ASTRONOMY & ASTROPHYSICS
SUPPLEMENT SERIES

APRIL 1987, PAGE 23

Astron. Astrophys. Suppl. Ser. **69**, 23-31 (1987)

Precise optical positions of strong extragalactic radio sources south of $\delta = +5^\circ$

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Received August 25, accepted October 28, 1986

Summary. — Precise optical positions, relative to the Perth-70 Catalogue, have been derived for 69 sources south of declination + 5 degrees selected from a list of strong and compact extragalactic radio sources given by Ulvestad *et al.* (1981).

Key words : astrometry — radio sources.

1. Introduction

We present the results obtained in a program for determining accurate optical positions of 84 strong radio sources south of declination + 5 degrees, included 23 sources with unknown optical counterpart, as published by Ulvestad *et al.* (1981). The 69 sources positions given in this work are in the Perth-70 Catalogue System (Hog and von der Heide, 1976). This constitutes the fifth and final part of the program undertaken at the Estación Astronómica de Cerro El Roble operated by the Universidad de Chile.

We found an optical counterpart candidate for 11 of the 23 unidentified sources. For 1320–446, 1622–297, 1908–202 and 2106–413 we have already published finding charts and positions (Torres and Wroblewski, 1984) and new positions for them are included in table II. For other 4 sources our candidates agree with those proposed meanwhile by Walter and West (1980) : 1245–197 ; by Savage *et al.* (1982) : 1351–018 ; and by Jauncey *et al.* (1982) : 1936–155 and 2149–307 ; therefore we are not giving their finding charts. For 1015–314, 1657–261 and 1748–253, we present candidates.

Among the remaining 12 sources without optical counterpart in the list of Ulvestad *et al.* (1981), there are 3 that seem to show very faint images impossible to measure in our plates : 0022–423, 0500+019 and 2337–334. For the other 9 sources : 0648–165, 0727–115, 0733–174, 0826–373, 0834–196, 1648+015, 2008–068, 2128+048 and 2210+016 we got empty fields. The empty field we obtained for source 2128+048 is a special case since Comm. 24 Patras Report (1982) classified it as a galaxy of visual magnitude 16.24 while our plate limiting magnitude is about 20.

Sources 0008–421 and 1308–220 reported as galaxies in Ulvestad *et al.* (1981) appear as empty fields on our plates. We did not find either the counterpart of 0019–000 classified as a galaxy of magnitude 20 in Véron and Véron (1975). Our result for the former object is in accordance with Lu (1970) who nevertheless gave a finding chart and position for a galaxy located at about 30 arcsec from the radio position.

54 sources, out of the 84 selected by us, were included in the Patras Report of Comm. 24, as strong and compact extragalactic radio sources appropriate to be used in the establishing of a quasi-inertial reference frame. We give optical positions for 46 of those sources.

2. Observational material, reduction procedure and errors.

The observations were made with the 70/100/210 cm double-meniscus Maksutov astrograph of the Estacion Astronómica de Cerro El Roble of the Universidad de Chile.

A minimum of two plates centred on the radio positions were exposed : a Kodak IIaO or Orwo ZU-1 with 1 min exposure and a Kodak IIaO with 30 min exposure. For sources 0834–201 and 0834–196, half a degree apart, the intermediate position was used. As explained in Wroblewski *et al.* (1981) and in order to minimize magnitude error, the short exposure plates were used to obtain accurate positions for 20 intermediate reference stars of magnitude ~ 14, referred to about 20 stars, fainter than magnitude 8, of Perth-70 Catalogue (Hog and von der Heide, 1976). Quadratic terms were used in all reductions. When the measured position of a catalogued star gave residual equal or

greater than 1.5 arcsec, the star was discarded. The intermediate reference stars were later used, on the deep plates, to obtain the accurate position of the optical counterpart. When the optical counterpart of a source was not found on the deep plates, hypersensitized Kodak IIIaJ and IIIaF unfiltered plates were exposed 40 and 60 min.

The deep plates of sources with unknown optical counterpart were measured twice. Firstly to determine the rectangular coordinates (x, y) of the radio position in the plate, as explained in Anguita and Pedreros (1977). Secondly, if the counterpart candidate appeared inside a squared reticle — of 8×8 arcsec at the plates scale — centred on the radio position, the plate was measured again to determine the precise equatorial optical position. If the determined optical and radio positions of a source gave a difference of 1 arcsec or more, the measurements were repeated in order to confirm it. In all these cases the measurements gave very similar values and we adopted the arithmetic mean.

