PROPER MOTION STUDIES OF STARS IN AND AROUND OPEN CLUSTERS

Floor van Leeuwen

Royal Greenwich Observatory
Herstmonceux Castle
Hailsham, East Sussex, BN27 1RP
United Kingdom

Abstract. A compilation of proper motion studies of stars in and around open clusters is presented. It can serve as a reference to cluster member selections, studies of cluster dynamics or as a guide to further improvement of the data presently available. The present paper is only a preliminary version; it is hoped for that reactions from the astronomical community will lead to a more complete and correct study in the near future.

Introduction. Compilations of data on open clusters have been made by Alter and Ruprecht, who still collect all references relevant to the research on open clusters, associations and globular clusters. For a general reference this is the most complete set of publications. Also in the present paper extensive use has been made of these compilations. Lynga (IAU Symp.85, 123) keeps an up to date record of the characteristic properties of open clusters, such as their size, content, age, distanc etc. Mermilliod prepared compilations of photometric and radial velocity data on open clusters (ref 171, 172 and IAU Symp.85, 129). Some of these studies are available at the CDS in Strasbourg. At least four other studies also provide many references to different open clusters: a paper by Van Schewick on absolute proper motions of 61 open clusters (ref 169), a paper by Janes and Adler on open clusters and the galactic distance scale (ref 125), a paper by Nicolet on distances of open clusters (ref 013) and a paper by Harris on colour magnitude diagrams of star clusters (ref 124). Each of these papers refers to earlier important reviews. Vasilevskis presented in 1962 an excelent review paper on proper motion studies of open clusters (ref 082). It describes extensively the why and how of this type of work. In his paper Vasilevskis counted some 90 individual studies. At present, 22 years later, this number has doubled. At least 81 clusters have now been investigated, and some of these several times. Improvements can still be obtained for most of the presented work, either by employing more of the photographic material available over the world, or by improving the measuring and reduction techniques. The present study also includes references to some of the old proper motion studies, not

J. Goodman and P. Hut (eds.), Dynamics of Star Clusters, 579–606.

only to do them justice, but also to show todays astronomers where they might find old plate material. This is, however, no historically complete compilation: the earliest references to studies of the Pleiades, the Hyades and probably some other clusters, have been omitted. Van Leeuwen (ref 377) and Van Bueren (ref 152) give reviews of the historical work on the Pleiades and the Hyades respectively.

The present paper is a compilation concentrating mainly on proper motion studies of stars in and around open clusters. Proper motions are the strongest selection criterion for cluster stars available. They do not depend on any other astrophysical assumption then the coincidence of the velocities of cluster members. (Apart from a time basis shorter than 5 years, when a possible disturbance due to orbital motions may influence the results.) This compilation will provide references to the selection of cluster members, which is the first step into the study of cluster dynamics: membership selection is needed to derive density profiles, which are reflections of the energy and angular momentum distribution in the cluster. In very few cases the proper motions are accurate enough to study the internal velocity dispersion in the cluster, providing additional data on the dynamics of the clusters involved.

The paper has been organized as follows. The first section gives a short review of how proper motions are derived and what this means to their interpretation. Some attention will be paid to intercomparing different studies and to deriving internal proper motion and velocity dispersions. In order to faciliate the use of the major review-table (II), we present in section two brief reviews of the most important centres of open cluster proper motion studies. The reference Table II , presented in section three, shows the characteristics of each individual study on proper motions in an open cluster. Table IV presents a listing of the literature which has been consulted.

The time given to prepare the present study has been short. It is therefore likely that it will not be complete and will contain a number of errors. A study like this should in addition contain references to work in progress. However, in this respect only a very limited picture could be obtained. My intention is, to publish this compilation once more in the supplements of one of the main journals. Hopefully then it will be more complete. That presentation could possibly also include some references to the vast amount of useful plate material scattered all over the world. The communication of any corrections and/or additions to the current version would be most appreciated.

