.4	-13 42	129.5	-76.2	17.6	-0.2	-0.4	4,7
918	00 55.5	-08 40	127.9	-71.2	17.7	-0.2	-0.3	9
919	00 55.6	-13 05	129.4	-75.6	18.3	-0.2	-0.3	4,7
928	00 56.9	-10 52	129.8	-73.4	18.2	-0.1	-0.4	8
931	00 57.1	-09 00	129.5	-71.5	18.1	-0.1	-0.3	9
943	00 58.7	-10 02	130.9	-72.5	18.2	-0.1	-0.3	12
945	00 58.8	-09 44	130.9	-72.2	17.5	-0.2	-0.5	12
946	00 58.8	-13 45	133.0	-76.2	18.7	-0.1	-0.3	7,10
950	00 59.5	-12 41	133.0	-75.1	18.0	-0.2	-0.4	10
951	00 59.6	-10 55	132.1	-73.3	18.6	-0.2	-0.2	11
953	00 59.8	-10 32	132.1	-72.9	16.9	-0.2	-0.4	11
955	01 00.1	-12 36	133.5	-75.0	18.1	-0.1	-0.3	10
956	01 00.5	-09 24	132.1	-71.8	18.3	-0.2	-0.2	12
963	01 00.8	-10 16	132.8	-72.6	18.5	-0.1	-0.3	11
974	01 02.2	-09 26	133.4	-71.8	18.1	-0.2	-0.3	12
980	01 02.8	-14 16	137.4	-76.5	16.5	-0.2	-0.5	10
982	01 03.3	-13 03	136.8	-75.3	18.2	-0.2	-0.4	10
983	01 03.4	-08 42	134.0	-71.0	18.0	-0.2	-0.4	12
991	01 04.2	-10 50	135.9	-73.1	18.3	-0.1	-0.3	11
993	01 04.6	-11 55	137.0	-74.1	18.5	-0.2	-0.3	11

reader we include a rough diagram, (Figure I), showing the distribution of the figures which cover the whole field of the corresponding Mount Palomar Schmidt plate. In all cases north is at the top and west to the right. It should be of interest to remark that after a careful revision of all the catalogues already published

TABLE 3

BLUE STARS

PHL	RA (1950)	Dec.	*l*	*b*	m_{pg}	U–V	Fig.
2897	00 40.5	-09 28	116.2	-72.0	18.6	-0.2	3
2903	00 40.6	-08 38	116.6	-71.1	18.0	-0.2	3
2904	00 40.6	-13 36	114.5	-76.1	18.6	-0.2	1
2905	00 40.8	-12 39	115.2	-75.1	18.4	-0.2	1
2911	00 41.3	-11 32	116.2	-74.0	18.3	-0.2	2
2921	00 42.2	-12 00	116.8	-74.5	18.4	-0.2	2
2922	00 42.3	-10 46	117.3	-73.3	18.2	-0.2	2
2928	00 42.7	-14 17	116.2	-76.8	18.0	-0.2	1
2933	00 43.2	-19 38	113.1	-82.1	18.7	-0.2	1
2935	00 43.3	-11 06	118.1	-73.6	18.5	-0.2	2
2937	00 43.4	-13 20	117.5	-75.9	18.1	-0.2	1
2950	00 44.1	-11 46	118.6	-74.3	18.5	-0.3	2
2952	00 44.2	-14 36	117.8	-77.2	18.7	-0.2	1
2955	00 44.3	-09 35	119.3	-72.1	17.9	-0.2	3
2965	00 44.7	-08 58	119.7	-71.5	18.6	-0.3	3
2968	00 44.8	-13 17	118.9	-75.9	18.8	-0.2	1
2971	00 44.9	-14 07	118.7	-76.7	18.0	-0.3	1
2973	00 45.0	-13 25	119.0	-76.0	18.2	-0.3	1
2976	00 45.2	-10 07	119.9	-72.7	18.5	-0.3	3
2979	00 45.6	-14 14	119.5	-76.8	16.6	-0.3	1
2985	00 46.2	-12 35	120.4	-75.2	17.9	-0.2	1
2999	00 46.8	-14 29	120.7	-77.1	18.4	-0.2	1
3001	00 47.1	-12 11	121.3	-74.8	18.3	-0.2	2,5
3004	00 47.2	-13 11	121.3	-75.8	18.3	-0.2	1
3018	00 47.9	-12 18	121.9	-74.8	18.4	-0.3	2,5
3023	00 48.2	-11 22	122.2	-73.9	18.5	-0.3	2,5
3024	00 48.4	-12 45	122.4	-75.3	18.6	-0.3	4
3025	00 48.4	-08 44	122.5	-71.3	18.6	-0.3	6
3027	00 48.6	-12 21	122.6	-74.9	18.4	-0.3	4
3028	00 48.7	-12 39	122.7	-75.2	18.7	-0.3	4
3034	00 49.0	-10 06	122.9	-72.7	18.8	-0.3	6
3044	00 49.7	-09 42	123.5	-72.2	16.0	-0.3	6
3049	00 50.0	-11 19	123.8	-73.9	18.6	-0.2	5
3053	00 50.2	-11 18	124.0	-73.8	15.1	-0.2	5
3056	00 50.2	-14 16	124.2	-76.8	18.6	-0.3	4
3073	00 51.0	-90 46	124.6	-72.3	18.4	-0.3	6,9
3077	00 51.2	-11 20	124.9	-73.9	18.5	-0.2	5
3080	00 51.2	-12 46	125.1	-75.3	18.4	-0.3	4,7
3084	00 51.4	-12 01	125.2	-74.6	18.9	-0.3	5
3094	00 52.0	-12 37	125.8	-75.2	18.9	-0.2	4,7
3101	00 52.1	-10 09	125.5	-72.7	17.3	-0.3	6
3108	00 52.4	-13 18	126.3	-75.8	18.9	-0.3	4,7
3110	00 52.6	-12 02	126.3	-74.6	18.5	-0.2	5
3114	00 52.7	-08 36	125.8	-71.1	17.7	-0.2	6,9
3120	00 53.0	-08 48	126.0	-71.3	17.0	-0.2	6,9
3121	00 53.0	-13 22	127.0	-75.9	18.3	-0.2	4,7
3131	00 53.6	-11 30	127.1	-74.0	18.3	-0.2	5,8
3136	00 53.7	-12 12	127.3	-74.7	18.4	-0.3	5

TABLE 3 (CONTINUED)

PHL	RA(1950)	Dec.	*l*	*b*	m_{pg}	*U–V*	Fig.
3139	00 53.9	-13 12	127.8	-75.7	16.7	-0.2	4,7
3152	00 54.6	-11 31	128.0	-74.1	18.7	-0.2	5,8
3163	00 55.0	-09 50	127.9	-72.4	18.5	-0.3	6,9
3167	00 55.2	-12 04	128.7	-74.6	18.7	-0.3	8
3172	00 55.4	-13 43	129.5	-76.2	18.8	-0.2	4,7
3182	00 56.1	-10 44	129.0	-73.3	18.2	-0.3	8
3183	00 56.1	-10 42	129.0	-73.2	18.6	-0.2	8
3191	00 56.7	-11 45	129.9	-74.2	18.9	-0.3	8
3194	00 56.9	-10 12	129.5	-72.7	18.6	-0.3	8,9
3197	00 57.0	-10 17	129.6	-72.8	18.9	-0.2	8,9
3198	00 57.0	-09 00	129.2	-71.5	18.5	-0.3	9
3200	00 57.2	-12 12	130.6	-74.7	18.3	-0.2	8
3212	00 57.6	-12 52	131.3	-75.3	18.9	-0.2	7,10
3215	00 57.7	-09 31	129.9	-72.0	18.9	-0.2	9
3216	00 57.7	-13 42	131.8	-76.2	18.6	-0.2	7,10
3219	00 57.8	-09 22	130.0	-71.8	18.8	-0.3	9
3223	00 58.1	-10 49	130.8	-73.3	18.2	-0.2	11
3225	00 58.2	-12 37	131.7	-75.1	17.8	-0.2	7,10
3229	00 58.2	-14 43	133.1	-77.1	18.2	-0.2	7,10
3244	00 58.8	-13 31	132.8	-75.9	18.8	-0.3	7,10
3254	00 59.4	-09 02	131.1	-71.5	18.7	-0.2	12
3259	00 59.6	-09 36	131.5	-72.0	16.3	-0.3	12
3261	00 59.7	-14 16	134.3	-76.6	18.3	-0.2	10
3268	01 00.0	-12 42	133.5	-75.1	18.3	-0.2	10
3284	01 00.6	-10 54	132.9	-73.3	18.6	-0.2	11
3299	01 01.2	-14 40	136.2	-77.0	17.9	-0.2	10
3306	01 02.2	-10 20	133.9	-72.7	18.7	-0.2	11,12
3307	01 02.4	-13 01	135.9	-75.3	18.3	-0.2	10
3316	01 03.0	-11 18	135.2	-73.6	18.0	-0.3	11
3318	01 03.1	-14 33	138.0	-76.7	16.7	-0.3	10
3320	01 03.2	-09 38	134.3	-71.9	17.8	-0.2	12
3330	01 03.9	-10 32	135.4	-72.8	18.6	-0.3	11,12
3335	01 04.2	-12 59	137.6	-75.2	18.3	-0.3	10
3337	01 04.4	-09 44	135.3	-72.0	18.9	-0.2	12
3338	01 04.4	-09 44	135.3	-72.0	18.9	-0.2	12