Measurements were made to 1 μ (0.1 arcsec at the plate scale) in both coordinates with the two coordinate Zeiss Jena Ascorecord measuring machine.

The residuals of the reference stars gave the mean internal accuracy as : ± 0.25 arcsec in x and ± 0.29 arcsec in y for the short exposure plates ; ± 0.24 arcsec in x and ± 0.26 arcsec in y for the long exposure plates.

The errors in the measurements were :

(i) Short exposure plates : ± 0.19 arcsec in x and ± 0.18 arcsec in y for the Perth-70 reference stars, and ± 0.10 arcsec in x and ± 0.11 arcsec in y for the intermediate reference stars.

(ii) Long exposure plates : ± 0.16 arcsec in both x and y for the intermediate reference stars and ± 0.14 arcsec in x and y for the optical counterpart of radio sources.

The error of the Perth-70 Catalogue in both coordinates was considered as ± 0.34 arcsec. For the short and long exposure plates, the total internal errors were determined by the same method described in Wroblewski *et al.* (1981).

Table I lists the 69 sources for which we are presenting precise positions, plus additional information. The magnitude and nature have been adopted primarily from IAU Comm. 24 Patras Report (1982), from the reference to the finding chart (*) or from other sources (**) as indicated in remarks to table I. G, Q, and L stand for galaxy, quasar and BL Lacertae objects, respectively.

3. Results.

Table II presents precise positions of the 69 sources for which our plates show measurable images. Column 1 gives the IAU designation for each source ; columns 2 and 4 give the positions we obtained, in the system of the Perth-70 Catalogue referred to the mean equator and equinox of the Besselian epoch 1950.0 ; columns 3 and 5 give the total internal errors ; columns 6 and 7 give the comparison of our positions with the radio positions of Ulvestad *et al.* (1981) in the sense theirs, R(U), minus ours, Op(M) ; columns 8 and 9 give the optical coordinates referred to the mean equator and equinox for the new standard epoch J2000.0, calculated by means of the software developed by Noel (1983) based on the method of Aoki *et al.* (1983) ; columns 10 and 11 give the comparison with the positions given by the IAU Commission 24 Patras Report (1982) in the sense Comm. 24, minus ours, Op(M).

Table III lists the sources for which we are presenting finding chart, with comments. Earlier finding charts for 0008–421 and 1308–220 showed galaxies at about half an arcmin of the radio position. We are presenting our candidates for 1015–314, 1657–261 and 1748–253 in spite of their large residuals. We have included finding charts for fields that resulted empty on our plates, since they could be helpful to somebody willing to search them with more photo-sensitivity. The finding charts were obtained directly from the measuring machine while determining the rectangular coordinates. The 8×8 arcsec central square of the reticle appearing in the photographies is centred on the radio position of each source.

In table IV, we present the comparison of our positions, (M), with those of 3 other independent optical surveys : Walter and West (1986), Jauncey *et al.* (1982), and Hunstead (1971), hereafter referred to as (WW), (J) and (H) respectively. The residuals between our positions and theirs are shown, in the sense theirs minus ours, for all sources in common ; they are expressed in arcsec for both right ascension and declination.

Table V presents the mean residuals, standard errors and number of common sources n considered for the two comparisons presented in table II and the three comparisons presented in table IV. It should be noted that sources giving residuals larger than 2 arcsec in table IV were discarded in computing the values of table V. This affects the sources 1657–261, 1748–253 and 2255–282 from (U) survey, 1748–253 and 2255–282 from Comm. 24 Patras Report and 2000–330 from (J) survey.

Acknowledgements.

We are indebted to professor C. Anguita for his careful reading of this paper and his interesting comments. We are also grateful to M. Wischnjewski for measuring the plates, to H. Alvarez and R. Lillo for their revision of the English version, to C. Monsalve for preparing the finding charts, to P. Hernandez for his careful maintenance of the equipments and to M. Gajardo for typing part of the manuscript. This work was partially supported by the Departamento de Investigacion y Bibliotecas, de la Universidad de Chile under the Project E. 1705-852F.

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TABLE I.