Proper motions. The present paper will deal primarily with proper motions derived from comparing positions on photographic plates. Some studies do, however, also include meridian data and/or triangularization in the focal plane by means of micrometers or heliometers. However, most of these, older, studies ceased to be of value. Photographic proper motions in open clusters have been obtained with a multitude of

instruments: initially with refractors only, but more recently also with different types of reflectors. A still very important contribution was made during the end of the 19th century and the first decades of the 20th century, using the Astrographs, of which many were build for the first sky surveys, the Astrographic Catalogue and the Carte du Ciel. Often these astrographs are refered to as Double Astrographs for having two tubes, one with a visually and the other with a photographically corrected objective. Their field size of 2.5 by 2.5 degrees and scale of 60"/mm make them still useful for the research of the nearby clusters. The second generation, with scales of 40" and 30" per mm (such as the Leiden, Bonn, Greenwich, Moscow and Zo-Se refractors) provide useful plate material on intermediate distance clusters. The range of large US telescopes with scales from 15" to 8" per mm has been used extensively, in particularly for the more distant clusters, that require a higher resolving power. Most of the instruments for which good plate files exist are still in working order, allowing one to take second epoch exposures with the same equipment as up to almost 100 years ago. Table I presents data on the telescopes that were found to be used in proper motion studies of stars in and around open clusters. The first part identifies the Astrographic Catalogue telescopes and the second part all others.

Proper motions are derived by means of comparing positions recorded on photographic plates at different epochs. In the past this has been done by means of plate pairs. A second epoch exposure was taken through the glass at the same hour angle and (almost) the same time of the year. The two exposures were superimposed and measured for differences in positions of the stars. The accuracies of the manual measurements vary from 1.5 to possibly 4 micron. More recent methods simply measure positions on the plates in a relative coordinate system of either a manual or automatic measuring machine. This method allows one to use plates taken at different hour angles and to combine plates at varies epochs. In particularly the automatic measuring machines brought a significant improvement in the measuring accuracy, to a repeatability of better than 0.8 micron. This means that the intrinsic positional noise on a photographic plate (roughly 0.8 to 1.8 micron) is no longer much increased by a measuring noise. The improved accuracy and availability of computers provide 2 to 4 times more accurate results. The contribution from the computer is mainly in the complexity of the mathematical model and the number of reference stars that can be used.

The reduction of positions to proper motions and the combination of different sets of proper motions involve transformations that inevitably remove some of the information contained in them. These transformations are needed in order to remove external influences on the positions of stars on a photographic plate. A linear transformation, which will always be needed, removes all the linear proper motion information from the stars used as reference points and defines by means of these stars a reference system for all the proper motions in the field. It is therefore virtually impossible to derive from such relative proper motions a linear rotation around the line of sight or a linear

contraction/expansion in the plane of projection. This also means that by using different sets of reference stars the results of different studies of the same object will be different. They can only be compared in detail after applying a transformation that brings one system in accordance with the other.

The least squares solution used in the transformation of positions do not use the measuring errors as residuals, but instead the actual proper motions. Only in an iterative process or simultaneous plate-star solution this can be avoided (see e.g. papers by H.Eichhorn such as his study on the Pleiades, Mem.Roy.Aston.Soc., 73, part 2, 125). Nevertheless, the selection of stars used to perform the transformation or to constrain the all-in solution define a non-ideal reference system, which contains relative to an absolute system remnants of linear rotation and expansion, and has an arbitrary zero point. The linear deviations will be smaller when the intrinsic proper motion dispersion of the reference stars is smaller. In the study of open clusters the cluster stars themselves can provide such a very low intrinsic dispersion reference frame. It is therefore advisable always to use a selection of cluster stars as final reference points in the definition of the proper motion system.

The same type of complications disturb the picture of the internal proper motion dispersions. Here the level of the dispersions is less than 0".001/annum, with only a few stars to define the reference system. Values derived for internal proper motion dispersions are therefore sensitive to the actual definition of the proper motion system. In order to derive the information about the internal velocity dispersion, one needs in addition to correct for the influences of the parallactic motions using the space density distribution. In comparing results obtained by different authors it is therefore best to use the initial proper motions rather than the interpretated results, which are unlikely to be unique.

Still one other type of proper motion determination has been in use. In order to study the proper motions of members of the very nearby Hyades and Coma Berenice clusters, the use of many plates covering a large area of the sky is needed. These plates are often reduced to star positions from catalogues such as the AGK2. This introduces, however, the systematic errors of the catalogues in the proper motion field, which has made it always difficult to compare different Hyades studies and which caused a lot of confusion about the existence of the Coma Berenice cluster.

Centres of Activity. A major contribution to the proper motion studies of stars in and around open clusters has come from a few groups of astronomers. Although their definition is somewhat arbitrary, their brief descriptions given below may still provide some useful background information that would otherwise be difficult to trace back.