TABLE 4

BLUISH OR WHITE STARS

PHL	RA (1950)	Dec.	*l*	*b*	m_{pg}	*U–V*	Fig.
6535	00 40.2	-12 35	114.7	-75.0	17.7	0.0	1
6537	00 40.2	-10 49	115.5	-73.3	18.3	-0.1	2
6538	00 40.3	-11 45	115.2	-74.2	18.5	-0.1	2
6544	00 40.6	-11 58	115.3	-74.4	18.1	-0.1	2
6545	00 40.6	-12 01	115.3	-74.5	18.5	-0.1	2
6547	00 40.7	-11 46	115.5	-74.2	18.4	-0.1	2
6548	00 40.8	-10 54	116.0	-73.4	18.1	0.0	2
6549	00 40.8	-14 30	114.2	-77.0	18.3	0.0	1

TABLE 4 (CONTINUED)

PHL	RA (1950)	Dec.	*l*	*b*	m_{pg}	*U*−*V*	Fig.
6551	00 40.8	-10 53	116.0	-73.4	16.6	-0.1	2
6557	00 41.4	-10 09	116.7	-72.7	16.7	-0.1	3
6560	00 41.4	-11 28	116.3	-74.0	18.3	-0.1	2
6572	00 42.0	-09 00	117.6	-71.5	17.8	-0.1	3
6574	00 42.1	-10 38	117.2	-73.2	18.1	-0.1	2
6578	00 42.3	-13 54	116.1	-76.4	18.9	-0.1	1
6583	00 42.6	-12 24	117.0	-74.9	18.3	0.0	1
6607	00 43.4	-08 50	118.7	-71.4	16.6	0.0	3
6613	00 43.7	-13 40	117.6	-76.2	16.7	0.0	1
6618	00 43.8	-13 36	117.8	-76.1	18.5	-0.1	1
6626	00 44.4	-11 05	119.0	-73.6	16.7	0.0	2
6627	00 44.4	-10 28	119.2	-73.0	18.4	0.0	2,3
6632	00 44.6	-12 46	118.8	-75.3	18.8	0.0	1
6633	00 44.6	-09 04	119.6	-71.6	17.9	-0.1	3
6639	00 44.6	-08 26	119.7	-71.0	18.3	-0.1	3
6640	00 44.6	-10 27	119.3	-73.0	18.2	-0.1	2
6641	00 44.8	-12 52	119.0	-75.4	17.9	0.0	1
6644	00 44.8	-12 02	119.2	-74.6	18.2	0.0	2
6646	00 44.8	-08 23	119.9	-71.0	18.6	-0.1	3
6648	00 44.9	-13 54	118.8	-76.5	17.6	0.0	1
6649	00 44.9	-10 48	119.5	-73.4	18.3	-0.1	2
6654	00 45.1	-08 44	120.0	-71.3	16.8	0.0	3
6655	00 45.1	-14 19	118.9	-76.9	18.3	0.0	1
6656	00 45.1	-09 48	119.9	-72.4	18.3	-0.1	3
6661	00 45.2	-10 36	119.8	-73.2	18.4	-0.1	2
6664	00 45.4	-12 55	119.6	-75.5	16.6	-0.1	1
6666	00 45.4	-12 01	119.7	-74.6	18.2	-0.1	2
6672	00 45.8	-11 36	120.2	-74.2	17.5	0.0	2
6676	00 46.1	-10 56	120.6	-73.5	16.7	-0.1	2
6677	00 46.2	-14 02	120.2	-76.6	16.9	0.0	2
6689	00 46.5	-11 44	120.8	-74.3	16.9	0.0	2
6690	00 46.5	-09 02	121.1	-71.6	18.2	0.0	3
6691	00 46.6	-13 44	120.6	-76.3	16.6	0.0	1
6692	00 46.6	-10 40	121.0	-73.3	18.4	0.0	2
6700	00 47.0	-12 00	121.3	-74.6	17.0	0.0	2
6714	00 47.4	-10 06	121.8	-72.7	17.3	0.0	3
6715	00 47.4	-10 46	121.8	-73.4	17.7	0.0	2,5
6716	00 47.4	-11 28	121.7	-74.1	18.0	0.0	2,5
6719	00 47.6	-12 26	121.8	-75.0	18.3	0.0	1,2,5
6723	00 47.6	-12 14	121.9	-74.8	18.1	-0.1	2,5
6725	00 47.7	-11 29	122.0	-74.1	17.9	0.0	2,5
6739	00 48.2	-09 34	122.3	-72.1	17.9	-0.1	6
6740	00 48.2	-10 04	122.3	-72.6	18.4	-0.1	6
6746	00 48.4	-11 20	122.4	-73.9	18.2	-0.1	5
6747	00 48.4	-12 19	122.4	-74.9	18.6	-0.1	5
6748	00 48.5	-08 45	122.6	-71.3	18.6	0.0	6
6757	00 48.8	-13 12	122.8	-75.7	18.3	0.0	4
6765	00 49.1	-10 04	123.0	-72.6	18.7	0.0	6
6770	00 49.2	-10 28	123.1	-73.0	18.1	-0.1	5,6
6771	00 49.2	-11 06	123.1	-73.6	18.6	-0.1	5

TABLE 4 (CONTINUED)

PHL	RA (1950)	Dec.	l	b	m_{pg}	$U-V$	Fig.
6776	00 49.4	-10 04	123.3	-72.6	18.0	0.0	6
6781	00 49.6	-11 24	123.5	-73.9	18.8	-0.1	5
6783	00 49.7	-10 56	123.6	-73.5	12.3	-0.1	5
6785	00 49.8	-11 30	123.7	-74.0	16.7	0.0	5
6803	00 50.2	-12 50	124.1	-75.4	18.2	0.0	4
6810	00 50.4	-12 22	124.3	-74.9	18.1	0.0	4,5
6811	00 50.4	-09 46	124.1	-72.3	18.5	-0.1	6,9
6816	00 50.6	-14 04	124.5	-76.7	18.9	-0.1	4
6818	00 50.7	-11 24	124.4	-74.0	16.3	0.0	5
6822	00 50.8	-13 20	124.7	-75.9	15.7	-0.1	4,7
6823	00 50.8	-08 40	124.3	-71.3	18.4	-0.1	6,9
6825	00 50.9	-14 44	125.0	-77.3	13.4	0.0	4
6835	00 51.2	-11 25	124.9	-74.0	18.4	0.0	5
6836	00 51.2	-10 38	124.8	-73.2	16.6	-0.1	5,6
6837	00 51.2	-12 01	124.9	-74.6	18.5	-0.1	5
6838	00 51.3	-13 02	125.2	-75.6	17.8	-0.1	4,7
6842	00 51.4	-08 32	124.8	-71.1	18.4	-0.1	6,9
6854	00 51.9	-12 04	125.6	-74.7	18.7	0.0	5
6862	00 52.0	-10 59	125.5	-73.6	18.2	-0.1	5,8
6884	00 52.8	-11 02	126.3	-73.6	18.3	-0.1	5,8
6886	00 52.9	-09 35	126.1	-72.2	18.5	-0.1	6,9
6887	00 53.0	-09 35	126.2	-72.1	15.9	0.0	6,9
6889	00 53.0	-13 18	126.9	-75.9	18.1	-0.1	4,7
6893	00 53.2	-09 30	126.3	-72.1	18.4	0.0	6,9
6897	00 53.2	-10 17	126.5	-72.9	18.2	-0.1	5,6,8,9
6902	00 53.3	-11 44	126.8	-74.3	16.0	-0.1	5,8
6934	00 54.6	-08 58	127.3	-71.5	18.5	-0.1	6,9
6939	00 54.8	-10 48	127.9	-73.3	18.4	-0.1	5,9
6940	00 54.8	-13 11	128.7	-75.7	18.2	-0.1	4,7
6946	00 55.2	-14 03	129.4	-76.6	18.7	0.0	4,7
6949	00 55.2	-13 46	129.3	-76.3	18.3	-0.1	4
6950	00 55.3	-13 44	129.4	-76.3	17.7	-0.1	4,7
6951	00 55.3	-14 02	129.5	-76.6	18.2	-0.1	4,7
6961	00 55.6	-13 16	129.5	-75.8	18.6	-0.1	4,7
6966	00 56.0	-12 36	129.6	-75.1	18.3	0.0	7
6969	00 56.0	-14 12	130.4	-76.7	18.8	-0.1	4,7
6971	00 56.1	-09 42	128.7	-72.2	18.4	0.0	9
6972	00 56.2	-11 50	129.5	-74.3	17.9	0.0	8
6975	00 56.4	-09 06	128.8	-71.6	17.4	0.0	9
6978	00 56.4	-14 11	130.8	-76.7	18.5	-0.1	7
6982	00 56.6	-11 01	129.6	-73.5	18.9	-0.1	8
6986	00 57.0	-14 37	131.6	-77.0	17.8	0.0	7
6987	00 57.0	-10 38	129.8	-73.1	18.2	0.0	8
6990	00 57.1	-11 47	130.3	-74.3	17.8	-0.1	8
6991	00 57.1	-12 48	130.8	-75.3	18.4	-0.1	7
6997	00 57.2	-11 41	130.4	-74.2	17.5	-0.1	8
6999	00 57.2	-09 22	129.5	-71.9	18.4	-0.1	9
7000	00 57.2	-11 06	130.1	-73.6	18.5	-0.1	8
7006	00 57.4	-13 12	131.3	-75.7	18.7	-0.1	7
7008	00 57.6	-14 10	132.0	-76.6	16.3	-0.1	7,10