Source IAU Designation	Other Name	Magnitude and Nature		Epoch of Observation	Ref. to Finding Chart	Remark
0003-066		19.7	G	1983 AUG 06	1	
0056-001	4C+00.06	18	Q	1983 AUG 06	2	
0112-017	UM 310	17	Q	1983 AUG 08	3	
0119+041	OC 033	19.5	Q	1983 SEP 09	4	
0135-247	OC 259	16.9	Q	1983 AUG 09	5	
0138-097		17.5	L	1983 AUG 06	6	
0202-172		18.5	Q	1982 AUG 22	2	
0426-380		19	Q	1981 DEC 23	7	**
0440-003	NRAO 190	18.5	Q	1981 DEC 24	8	
0454-234		18.5	Q	1982 NOV 18	9	**
0457+024	OF 097	18.0	Q	1982 DEC 18	3	
0458-020	4C-02.19	18.4	Q	1982 DEC 20	2	
0528-250		17	Q	1981 DEC 23	1	
0606-223		20	Q	1982 DEC 20	1	**
0723-008	OI-039	18	G	1982 DEC 18	10	
0736+017	OI 061	18	Q	1984 FEB 26	11	
0743-006		17.5	Q	1984 JAN 27	3	*
0823+033		18	Q	1982 DEC 18	12	*
0823-223		17.5		1984 JAN 26	1	**
0834-201		19	Q	1982 DEC 21	13	**
0859-140	OJ-199	17.8	Q	1982 MAR 19	2	
0906+015	4C+01.24	17.5	Q	1983 MAR 17	14	
0919-260	OK-232	19	Q	1982 DEC 18	5	
0922+005		18	Q	1984 FEB 27	15	*
0941-080		19	G	1984 JAN 28	8	
1004-018		19	Q	1984 FEB 26	3	*
1015-314		19	?	1983 MAR 17	16	*
1032-199		19	Q	1982 MAR 22	5	
1145-071		18.5	Q	1982 MAR 22	5	
1151-348		17.5	Q	1982 JAN 26	17	*
1237-101	ON-162	18.2	Q	1982 MAR 22	2	
1243-072	ON-073	18.5	Q	1982 APR 22	5	
1245-197		20.5		1982 APR 24	25	*
1255-316		18.5	Q	1983 FEB 10	18	
1302-102	OP-106	15.2	Q	1983 MAR 17	18	
1320-446		21	Q	1982 APR 26	19	*
1334-127		18.5	Q	1983 MAR 20	18	
1351-018		21.0	Q?	1983 MAR 17	20	*
1354-152		18.5	Q	1982 MAR 22	18	
1402-012		18.5	Q	1982 APR 22	3	*
1402+044		18.5	Q	1982 APR 24	1	*
1504-166		18.5	Q	1984 APR 30	21	
1514-241		16.2	G	1984 APR 24	22	*
1524-136		20.5	Q?	1983 MAR 20	2	*
1546+027	OR 078	18.0	Q	1982 MAY 24	3	
1622-297		21	?	1982 APR 22	19	*
1657-261		21	?	1984 APR 29	16	*
1725+044		17.5	Q	1982 May 21	1	*
1748-253		18	?	1982 APR 24	16	*
1908-202		22	?	1983 JUN 13	19	

TABLE I *(continued).*

1936-155		19	?	1983 SEP 09	23	**
1954-388		17.5	Q	1982 AUG 20	17	*
1958-179	OV-198	18.5	Q	1984 AUG 25	18	
2000-330		19.0	Q	1983 SEP 12	23	*
2037-253		18.5	Q	1982 AUG 20	18	*
2106-413		18.4	Q	1983 SEP 09	19	
2128-123		16.0	Q	1982 AUG 20	24	
2131-021	4C-02.81	19.0	Q	1984 AUG 27	3	
2149-307		18.0	Q	1983 SEP 12	23	*
2203-188	MSH 22-101	19.5	Q	1983 SEP 10	24	
2210-257		19.5	Q	1982 AUG 20	6	
2216-038	4C-03.79	17.2	Q	1984 AUG 27	2	
2227-088		18	Q?	1983 SEP 09	13	
2240-260		17.5	Q	1983 AUG 09	18	*
2243-123		17	Q	1984 AUG 25	18	
2245-328		16.5	Q	1983 SEP 12	23	
2255-282		16.3	Q	1983 SEP 11	18	
2318+049	OZ 031	19	Q	1983 SEP 10	4	
2329-162		20	Q	1984 AUG 27	26	

Remarks to table I.

0426-380	Q	(Ulvestad et al. 1981)
0454-234	Q	(Ulvestad et al. 1981)
0606-223	Q	(Ulvestad et al. 1981)
0823-223	Q	(Ulvestad et al. 1981)
0834-201	?	Mag. 19 (This paper)
1402+044	Q	(Ulvestad et al. 1981)
1725+044	Q	(Ulvestad et al. 1981)

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TABLE II. — *List of optical position of 69 radio sources south of* $\delta = +5°$.