1. Bonn and Vienna. Uses mainly the Bonn refractor (40"/mm, 16x16cm plates) but also occasionally the AG refractors (100"/mm) of Bonn and Bergedorf. Studies of more than 20 open clusters were performed from 1953 to 1967, mainly by Van Schewick and Meurers. Plates have always been measured manually. First epoch plates from the period 1900-1920, second epoch plates taken between 1950 and 1965. Publications in Bonn Veroffentlichungen and Wien Mitteilungen.

2. Greenwich-MtWilson. Uses mainly the Greenwich 26 inch refractor (30"/mm 16x16 cm plates) and MtWilson 60 inch reflector (8".24/mm, 20x20 cm plates). Studies of a number of open clusters by Van Maanen, Murray, Cannon and others. Plates were all manually measured. Publications in the Royal Observatory Bulletin, Ap.J. and MNRAS.

3. Lick-Allegheny-Univ.New Mex.. Uses the astrographs of Lick (55"/mm) and Allegheny (14".7/mm). Extensive use of the Allegheny plate file on open clusters, initiated by Vasilevskis, and continued by Sanders, Jones, Cudworth, McNamara and others. Close collaboration with Yerkes. Most of the measurements done by automatic machine. Publications in A.J. and Aston.Astroph.Suppl.

4. Moscow Sternberg. Uses mainly the wide angle astrograph (90"/mm, 24x24 cm plates) and the double astrograph (30"/mm, 16x16cm plates). The first has been used for cluster halo surveys, in comparison with published positions in Astrographic Catalogues. The second is used for differential proper motions of higher accuracies in more distant clusters. Plates are measured manually. Most of the work has been performed by Arthiukhina from 1954 to 1976. Publications in Sternberg Trudy.

5. Pulkovo. Uses the 33 cm astrograph (60"/mm, 16x16cm plates). Studies of a large number of open clusters, which are still going on. Old epoch plates date back to around 1910 and are exposed at least till 14th magnitude. All measurements have been performed manually. The studies have been performed mainly by Bronnikova, Lavdovskij and Frolov. New plates are still being taken. Publications in Pulkovo Bulletin and -Trudy.

6. Sydney. Uses the 33 cm Astrograph (60"/mm, 16x16 cm plates). Unique studies of southern open clusters. Old epoch plates from last decenium of 19th century, exposed till 12th to 13th magnitude. Most of the work has been performed by D.S.King. All measurements were done manually. Publications from 1977 on in Sydney Observatory Papers.

7. Tashkent. Uses the 33 cm astrograph (60"/mm, 16x16 cm plates) with probably one of the finest plate files on open clusters in existence. Several deep studies (16th magn) have been performed by Ishmukhamedov, Latypov and Muminov. Many of the first epoch

exposures (taken around 1920) are on 8x8 cm plates. A study of NGC7654 covered five different field centres, and was performed from 1927 to 1954 by Subbotin and Savitskij. All measurements are performed manually. Publications mainly in Tashkent Circulars and Trudy.

8. Yerkes. Uses the Yerkes refractor (10"/mm) which provides on a short time interval good proper motions. First studies by Ebbighausen, later work by Van Altena and others, also in collaboration with Lick Observatory. Publications in A.J.

9. Zô-Sé. Uses the 40 cm Zô-Sé refractor (30"/mm). This former Jesuit missionary observatory has taken up the task of measuring proper motions again, and presented so far some of the most extensive studies available. All measurements are performed manually in as far as I could find out. Early publications in the Annals of the Zo-Se observatory (in French), later publications in the annals of Shanghai Observatory (in Chinese with English abstracts).

In addition significant work has been performed at a number of other observatories, but non of this has resulted yet in a long lasting and systematic research for proper motions in and around open clusters.

The tables. The present compilation is presented in the form of 4 tables. The first, which was presented already above, contains a review of telescopes that have been used. Table II presents a compilation of 200 studies, that were at least to a great extend aiming at and successful in measuring proper motions of stars in and around open clusters. It presents for each of these studies a reference number, the year(-1900) in which it was presented, the cluster identification, the investigated field, the limiting magnitude, total number of stars, spread in epochs of exposures, number of plates or exposures, telescopes that have been used (see table I), highest accuracy of proper motions obtained (in arcsec/1000 years), the highest likelihood for cluster members and an indication on whether the study has been selective on members only (indicated by s). When a value is followed by ":", it applies only to part of the study. An asterisk is used if part of the data has come from existing catalogues, e.g. the indication "ihg*" means that the zones i, h and g (see Table I) of the Astrographic Catalogue have been used for reference positions.