TABLE 4 (CONTINUED)

PHL	RA (1950)	Dec.	*l*	*b*	mpg	*U–V*	Fig.
7020	00 58.2	-13 00	131.9	-75.4	17.0	-0.1	7,10
7024	00 58.4	-11 16	131.2	-73.7	18.7	0.0	11
7025	00 58.4	-13 46	132.6	-76.2	16.6	-0.1	7,10
7027	00 58.6	-12 07	131.8	-74.6	18.5	0.0	11
7028	00 58.6	-14 35	133.3	-77.0	18.7	-0.1	7
7032	00 58.9	-10 22	131.2	-72.8	17.8	0.0	11
7038	00 59.1	-12 04	132.2	-74.5	18.3	0.0	11
7053	00 59.7	-11 44	132.6	-74.1	17.9	0.0	11
7055	00 59.8	-09 18	131.5	-71.7	17.8	0.0	12
7056	00 59.8	-12 36	133.2	-75.0	18.4	0.0	10
7060	00 59.9	-13 47	134.1	-76.1	16.7	0.0	10
7062	00 59.9	-14 01	134.3	-76.4	18.4	-0.1	10
7063	01 00.0	-13 33	134.0	-75.9	18.3	0.0	10
7064	01 00.0	-11 14	132.6	-73.6	18.5	0.0	11
7072	01 00.3	-10 06	132.3	-72.5	18.4	-0.1	12
7082	01 00.8	-09 16	132.3	-71.7	16.6	-0.1	12
7087	01 01.0	-11 12	133.4	-73.6	18.2	-0.1	11
7089	01 01.1	-09 35	132.7	-72.0	17.9	-0.1	12
7090	01 01.2	-14 02	135.6	-76.3	17.7	0.0	10
7096	01 01.3	-13 57	135.6	-76.2	18.2	-0.1	10
7105	01 01.6	-11 36	134.2	-73.9	17.0	0.0	11
7107	01 01.6	-09 52	133.2	-72.2	17.9	-0.1	12
7109	01 01.7	-13 52	136.0	-76.1	18.9	-0.1	10
7112	01 01.9	-11 44	134.5	-74.0	17.2	0.0	11
7131	01 02.4	-13 40	136.5	-75.9	18.6	-0.1	10
7134	01 02.8	-12 05	135.6	-74.3	18.7	0.0	11
7136	01 02.9	-12 10	135.7	-74.4	18.5	-0.1	11
7141	01 03.2	-10 32	134.9	-72.8	18.3	0.0	11
7162	01 03.7	-12 07	136.4	-74.3	16.7	-0.1	11
7163	01 03.7	-10 14	135.1	-72.5	18.2	-0.1	11
7167	01 04.2	-12 21	137.0	-74.5	18.6	0.0	11
7168	01 04.2	-12 35	137.2	-74.8	18.8	0.0	10
7169	01 04.2	-12 50	137.4	-75.0	18.5	0.0	10
7174	01 04.4	-13 52	138.6	-76.0	18.5	-0.1	10
7176	01 04.7	-14 02	139.1	-76.1	18.1	-0.1	10

on quasars and active nuclei, we found that only one object of our new Table 2, PHL 856, was identified as being a BL Lac (PKS 0048–09).

We want to express gratitude to our former colleague, Braulio Iriarte, for his collaboration in an earlier phase of this paper. We are also thankful to Dr. Paris Pismis for her critical reading of the manuscript.

REFERENCES

Burbidge, G.R., Crowne, A.H., and Smith, G.E. 1977, *Ap. J. Suppl.*, **33**, 113.
Haro, G. 1956, *Bol. Obs. Tonantzintla y Tacubaya*, 14, 16.
Haro, G. and Luyten, W.J. 1962, *Bol. Obs. Tonantzintla y Tacubaya*, **3**, No. 22, 37.
Hewitt, A. and Burbidge, G. 1980, *Ap. J. Suppl.*, **43**, 57.
Hewitt, A. and Burbidge, G. 1987, *Ap. J. Suppl.*, **63**, No. 1.
Luyten, W.J. 1964, *First Conference on Faint Blue Stars*, ed. W.J. Luyten (The Observatory of University of Minnesota).
Sandage, A. 1965, *Ap. J.*, **141**, 1560.
Sandage, A. and Luyten, W.J. 1967, *Ap. J.*, **148**, 767.
Sandage, A. and Luyten, W.J. 1969, *Ap. J.*, **155**, 913.
Véron-Cetty, M.-P. and Véron, P. 1984, *ESO Sci. Report No. 1.*
Véron-Cetty, M.-P. and Véron, P. 1985, *ESO Sci. Report No. 4.*

E. Chavira: Instituto Nacional de Astrofísica, Optica y Electrónica, Apartado Postal 216, Puebla, Pue., México.
Guillermo Haro: Instituto de Astronomía, UNAM, Apartado Postal 70-264, 04510 México, D.F., México.

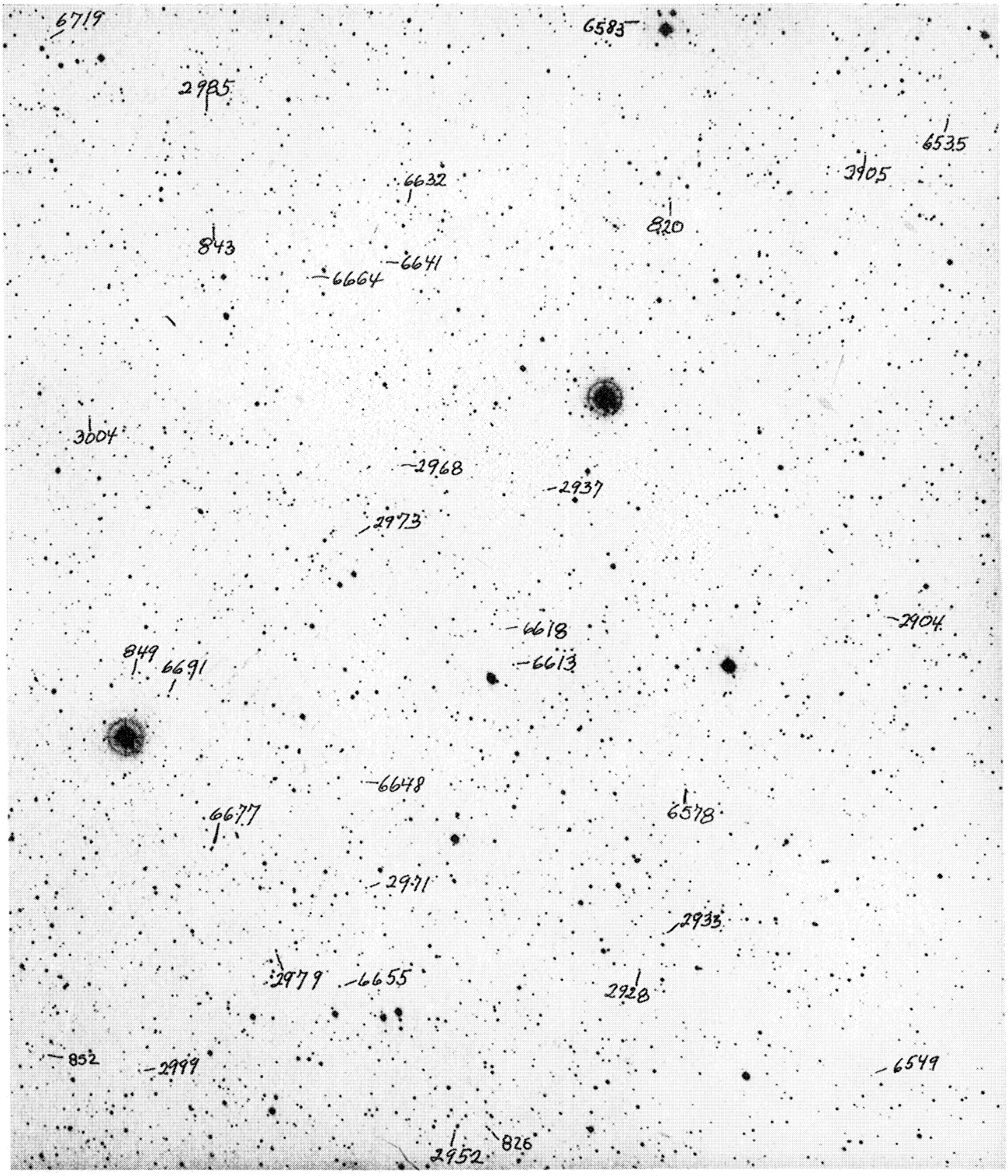

Fig. 1. Identification chart.