(1) Source IAU Designation	(2) α(B1950.0)	(3) Error σ(α) × cosδ	(4) δ(B1950.0)	(5) Error σ(δ)	(6) Residuals R(U)-Op(M) Δαcosδ	(7) Δδ	(8) α(J2000.0)	(9) δ(J2000.0)	(10) Residuals Comm.24-Op(M) Δαcosδ	(11) Δδ
0003-066	$00^h03^m40^s.29$	±0".2	-06°40'17".1	±0".2	0".0	-0".2	$00^h06^m13^s.90$	-06°23'35".1	0".0	-0".2
0056-001	00 56 31.80	0.2	-00 09 18.7	0.2	-0.6	0.0	00 59 05.56	+00 06 51.7	-0.7	0.0
0112-017	01 12 43.92	0.2	-01 42 55.4	0.2	0.0	+0.4	01 15 17.10	-01 27 05.0	0.0	+0.4
0119+041	01 19 21.40	0.2	+04 06 44.0	0.2	-0.2	-0.02	01 21 56.87	+04 22 24.7	-0.2	0.0
0135-247	01 35 17.07	0.2	-24 46 08.8	0.2	+0.5	+0.1	01 37 38.31	-24 30 54.0	+0.4	+0.1
0138-097	01 38 56.87	0.2	-09 43 52.2	0.2	-0.2	+0.5	01 41 25.84	-09 28 44.2	-0.2	+0.5
0202-172	02 02 34.48	0.2	-17 15 39.4	0.2	+0.5	0.0	02 04 57.64	-17 01 19.8	+0.4	0.0
0426-380	04 26 54.71	0.2	-38 02 52.0	0.2	+0.1	-0.1	04 28 40.43	-37 56 19.4		
0440-003	04 40 05.26	0.2	-00 23 21.3	0.2	+0.5	+0.8	04 42 38.62	-00 17 44.2	+0.5	+0.7
0454-234	04 54 57.31	0.2	-23 29 28.6	0.2	+0.1	-0.5	04 57 03.20	-23 24 52.3		
0457+024	04 57 15.54	0.2	+02 25 05.9	0.2	+0.2	-0.2	04 59 52.04	+02 29 31.4	+0.1	-0.3
0458-020	04 58 41.28	0.2	-02 03 33.7	0.2	+0.9	+0.3	05 01 12.75	-01 59 14.0	+0.8	+0.2
0528-250	05 28 05.16	0.2	-25 05 44.8	0.2	+0.5	+0.3	05 30 07.92	-25 03 30.0	0.0	+0.2
0606-223	06 06 53.30	0.2	-22 19 46.3	0.2	+1.1	+0.1	06 08 59.62	-22 20 20.9		
0723-008	07 23 17.81	0.2	-00 48 55.3	0.2	+0.4	-0.1	07 25 50.61	-00 54 56.7	+0.4	+0.2
0736+017	07 36 42.55	0.2	+01 44 00.2	0.2	-0.6	0.0	07 39 18.07	+01 37 04.7	-0.6	0.0
0743-006	07 43 20.99	0.2	-00 36 56.9	0.2	+0.3	+1.2	07 45 54.03	-00 44 18.6		