References to papers presenting also some proper motion information are presented in Table III (underlined numbers), as well as references to some papers presenting discussions of the studies shown in Table II.

In addition to the papers presented above, there are some studies under way. In this respect only a very limited picture can be presented. The following studies I know about from private communications: 1. J.Stauffer et al, a proper motion study of 4000 stars in a Per, using plates from (PS, L1) to a limiting magnitude of

V=17. 2. Zhao Jun-liang, a study on NGC1718 has been completed and a study on NGC2286 is well on its way at Shanghai Observatory (Zô-Sé). 3. B.Green (Mt.Stromlo), a proper motion study of Melotte 66, based amongst others on plates obtained in the Newtonian focus of the SAAO Radcliffe reflector. 4. F.van Leeuwen et al, proper motion studies of NGC2204, NGC2243 and Melotte 66. 5. B.McNamara, study of the internal motions of NGC6705. 6. F.van Leeuwen, study of internal motions in a 3x3degr field centred on the Pleiades and a survey for faint members in the outer halo of the Pleiades (see present volume). This list is hopefully far from complete, as many more proper motion studies need to be performed.

References to photometry, radial velocities, distance moduli and other relevant data can be found in the papers mentioned in the introduction. Roughly half of the clusters for which proper motions have been obtained have also been investigated photometrically. This applies also to radial velocities, although here often only very few stars were investigated. Table IV presents the list of references, sorted on Journal in order to faciliate the reference to less commonly known journals and to keep studies with the same origin together. This type of presentation also allowed me to indicate the content of the study, the clusters investigated or whether it concerns a review or catalogue of interest, and the type of study. All those indicated with "p" are shown in Table II, the others in Table III.

Some clusters are mentioned in Table IV, but not in Table II. Most of these are insignificant and fall within the field of a more obvious cluster. This applies to the following clusters: Tr.1: see NGC 581, NGC1907: see NGC1912, NGC2158: see NGC2168, Cr.401: see NGC6611, NGC6882: see NGC6885, NGC7790: see NGC7788. There may also be some confusion between the cluster NGC6530, often by mistake refered to as M8, and the nearby situated NGC6523, which is the true M8 and not an open cluster. The exact borders of this compilation were also not always clear. The cluster M71, NGC6838 has been refered to as an old open cluster as well as a globular cluster, while a Per and IC 348 are also regarded as parts of associations rather than individual open clusters.

Acknowledgements. The present compilation was made possible mainly due to two factors: the very extensive library of the Royal Greenwich Observatory, with the much appreciated assistence of J.Hutchins, and the assistence of my wife Małgorzata in translating the many Russian references. In addition I enjoyed discussions with R.D.Mathieu and C.A.Murray, and would like to thank those who bothered answering my enquiries.

Table I

data on telescopes used in open cluster proper motion studies

Cd	site and telescope	altitude (m)	latitude	scale ("/mm)
a	Greenwich Astrograph	47	+51.5	60.
b	Vatican Astrograph	100	+41.9	60.
c	Catania Astrograph	47	+37.5	60.
d	Helsinki Astrograph	33	+60.2	60.
e	Hyderabat Astrograph	554	+17.4	60.
f	Potsdam Astrograph	97	+52.4	60.
g	Oxford Astrograph	64	+51.8	60.
h	Paris Astrograph	57	+48.8	60.
i	Bordeaux Astrograph	73	+44.8	60.
j	Toulouse Astrograph	195	+43.6	60.
k	Alger Astrograph	345	+36.8	60.
p	Perth Astrograph	60	-32.0	60.
q	Cape Astrograph	8	-33.9	60.
r	Sydney Astrograph	44	-33.9	60.
A1	Allegheny Thaw	370	+40.5	15.
A2	Allegheny Doublet	370	+40.5	127.
B	Bonn Astrograph	62	+50.7	40.
BA	Bergedorf AG astrograph	41	+53.5	100.
C	Camebridge Sheepshanks equ.	28	+52.2	36.
Co	Copenhagen Astrograph	14	+55.7	43.
CV	Cape, Victoria triplet	10	-33.9	30.
G	Greenwich 26 inch	47	+51.5	30.
GA	Gottingen Astrograph	161	+51.5	50.
Go	Goloseevo Astrograph	184	+50.5	40.
H	Harvard Boyden	1387	-29.0	43.
L1	Lick Carnegie	1283	+37.3	55.
L2	Lick 36 inch	1283	+37.3	12.
LA	Lippert Astrograph	41	+52.5	60.
Le	Leiden Astrograph	6	+52.1	40.
Lo	Lowell	2210	+52.1	122.
Lp	Leipzig	119	+52.3	60.
M1	Moscow wide angle	130	+55.6	90.
M2	Moscow Astrograph	130	+55.6	30.
MC	McCormic 26 inch	259	+38.0	21.
P	Pulkovo Astrograph	75	+59.8	60.
PS	Palomar Schmidt	1706	+33.4	67.
R	Oxford, Radcliffe	65	+51.8	30.
Ru	Rutherfurd Astrograph	25	+40.6	53.
S	Swarthmore, Sproul	63	+39.9	19.
St	Stockholm Astrograph	44	+59.3	25.