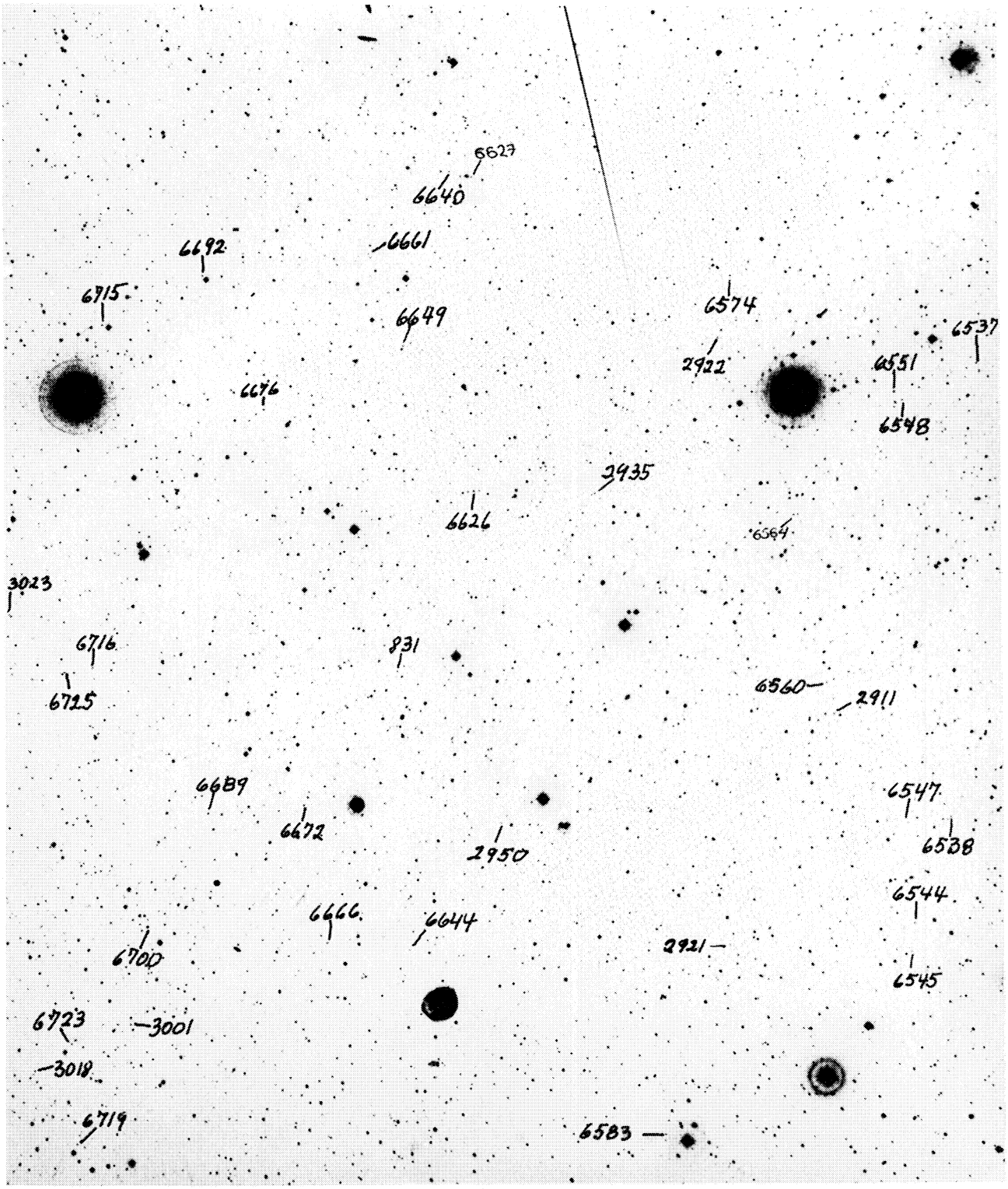

Fig. 2. Identification chart.

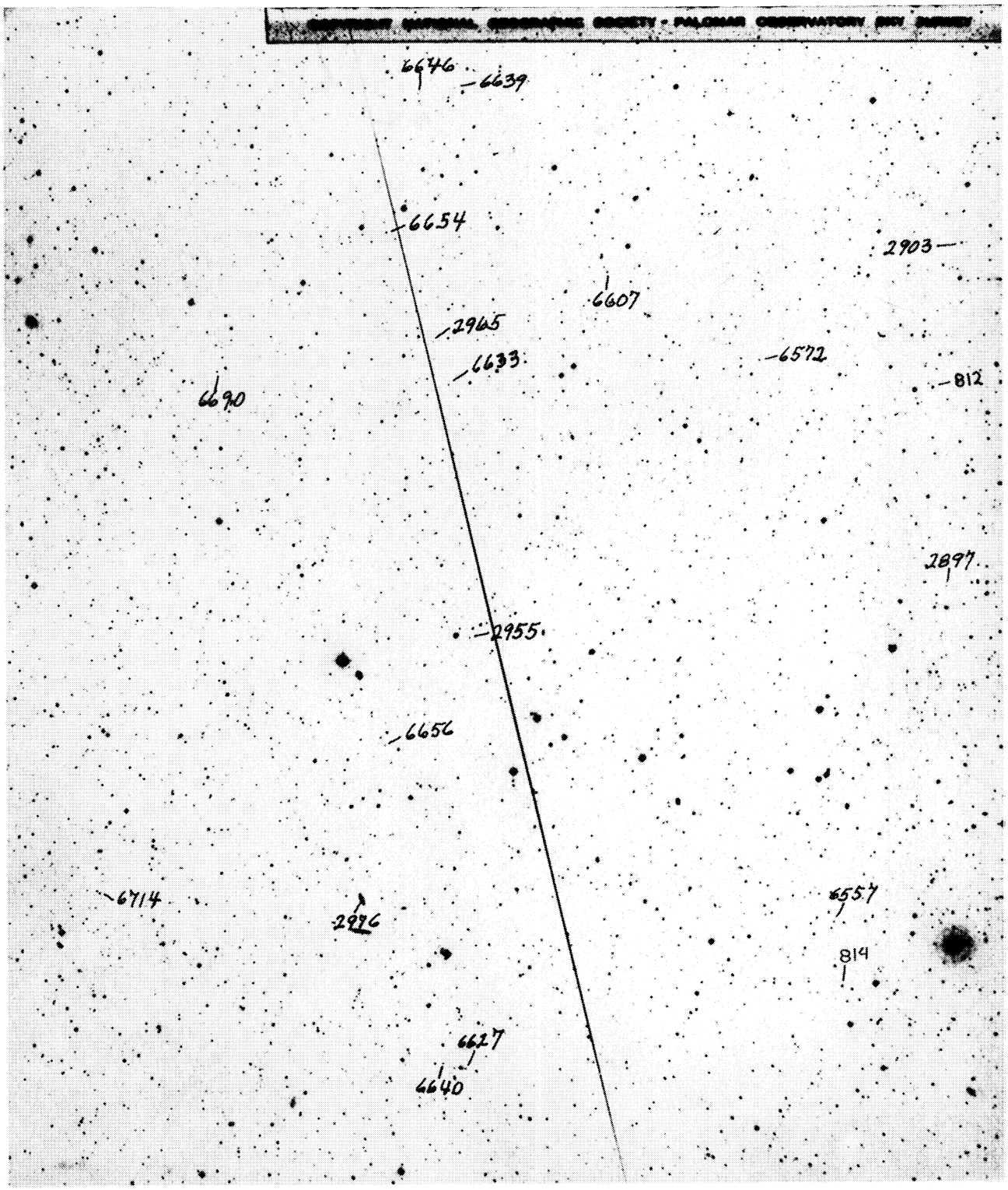

Fig. 3. Identification chart.