(1) Source IAU Designation	(2) α(B1950.0)	(3) Error σ(α) × cosδ	(4) δ(B1950.0)	(5) Error σ(δ)	(6) Residuals R(U)-Op(M) Δαcosδ	(7) Δδ	(8) α(J2000.0)	(9) δ(J2000.0)	(10) Residuals Comm.24-Op(M) Δαcosδ	(11) Δδ
0823+033	$08^h23^m13^s.54$	±0".2	+03°19'15".2	±0".2	-0".2	+0".2	$08^h25^m50^s.34$	+03°09'24".3	0".0	+0".2
0823-223	08 23 50.04	0.2	-22 20 34.6	0.2	+0.5	-0.2	08 26 01.54	-22 30 26.9		
0834-201	08 34 24.59	0.2	-20 06 30.3	0.2	+0.1	-0.1	08 36 39.21	-20 16 59.4		
0859-140	08 59 54.94	0.2	-14 03 38.4	0.2	+0.2	-0.4	09 02 16.82	-14 15 30.5	+0.2	-0.4
0906+015	09 06 35.17	0.2	+01 33 47.7	0.2	+0.5	-0.4	09 09 10.08	+01 21 35.2	+0.4	+0.2
0919-260	09 19 16.70	0.2	-26 05 54.1	0.2	+0.1	-0.4	09 21 29.36	-26 18 42.9	0.0	-0.4
0922+005	09 22 33.76	0.2	+00 32 12.5	0.2	+0.2	-0.3	09 25 07.82	+00 19 14.2		
0941-080	09 41 08.68	0.2	-08 05 43.9	0.2	-0.6	-0.2	09 43 36.98	-08 19 30.7	-0.5	-0.2
1004-018	10 04 31.72	0.2	-01 52 30.8	0.2	-0.5	0.0	10 07 04.36	-02 07 11.1		
1015-314	10 15 53.40	0.2	-31 29 10.8	0.2	-0.1	-0.6	10 18 09.29	-31 44 13.5	-0.1	-0.6
1032-199	10 32 37.40	0.2	-19 56 01.9	0.2	-0.6	-0.3	10 35 02.20	-20 11 34.1	-0.6	-0.2
1145-071	11 45 18.30	0.2	-07 08 00.2	0.2	-0.1	-0.6	11 47 51.57	-07 24 40.7	-0.1	-0.5
1151-348	11 51 49.42	0.2	-34 48 46.3	0.2	+0.3	-0.9	11 54 21.77	-35 05 28.2		
1237-101	12 37 07.25	0.2	-10 07 00.4	0.2	+0.4	-0.3	12 39 43.03	-10 23 28.5	+0.5	-0.2
1243-072	12 43 28.81	0.2	-07 14 23.0	0.2	-0.3	-0.5	12 46 04.25	-07 30 46.1	-0.3	-0.5
1245-197	12 45 45.20	0.2	-19 42 57.4	0.2	+0.3	-0.1	12 48 23.88	-19 59 18.5	+0.2	-0.1
1255-316	12 55 15.19	0.2	-31 39 04.4	02	-0.2	-0.8	12 57 59.08	-31 55 16.2	-0.2	-0.7