https://doi.org/10.1017/S0074180900147783 Published online by Cambridge University Press

Table I, continued

Cd	site and telescope	altitude (m)	latitude	scale ("/mm)
T	Tashkent Astrograph	479	+41.3	60.
To	Cerro Tololo 1m	2399	-30.2	20.
U	Uppsala Astrograph	21	+59.9	47.
W1	MtWilson 60 inch	1742	+34.2	8.
W2	MtWilson 100 inch	1742	+34.2	16.
Wi	Wien Astrograph	240	+48.2	60.
Y	Yerkes refractor	334	+42.6	11.
Zo	Zô-Sé Astrograph	100	+31.1	30.
Zu	Zürich Astrograph	469	+47.4	60.

Table III

cross-references to papers not incorporated in Table II

Hyades: 044, 048, 140, 150, 151, 177, 209, 366, 373, 378; Orion: 033; a Per: 211, 301; h & X Per: 205, 223, 230, 335, 375, 376; Pleiades: 136, 137, 220, 358, 377; Praesepe: 049, 063; NGC 129: 130, 228; NGC 457: 228; NGC 581: 228, 345; NGC 654: 139; NGC1513: 227; NGC1907: 230; NGC1912: 230; NGC1960: 227, 229; NGC2099: 227, 229, 328, 374; NGC2168: 230, 309, 374, 378; NGC2287: 119; NGC2506: 122; NGC2682: 308, 378; NGC6494: 014; NGC6530: 145; NGC6705: 010, 055, 060, 229, 378; NGC6750: 227; NGC6882: 230; NGC6885: 056, 230; NGC6910: 040, 059; NGC6913: 038, 039; NGC6940: 005; NGC7092: 230, 300; NGC7209: 228; NGC7654: 057, 058, 310; NGC7788: 061, 233; NGC7789: 302; NGC7790: 233; IC1805: 005; IC2391: 221; Tr.1: 145, 228; Berk.58: 062, 233;

Notes to Table II

1) ref 182, tel: P, a, St(87"/mm), d, r,Lick(39"/mm), f, y, A1 and Dearborn(30"/mm)
2) ref 135, tel: k, B, i, Co, a, Harvard, d, Le, Oxford, R, h, f, P, T, b

https://doi.org/10.1017/S0074180900147783 Published online by Cambridge University Press