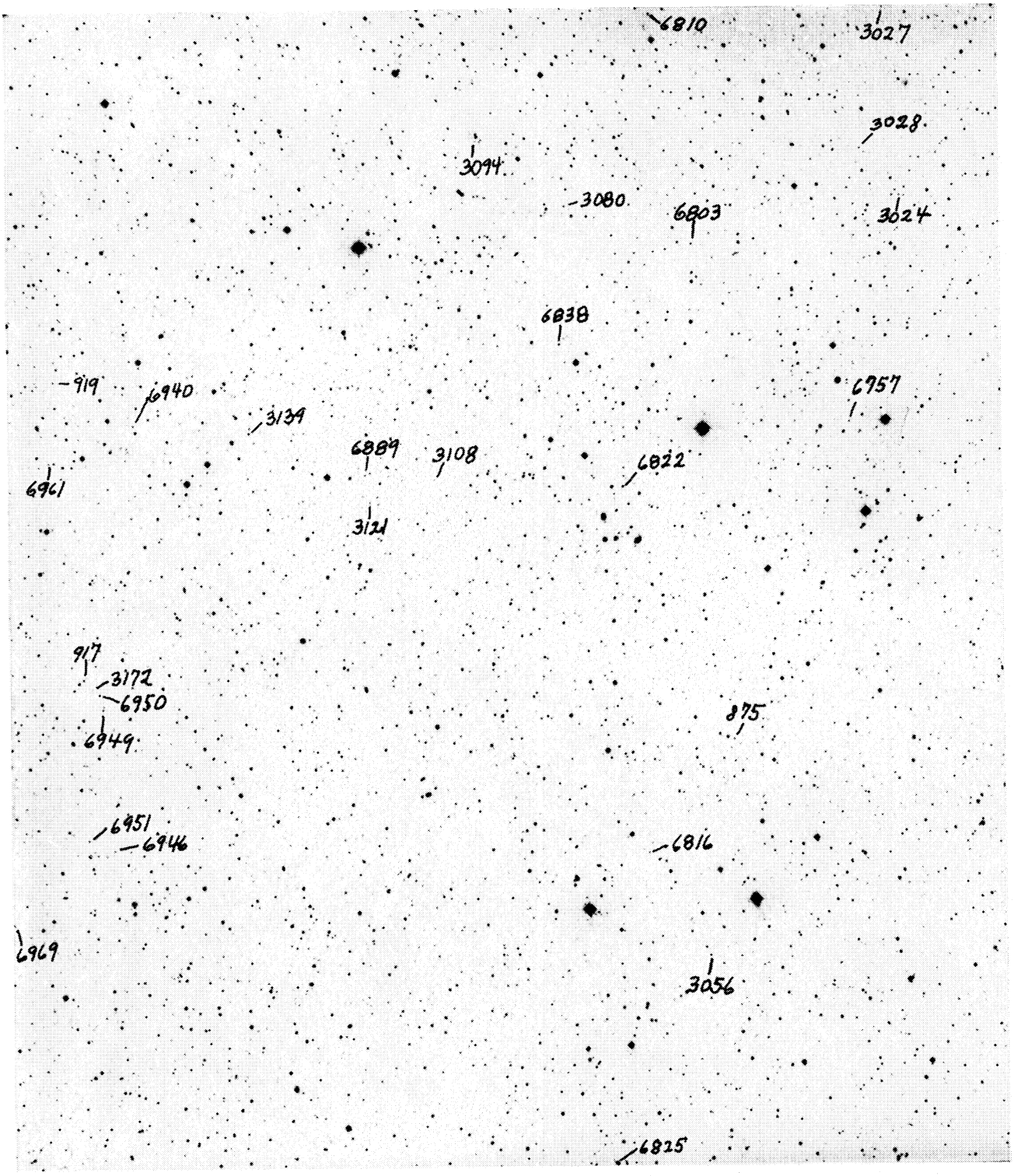

Fig. 4. Identification chart.

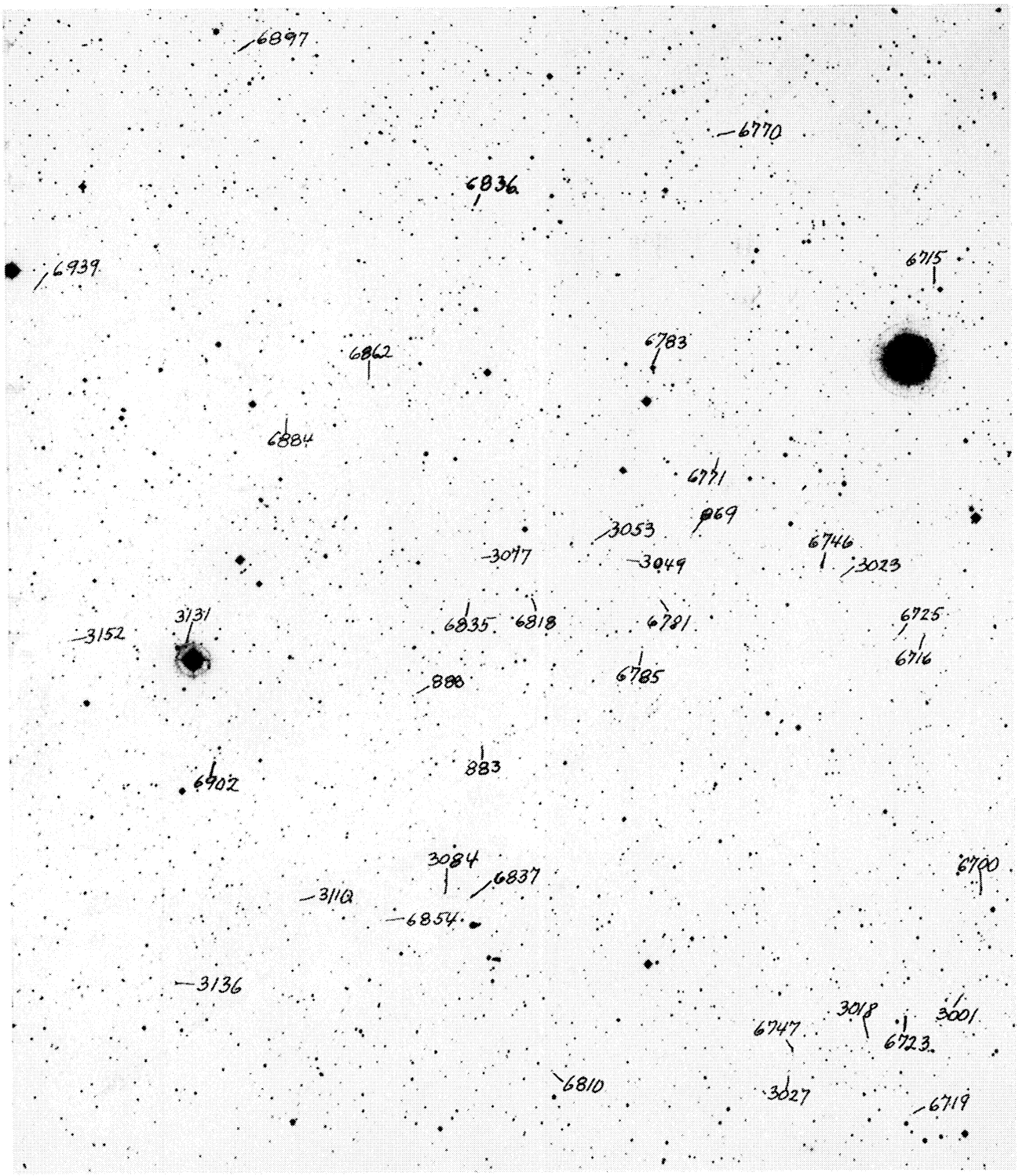

Fig. 5. Identification chart.