TABLE II *(continued).*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Source IAU Designation	α(B1950.0)	Error σ(α) × cosδ	δ(B1950.0)	Error σ(δ)	Residuals R(U)-Op(M) Δαcosδ	Δδ	α(J2000.0)	δ(J2000.0)	Residuals Comm.24-Op(M) Δαcosδ	Δα
1302-102	$13^h02^m55^s.83$	±0".3	-10°17'16".6	±0".2	+0".3	+0".1	$13^h05^m33^s.00$	-10°33'19".6	+0".2	0".0
1320-446	13 20 07.42	0.2	-44 36 53.6	0.2	-0.2	+0.2	13 23 04.27	-44 52 33.1		
1334-127	13 34 59.84	0.2	-12 42 10.0	0.2	-0.3	+0.1	13 37 39.82	-12 57 24.9	-0.6	+0.2
1351-018	13 51 32.08	0.2	-01 51 20.6	0.2	-0.7	+0.6	13 54 06.94	-02 06 03.7		
1354-152	13 54 28.62	0.2	-15 12 52.1	0.2	-0.5	+0.3	13 57 11.27	-15 27 29.0	-0.4	+0.2
1402-012	14 02 11.30	0.2	-01 16 01.9	0.2	-0.1	+0.1	14 04 45.90	-01 30 22.0		
1402+044	14 02 30.00	0.4	+04 29 55.0	0.3	-0.4	+0.6	14 05 01.14	+04 15 35.5		
1504-166	15 04 16.39	0.2	-16 40 58.6	0.2	+0.6	-0.7	15 07 04.76	-16 52 29.4		
1514-241	15 14 45.30	0.2	-24 11 22.4	0.2	-0.3	-0.2	15 17 41.85	-24 22 19.2		
1524-136	15 24 12.87	0.2	-13 40 34.9	0.2	0.0	0.0	15 26 59.44	-13 51 00.1		
1546+027	15 46 58.28	0.2	+02 46 06.0	0.2	+0.2	+0.1	15 49 29.42	+02 37 01.1	+0.2	0.0
1622-297	16 22 57.24	0.2	-29 44 40.8	0.2	+0.1	-0.4	16 26 06.02	-29 51 26.4		
1657-261	16 57 47.72	0.2	-26 06 29.4	0.2	+0.5	-2.9	17 00 53.15	-26 10 51.5		
1725+044	17 25 56.37	0.2	+04 29 27.9	0.2	-0.6	+0.0	17 28 24.99	+04 27 04.9		
1748-253	17 48 45.65	0.2	-25 23 19.3	0.2	+2.0	+1.9	17 51 51.14	-25 24 01.6	+1.8	+1.8
1908-202	19 08 12.48	0.2	-20 11 55.2	0.2	-0.1	+0.1	19 11 09.67	-20 06 55.1	-0.3	+0.1
1936-155	19 36 36.05	0.2	-15 32 38.8	0.2	-0.3	0.0	19 39 26.68	-15 25 43.1	-0.4	+0.1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Source IAU Designation	α(B1950.0)	Error σ(α) × cosδ	δ(B1950.0)	Error σ(δ)	Residuals R(U)-Op(M) Δαcosδ	Δδ	α(J2000.0)	δ(J2000.0)	Residuals Comm.24-Op(M) Δαcosδ	Δα
1954-388	$19^h54^m39^s.07$	±0.2	-38°53'12".7	±0".2	0".0	-0".5	$19^h57^m59^s.84$	-38°45'05".6		
1958-179	19 58 04.61	0.2	-17 57 16.7	0.2	+0.3	-0.2	20 00 57.09	-17 48 57.4	0.0	-0.3
2000-330	20 00 13.06	0.2	-33 00 12.3	0.2	-0.7	-0.2	20 03 24.16	-32 51 44.3		
2037-253	20 37 10.78	0.2	-25 18 26.1	0.2	-0.1	-0.3	20 40 08.79	-25 07 46.4		
2106-413	21 06 19.39	0.2	-41 22 33.8	0.2	+0.1	+0.4	21 09 33.19	-41 10 20.9	0.0	+0.4
2128-123	21 28 52.72	0.2	-12 20 20.1	0.2	-0.6	-0.5	21 31 35.31	-12 07 04.3	-0.7	-0.5
2131-021	21 31 35.17	0.2	-02 06 38.7	0.2	+0.3	-1.3	21 34 10.34	-01 53 16.2	-0.5	-1.1
2149-307	21 49 00.60	0.2	-30 42 00.0	0.2	0.0	-0.2	21 51 55.53	-30 27 53.5		
2203-188	22 03 25.73	0.2	-18 50 16.6	0.2	-0.2	-0.4	22 06 10.42	-18 35 38.3	0.0	-0.4
2210-257	22 10 14.14	0.2	-25 44 22.3	0.2	0.0	-0.2	22 13 02.51	-25 29 30.0	-0.2	-0.2
2216-038	22 16 16.40	0.2	-03 50 40.8	0.2	-0.1	+0.1	22 18 52.05	-03 35 37.0	-0.2	+0.1
2227-088	22 27 02.38	0.2	-08 48 17.4	0.2	-0.8	-0.1	22 29 40.13	-08 32 54.3	-0.7	-0.1
2240-260	22 40 41.84	0.2	-26 00 15.1	0.2	-0.3	+0.3	22 43 26.43	-25 44 30.2		
2243-123	22 43 39.79	0.2	-12 22 39.7	0.2	+0.2	-0.5	22 46 18.23	-12 06 50.7	+0.1	-0.6
2245-328	22 45 51.48	0.2	-32 51 44.2	0.2	-0.6	+1.7	22 48 38.66	-32 35 51.9	+0.3	-0.3
2255-282	22 55 22.48	0.2	-28 14 26.0	0.2	-1.6	-1.4	22 58 05.98	-27 58 21.6	-1.6	-1.4
2318+049	23 18 12.13	0.2	+04 57 23.2	0.2	+0.1	+0.2	23 20 44.85	+05 13 49.7	0.0	+0.2
2329-162	23 29 02.40	0.2	-16 13 31.4	0.2	0.0	+0.5	23 31 38.66	-15 56 57.5	-0.1	+0.5

TABLE III. — *List of finding charts.*

Source	Ident.	Comments
0008-421	EF	Lu (1970) and this paper.
0019-000	G	IAU Commission 24 (1982). EF This paper.
0022-423		Very faint object? It could not be measured.
0500+019		Very faint object? It could not be measured.
0648-165	EF	This paper.
0727-115	EF	This paper.
0733-174	EF	This paper.
0826-373	EF	This paper.
0834-196	EF	This paper.
1015-314	?	This paper.
1308-220	EF	This paper.
1648+015	EF	This paper.
1657-261	?	This paper.
1748-253	?	This paper.
2008-068	EF	This paper.
2128+048	G	IAU Commission 24 (1982). EF This paper.
2210+016	EF	This paper.
2337-334		Very faint object? It could not be measured.