Table II, review of open cluster proper motion studies

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr	sel
052	56	Coma B	5.x5.d	<14	99	50	R	4	9.		
178	04	Hyades	7.x5.d	<9.5	395	5	d	12x2	8.		
181	24	Hyades	7.x5.d	<12	328	16	d	12x4	3.		
152	52	Hyades	30x30d	<9.0	152		BA,Y	*	10.		s
050	54	Hyades	5.x5.d	<13.5	1359	21	BA,B,LA	6	7.		
191	62	Hyades	11x14d	<16.5	1000	30	Lo	2	26.		s
086	66	Hyades	6.5x6.5d	<18	778	14	L1	2	19.0	.91	s
367	66	Hyades	17.7sq d	<15.5	70	46:	W1	39x2	7.0		s
372	71	Hyades	6.5x6.5d	<21	4800	18	PS	2	20.		s
009	75	Hyades	30x30d	<12.5	112	55	ghi*,Le	*	6.0	-	s
094	75	Hyades	6.5x6.5d	<18	>600	24:	L1	5	5.0	.95	s
257	75	Hyades	3x(5x5d)	<13	3481	60:	ij*,M2	*,3	7.		
258	76	Hyades	6x(5x5d)	<13	6728	60:	hi*,M2	*,6	7.		
317	30	Orion	100'x100'		705	21	Zo	6	5:		
250	54	Orion	0.8x3.0d	<15	1058	54:	M1,T	30	3.8		
120	58	Orion	0.5x0.5d	<14.5	224	52	Y	19	0.6		
095	76	Orion	1.x1.d	<14	222	84	H,L1	8	0.7		
141	77	Orion	1.5x1.5d	<12.5	136	50	*	04			
054	55	a Per	5.5x5.d	<12.2	1379	50	cd*,BA,	10	4.0		
							GA,LA	4,6	6.0		
096	80	a Per	5.x5.d	<12	1200	25?	PS	8*	4.0	1.00	
043	09	h & X Per	2.x1.5d	<13	17	12	P	2			s
354	11	h & X Per	2.x2.d	<13.5	1418	13	d,P	16	8.1		
117	44	h & X Per	20'x20'	<16.0	800	29	W1	4	0.7		
053	55	h & X Per	6.x 6.d		203	81	BA	*,8	0.8		
164	60	h & X Per	1.5x1.5d	<14	800	43	B	8	2.0		
241	61	h & X Per	80'x80'	<14.6	2914	60	P	6	1.2		
283	83	h & X Per	1.0x1.0d	<17	1323	80	T	4	2.0		
045	19	Pleiades	1.5x1.5d	< 9.0	70	75:	*,Lp	*			
185	21	Pleiades	6.x6.d:	<15::	246	*	hg*,*,A1,				
							A2,Zu	*,23			s
204	21	Pleiades	1.5x1.5d	8-10	130	22	C	10	80		
148	24	Pleiades	2.5x2.5	<14.5	112	29	a,d,f	10	4.0		s
072	38	Pleiades	1.5x1.5d	<9.5	51	67	Ru	52	0.6		
115	40	Pleiades	40'x32'	<17.8	137	19	W2	4	2.0		s
118	45	Pleiades	.9x.9 d	<15.9	409	25	W1	10			s
135	47	Pleiades	2.5x2.5d	<16	2920	56:	(2	161	0.8		
089	70	Pleiades	1.6x1.6d	<15:	98	47:	Y,L2	66	0.3		s
255	70	Pleiades	9.x9.d	<14	4228	60:	gh*,M2	*,5	6.0		
023	73	Pleiades	5.x5.d	12-18	*	21	L1,PS	13	2.-8.	-	s
088	73	Pleiades	6.5x6.5d	10-17	125	16	L2	2	14.0		s
030	79	Pleiades	1.5x1.5d	<12.5	146	77:	Le	88	0.2		
097	81	Pleiades	6.5x6.5d	14-18	232	16	L1	7	1.0	.97	s

Table II, continued

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr	sel
179	16	Praesepe	2.x2.d	<13.6	531	25	f	4	4.0		
149	24	Praesepe	2.2x2.2d	<13.5	173	29	P,a,R	10	3.5		s
046	25	Praesepe	1.5x1.5d	<10	45	64:	*,B	*,2			
182	27	Praesepe	2.0x2.0d	<14.	577	29:	(1	42	1.5		
110	34	Praesepe	50'x30'	<10.5	52	20	MC	20	0.8		
071	38	Praesepe	1.5x1.5d	6.3-8.7	37	65	Ru	32	0.8		
210	39	Praesepe		<13.2	179	30	R	4	4.0		
156	53	Praesepe	1.5x1.5d	<13	290	29	B	4	2.0		
254	66	Praesepe	5.x5.d	<13.0	1978	60:	h,M2	1*	5.0		
215	67	Praesepe	30'x50'	<10.5	35	51	MC	25	0.9		
245	71	Praesepe	1.5x1.5d	<16.6	784	30	M1	3	4.0		
090	71	Praesepe		<13	91	67:	Y,L2	68	0.2		s
099	83	Praesepe	2.5x2.d	<16.5	3000	23	PS	8	2.0	.99	
241	61	NGC 129	80'x80'	<14.6	1025	50	P	6	2.0		s
080	61	NGC 129	40'x40'	<12.4	70	42	Y	4	1.1		
232	75	NGC 129	2.5x2.5d	<14.7	326	72	P	6	2.1		
092	72	NGC 188	50'x40'	<15.6	228	40	A1	6	1.8	.97	
208	26	NGC 225	44'x36'	<12.3	62	22	Y	2			
241	61	NGC 457	80'x80'	<15.	905	51	P	4	2.0		s
275	72	NGC 457	1.4x1.4d	<14.5	659	43	T	8	1.7		
356	79	NGC 559	2.x2.d	<15.5	811	35	b	2			
241	61	NGC 581	80'x80'	<14.	1155	56	P	4	1.8		
346	65	NGC 581	80'x80'	<15.5	1618	49	U	8	0.5		
011	77	NGC 654	40'x40'	<14.5	186	55	Y	4	0.7	.93	
070	19	NGC 663			209	13	Y	4			
362	60	NGC 663	30'x30'	<14	168	54	Wi	5	2.8		
276	73	NGC 663	1.0x1.0d		1086	44	T	6	1.8		
111	39	NGC 752	50'x50'	<12.5	125	21	A1	10	1.1		
241	61	NGC 752	80'x80'	<15.	883	46	P	2			
051	54	NGC1039	50'x43'	<10.5?	136	50:	d,BA	6	3.0		
277	73	NGC1039	1.0x1.0d	<13.8	696	46	T	4	2.0		
138	75	NGC1039			700	50:	S,A1	90:	1.0		
361	58	NGC1502	1.x1.d	<13.3	146	49	b,Wi	6	5.0		
274	66	NGC1502	2.0x2.0d	<13.4	296	40	T	2	1.9		
240	58	NGC1513	80'x80'	<14.6	664	55	P	2			