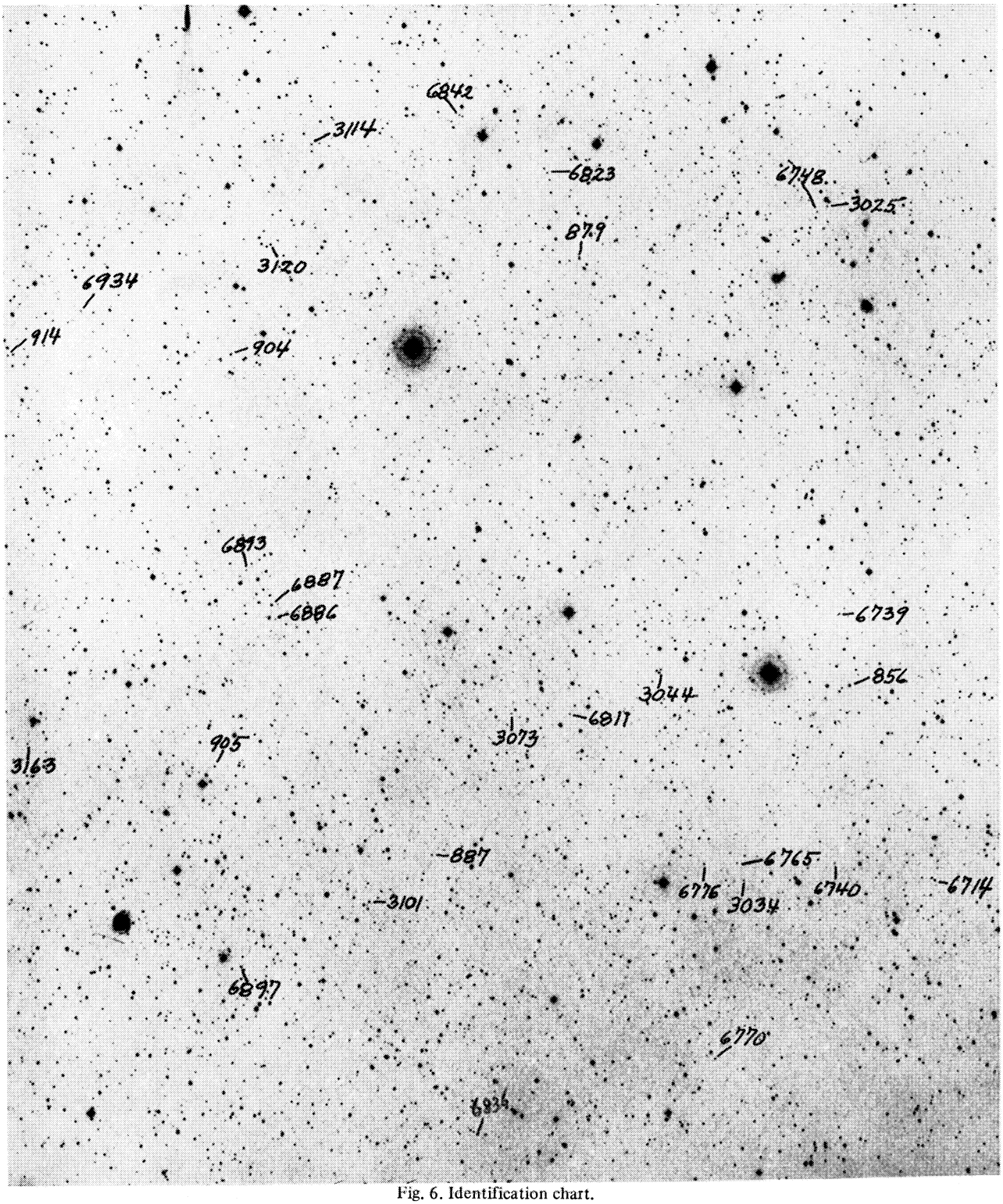

Fig. 6. Identification chart.

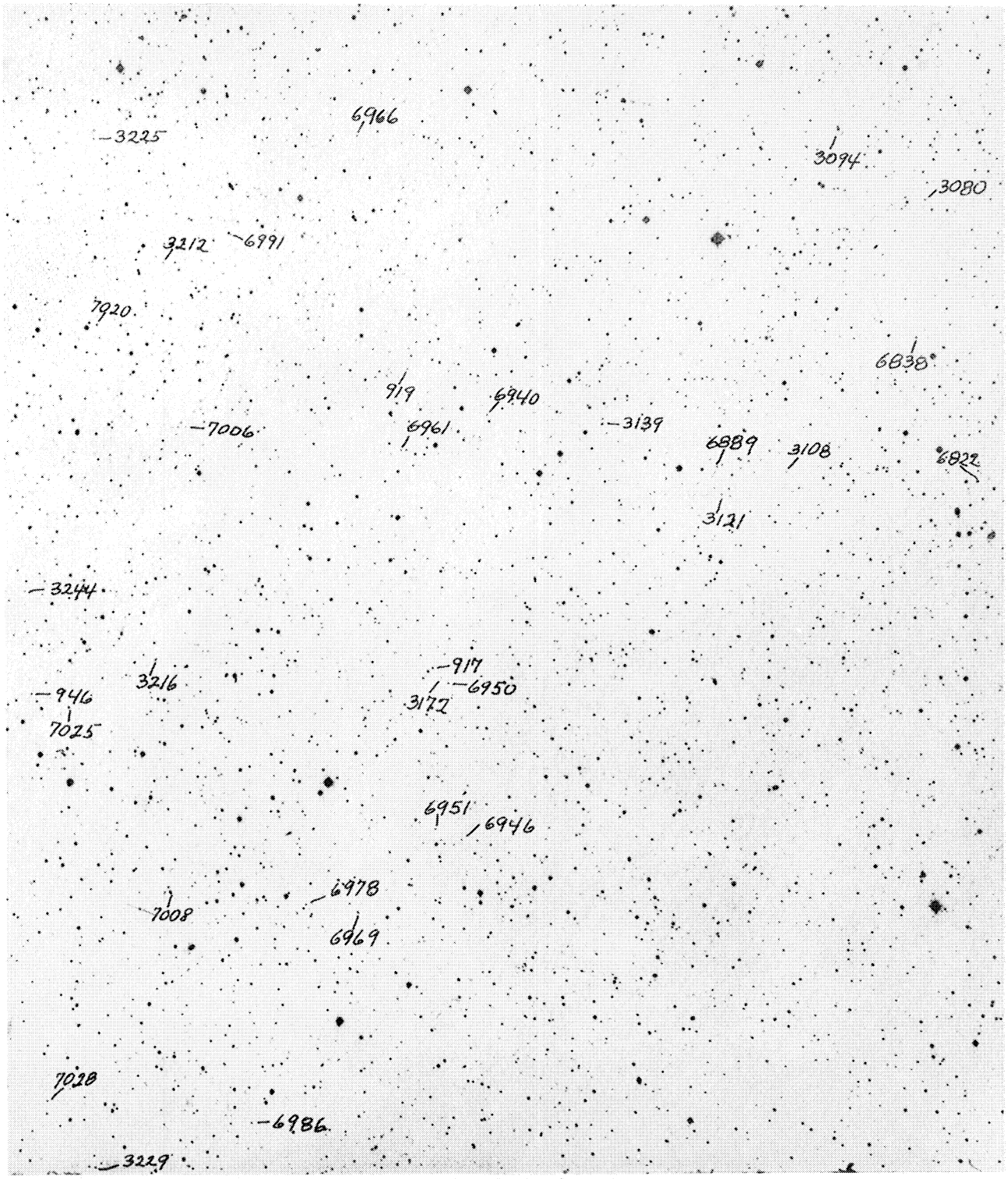

Fig. 7. Identification chart.