TABLE IV. — *Comparison with other 3 optical surveys.*

Sources	Residuals (WW) − (M) $\Delta\alpha\cos\delta$ "	Residuals (WW) − (M) $\Delta\delta$ "	Residuals (J) − (M) $\Delta\alpha\cos\delta$ "	Residuals (J) − (M) $\Delta\delta$ "	Residuals (H) − (M) $\Delta\alpha\cos\delta$ "	Residuals (H) − (M) $\Delta\delta$ "
0056-001					−0.8	+0.2
0202-172					+1.0	+0.3
0440-003	+0.8	+0.6				
0723-008	+0.6	+1.0				
0736+017					−0.3	−0.3
0823+033	0.0	+0.2				
0859-140	−0.4	0.0			−1.5	+0.2
0941-080					−0.8	−0.4
1237-101					0.0	−0.6
1255-316			+0.5	+0.4		
1334-127	−0.2	−0.1				
1504-167					−0.1	+0.5
1936-155			+0.3	+1.0		
1958-179	+0.5	−0.1				
2000-330			(−1.6	−2.3)		
2149-306			−0.7	+0.4		
2203-188					−0.2	−0.2
2243-123	−0.4	−0.6				
2245-328	+0.8	0.0	−0.2	+1.1		

TABLE V. — *Mean residuals, standard errors and number of common sources n for the comparisons.*

Comparisons	Mean residuals and standard errors $\Delta\alpha\cos\delta$ "		$\Delta\delta$ "		n
Rad.(U) − Op(M)	0.0	0.0	−0.1	±0.1	66
Comm.24 − Op(M)	−0.1	±0.1	−0.1	±0.1	43
Op.(WW) − Op(M)	+0.2	±0.2	+0.1	±0.2	8
Op. (J) − Op(M)	0.0	±0.3	+0.7	±0.2	4
Op. (H) − Op(M)	−0.4	±0.3	0.0	±0.1	8