https://doi.org/10.1017/S0074180900147783 Published online by Cambridge University Press

Table II, continued

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr	sel
093	73	NGC1664	50'x40'	<13.4	222	40	A1	4	1.3	.91	
318	53	NGC1750	100'x100'	<14	2461	12	Zo	4	10:		
318	53	NGC1817	100'x100'	<14	2103	27	Zo	4	5:		
241	61	NGC1912	80'x80'	<14.6	1252	58	P	8	1.3		
330	67	NGC1912	1.5x1.5d	<15	964	72	h	2	1.0	.79	
206	23	NGC1960		<11	170	20	C	4			
155	24	NGC1960	1.5x1.5d	<11.4	34	20:	f,B	*,3	6.0		
161	58	NGC1960	0.5x0.5d	<15	550	36	B	6	3.0		
240	58	NGC1960	80'x80'	<14.8	1634	50:	P	4	5.4		
319	66	NGC1960	100'x100'	<12.7	360	51	Zo	2	2.2		
069	16	NGC2099	0.5x0.5d	<13.5	292	12	Y	3			
327	53	NGC2099	1.x1.d	<15	691	15	St	4	4.:		
240	58	NGC2099	80'x80'	<14.9	2532	59	P	2			
163	60	NGC2099	1.5x1.5d	<15.8	693	53	B	3	2.3		
081	62	NGC2099	40'x40'	?	243	50	*,MC	6	3.0		
087	66	NGC2099	20'x20'	<14	489	60	Y	11	1.0		
207	25	NGC2168	1.3x1.3d	<14.	200	21	C	6	8.0		
073	42	NGC2168	26'x26'	<12.0	150	30:	Y	10	0.9		
163	60	NGC2168	1.5x1.5d	<16	853	40	B	4	2.3		
241	61	NGC2168	80'x80'	<15.5	2784	60	P	8	1.1		
091	71	NGC2168	40'x40'	<14.5	763	54:	A1,L2	5	1.1	.97	
162	58	NGC2244	25'x25'	<14.2	161	39	B	6	2.0		
098	82	NGC2244	40'x40'	<14.4	287	60:	Y,A1	17	0.6	.99	
162	58	NGC2252	6'x6'	<14.2	33	39	B	6	2.0		s
083	65	NGC2264	40'x40'	<15	245	53:	A1,W1,Lo	18	1.0		
079	59	NGC2281	50'x40'	<13.0	127	40	A1	4	0.9		
318	53	NGC2286	100'x100'	<14	2242	18	Zo	2	7:		
213	70	NGC2420	21'x19'	<15	208	42	W1	3	0.6		
001	70	NGC2420	40'x40'	<13.6	85	52	Y	4	0.7	.91	
167	66	NGC2422	1.1x0.9	<11.5	138	62	B	6	1.9		
273	66	NGC2422	1.4x1.4d	<14.0	727	42	T	2			
167	66	NGC2423	1.1x0.7	<12.5	74	57	B	4	2.:		