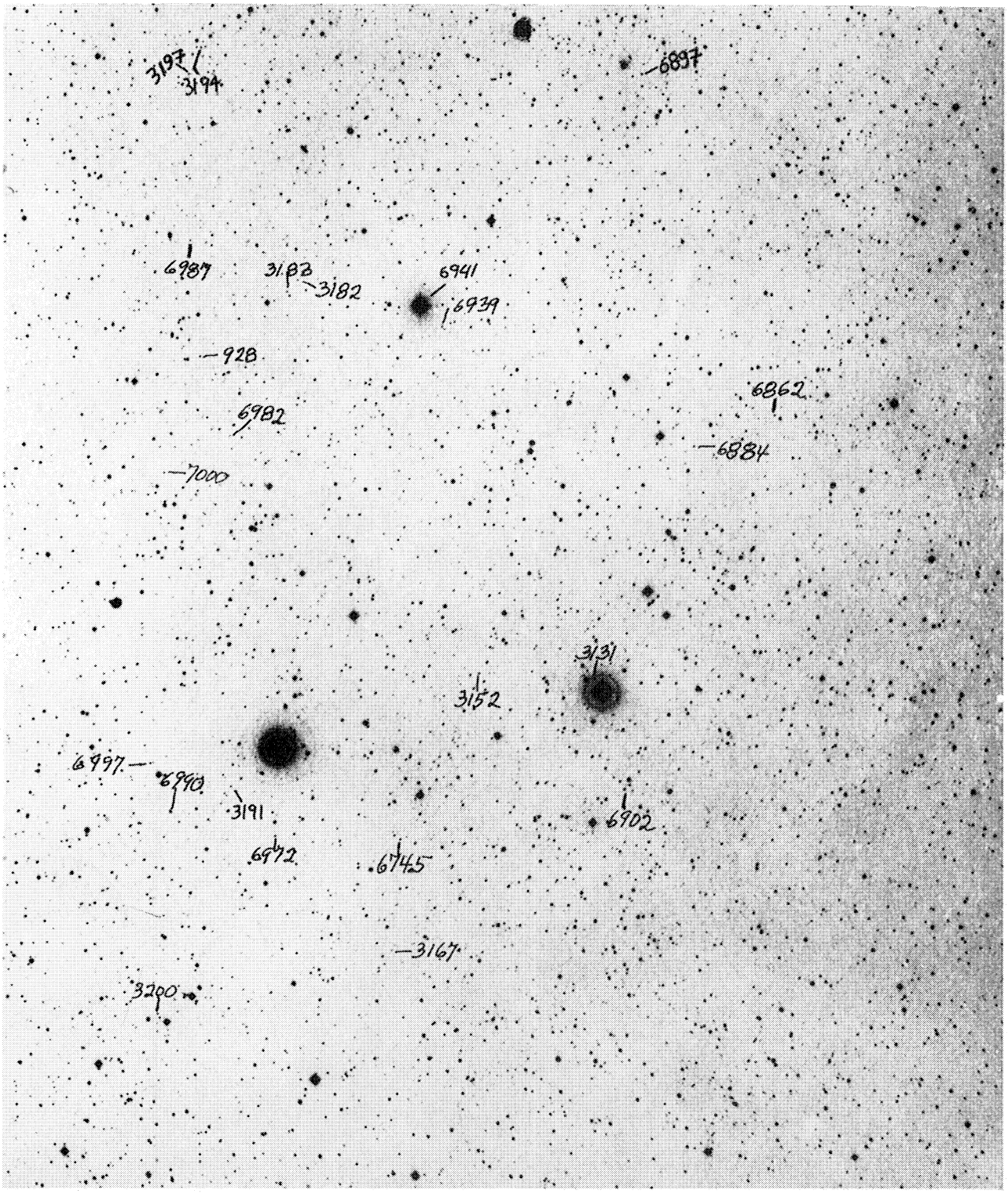

Fig. 8. Identification chart.

G. HARO AND E. CHAVIRA (See page 107)

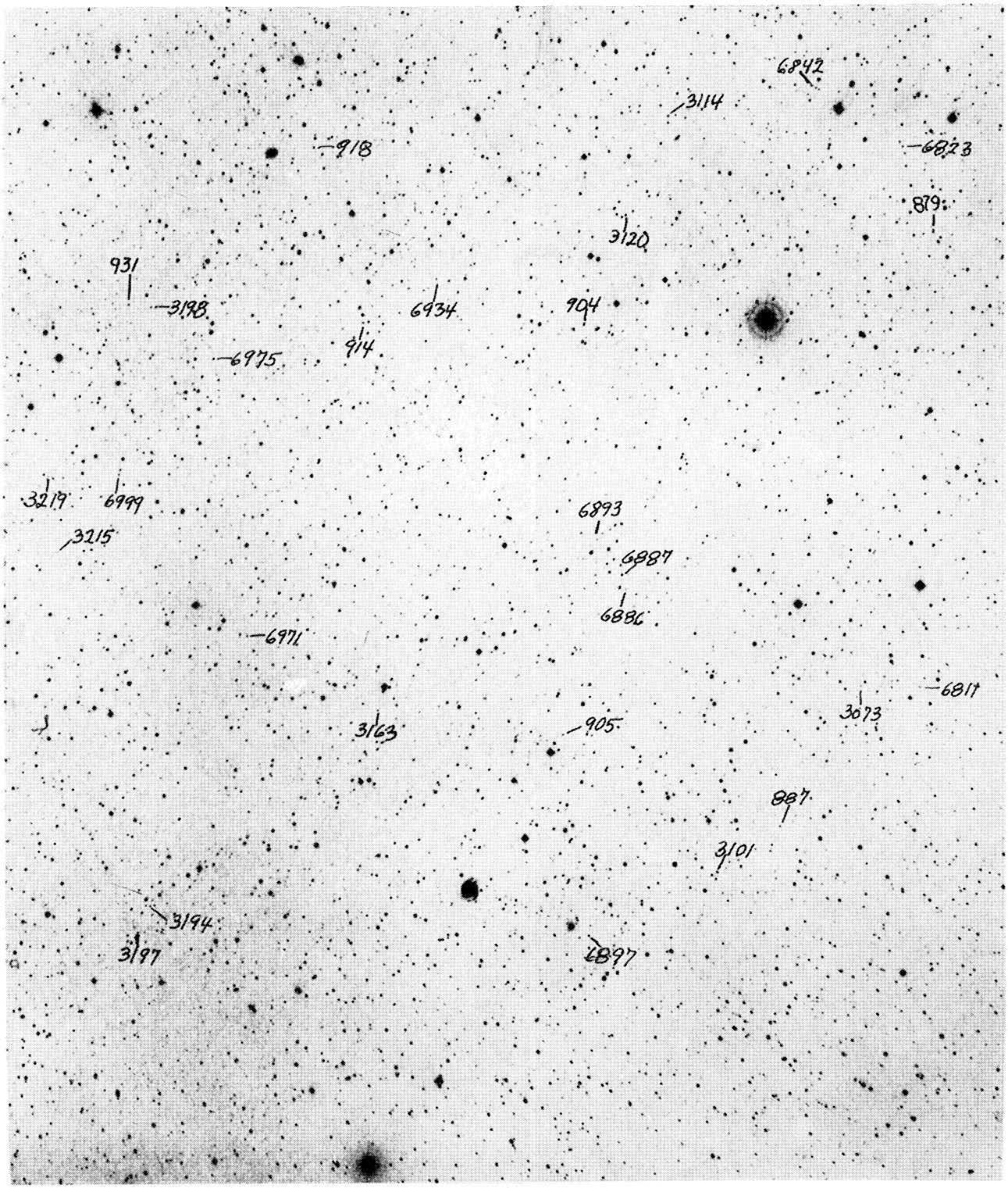

Fig. 9. Identification chart.

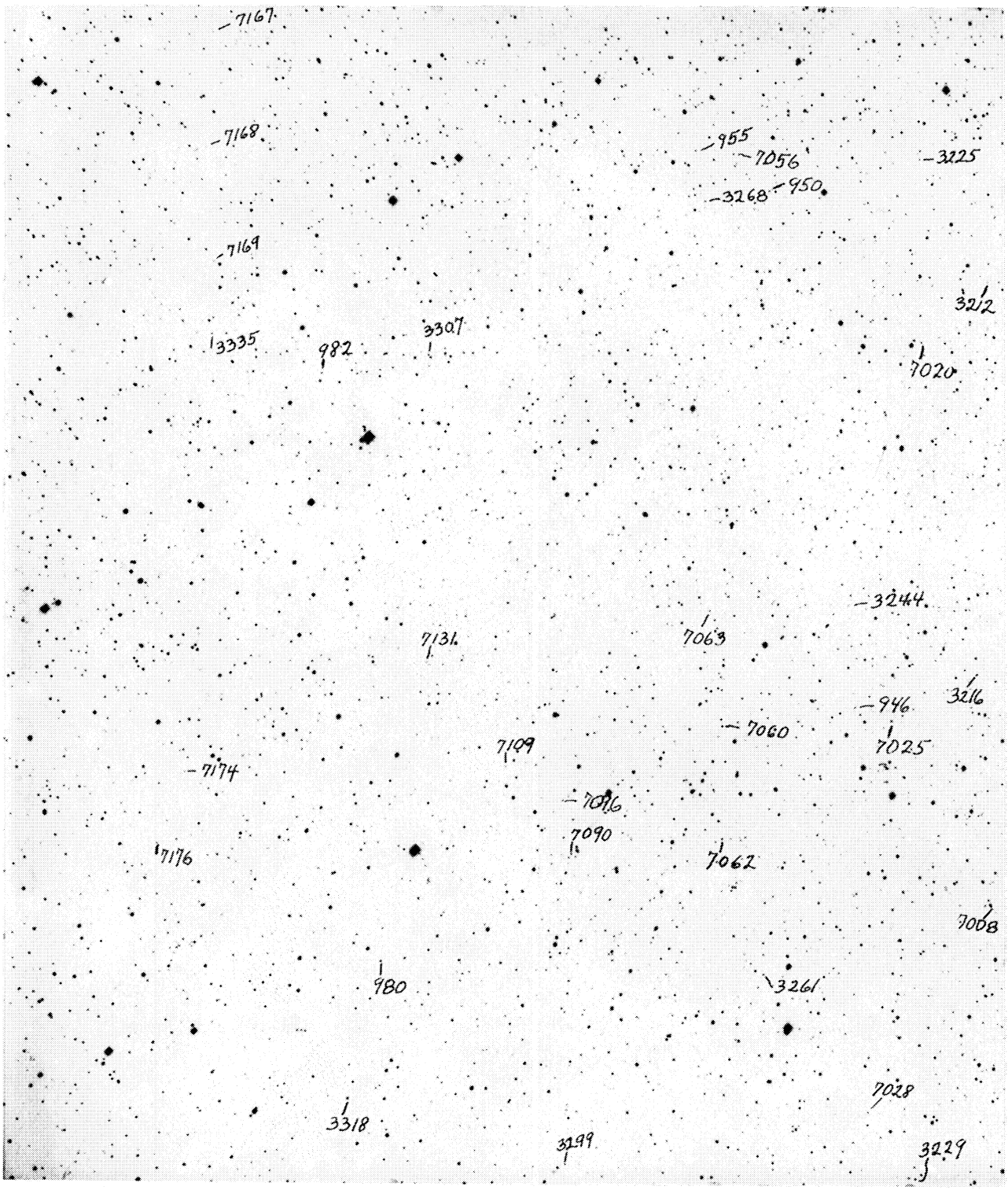

Fig. 10. Identification chart.