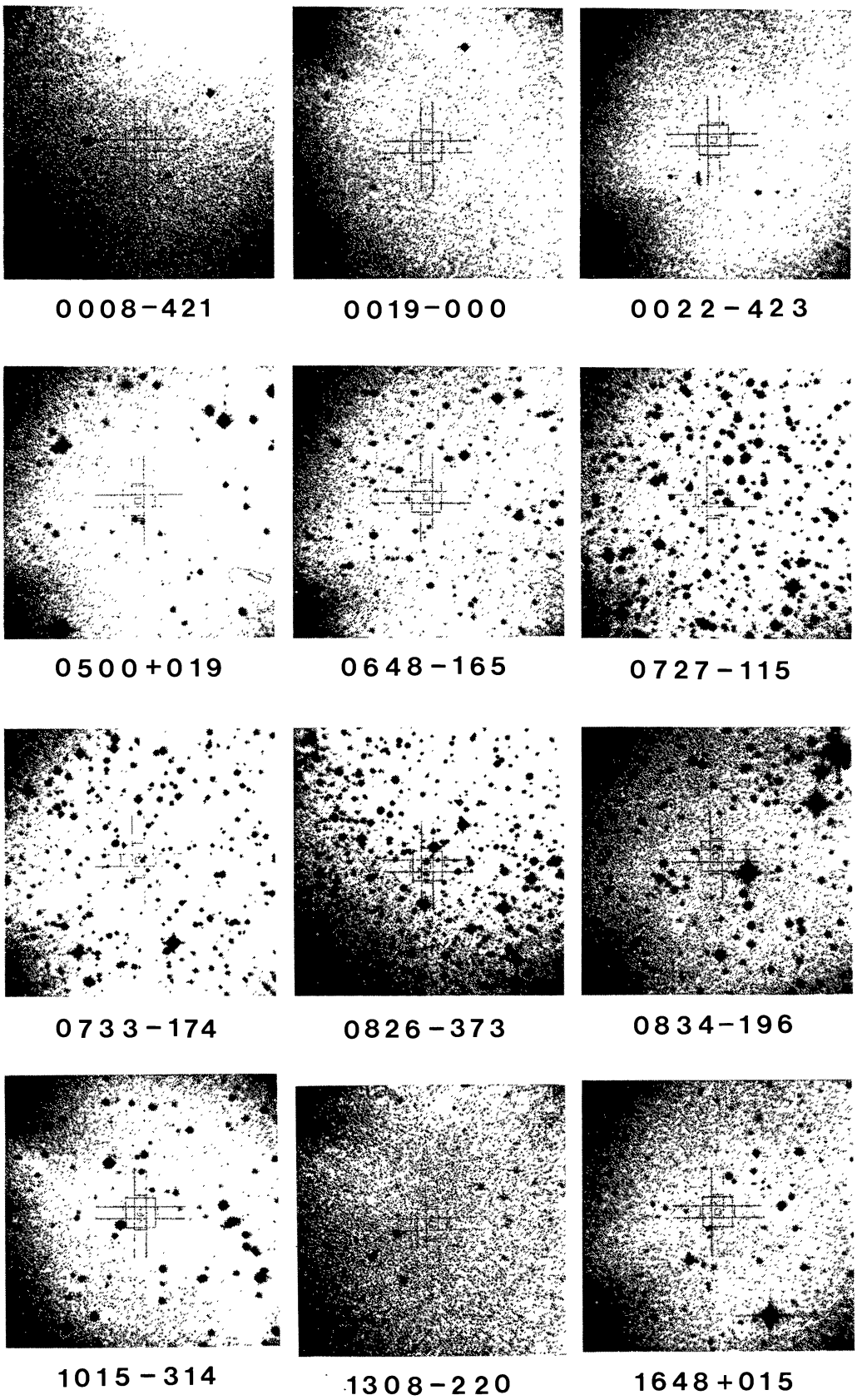

FIGURE 1. — Finding charts of 18 strong and compact radio sources. North is at the top, East to the left. The scale is given by the central 8 × 8 arcsec square of the Zeiss Jena ascorecord reticle appearing in each photography.

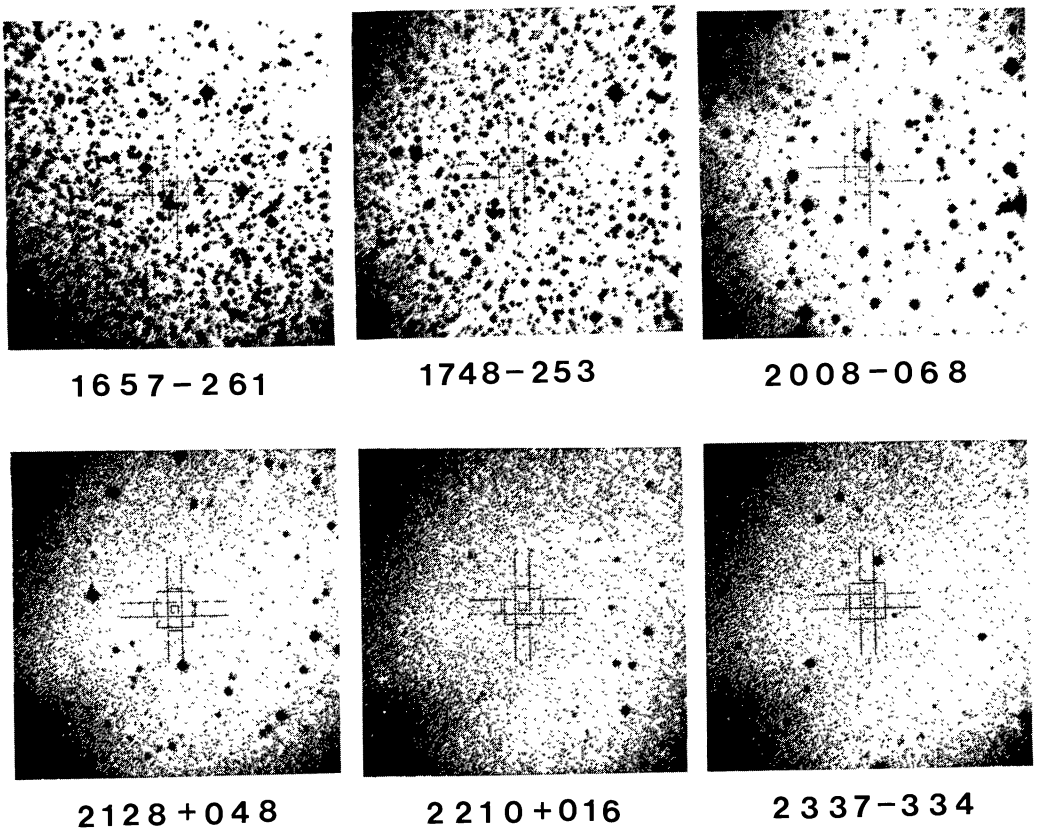

FIGURE 1 *(continued)*.