G. HARO AND E. CHAVIRA (See page 107)

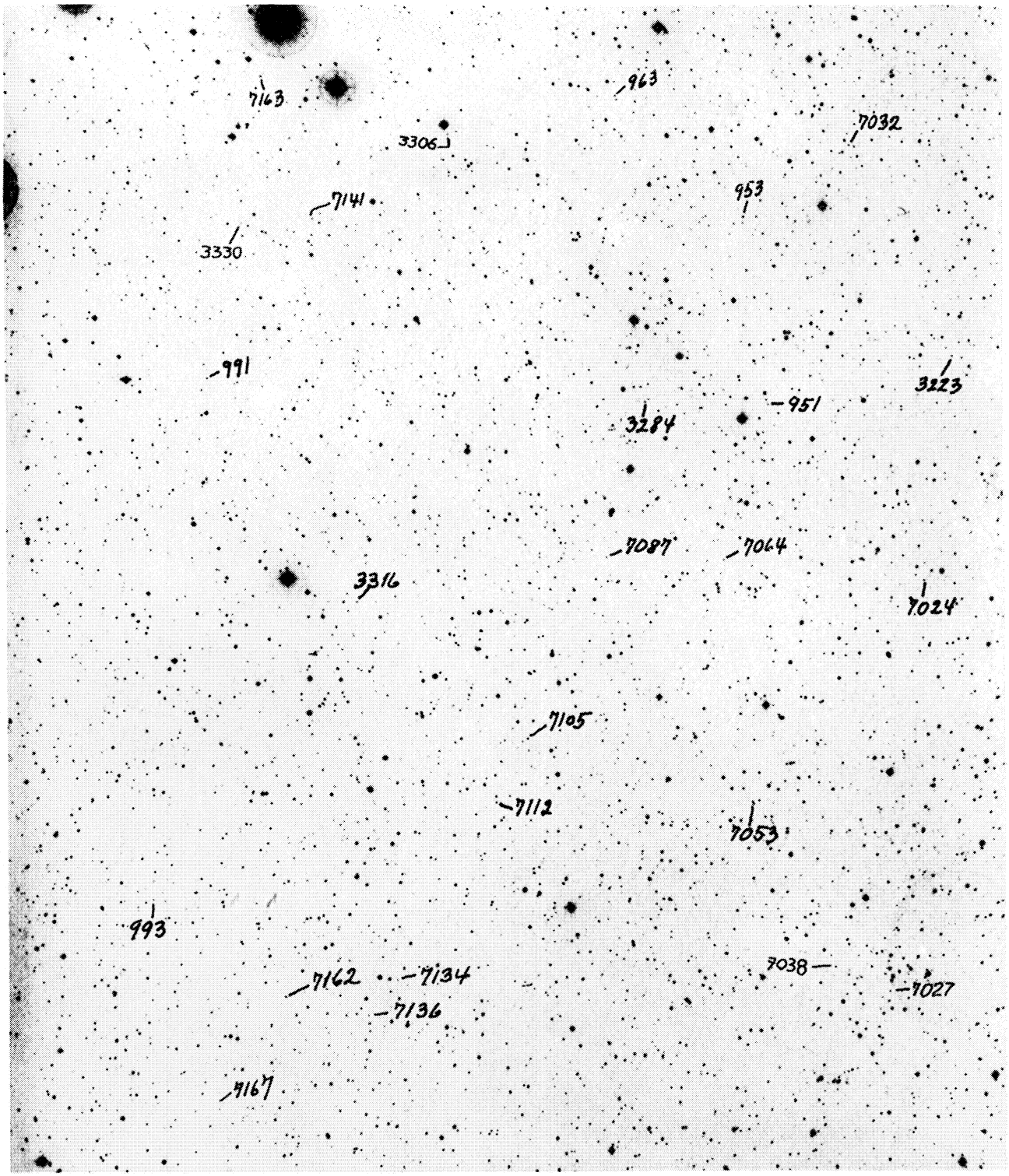

Fig. 11. Identification chart.

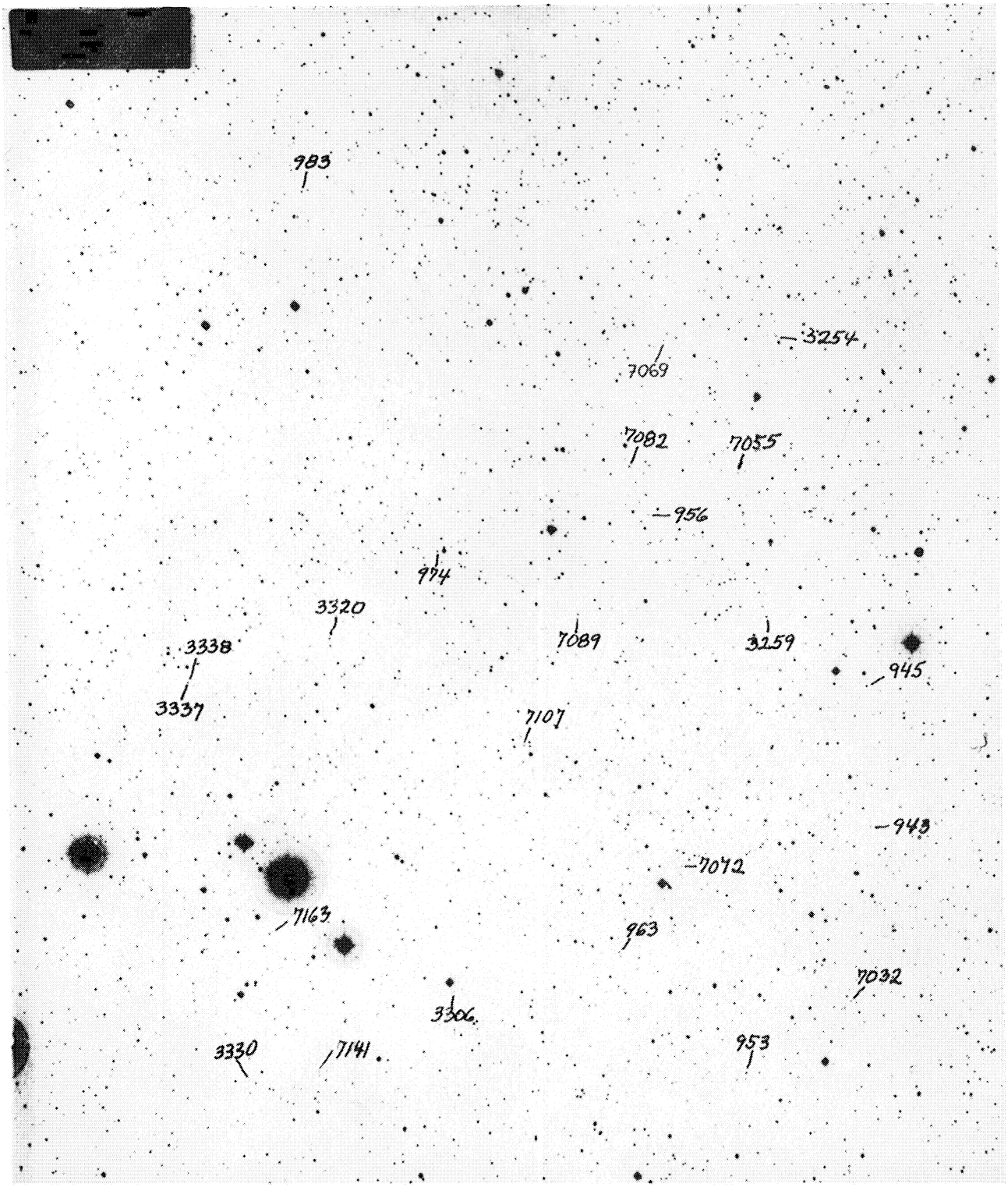

Fig. 12. Identification chart.