Table II, continued

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr	sel
165	62	NGC2437	1.x1.d	<12.5	226	58	B	3	1.0		
121	81	NGC2506	10'x10'	<18	724	57	W1,To	3	0.6	.95	
263	78	NGC2516	2.5x2.5	<12.0	119	84	r	10	0.7	.99	
201	60	NGC2547		<11	67	62	q		3.0		s
112	39	NGC2548	30'x30'	<12.5	115	28:	Y	8	1.3		
318	53	NGC2548	100'x100'	<14	2451	14	Zo	2	10:		
265	79	NGC2669	2.5x2.5d	<12.5	226	86	r	28	0.9	.90	
180	22	NGC2682	2.0x2.0d	<14.	555	27	f	2			
116	42	NGC2682	20'x20'	12-15	343	21	W1	4	0.8		
113	42	NGC2682	30'x30'	<13.0	158	35:	Y	8	1.2		
365	65	NGC2682	27'x27'	<16.5	487	62	G,W1	4	2.0		
368	68	NGC2682	1.x1.d	<16.5	671	65	G	2	2.3		
277	73	NGC2682	1.0x1.0d	<14.0	550	44	T	6	1.9		
026	77	NGC2682	1.5x1.5d	<17.0	1866	67:	B,Y	12	1.0	.96	
324	82	NGC2682	100'x100'	<15.5	1067	69	Zo	8	2.7	.93	
336	30	NGC3064	24'x30'	<15.1	133	11	W1	4	2.7		
153	59	NGC3532	1.x1.d	<11.4	255	52	CV	4	1.9		
262	78	NGC3532	2.5x2.5	<12.5	647	84	r	6	1.3	.90	
264	79	NGC4103	2.5x2.5d	<13.0	171	84	r	24	0.8	.85	
267	81	NGC4755	2.5x2.5d	<11.9	164	88	r	10	0.6	.93	
266	80	NGC5662	2.5x2.5d	<12.6	188	87	r	14	0.9	.89	
261	77	NGC6025	2.5x2.5d	<12.5	132	78	r	6	1.5		
268	82	NGC6087	2.5x2.5	<12	157	89	r	10	1.5	.96	
350	69	NGC6475	1.5x1.5d	<13.5	746	75:	p,q	8			
012	80	NGC6494	40'x40'	<13.5	304	34	Y	13	0.5	.98	
319	66	NGC6530	100'x100'	<11.5	160	48	Zo	2	2.2		
008	72	NGC6530	60'x30'	<13.6	363	34	Y	12	0.6	.86	
323	81	NGC6530	100'x100'		303	66:	Zo	6	1.0		
166	62	NGC6611	1.3x1.3d	<13.0	231	40	B	10	2.1		
024	74	NGC6611	40'x40'	<13.2	142	47	Y	3	0.7	.94	

https://doi.org/10.1017/S0074180900147783 Published online by Cambridge University Press

Table II, continued

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr sel
078	58	NGC6633	50'x40'	<13.5	207	40	A1	6	1.0	
021	73	NGC6633	40'x40'	<14.0	497	33	Y	10	0.7	.93
278	73	NGC6633	1.0x1.0d	<15.5	1000	42	T	4	1.3	
280	75	NGC6694	1.0x1.0d	<14.7	627	42	T	4	2.6	
157	54	NGC6705	1.5x1.5d	<13.5	426:	51:	B	5	1.6	
240	58	NGC6705	80'x80'	<14.2	1097	53	P	2		
280	75	NGC6705	1.0x1.0d	<13.6	762	68	T	8	1.2	
027	77	NGC6705	30'x30'	<16.5	1890	70:	Y	30	0.4	.99
281	77	NGC6709	1.2x1.2d	<14.6	1139	43	T	4	1.5	
032	83	NGC6709	30'x30'		502	57:	Y	10	0.4	.90
279	73	NGC6755	1.0x1.0d	<15.7	706	43	T	6	2.2	
004	71	NGC6811	40'x40'	<14.1	296	53:	Y	14	0.7	.97
007	72	NGC6819	40'x40'	<14.5	189	60	Y	2	1.2	.91
003	71	NGC6823	40'x40'	<13.6	146	49	Y	4	0.8	.98
251	56	NGC6838	1.5x1.1d	<14.5	1372	43	M1	2	3.0	
253	61	NGC6866	50'x50'	<14.1	392	25	M1	4	7.0	
231	71	NGC6866	2.5x2.5d	<15.	2036	45:	P	8	1.3	
224	30	NGC6885	2.0x2.0d	<14.7	1433	29	P	4	5.7	
288	54	NGC6885	1.x1.d	<13.5	431	46	T	2	2.	
161	58	NGC6885	1.4x1.4d	<13.5	374	36	B	2?	3.2	
241	61	NGC6885	80'x80'	<14.0	544	56	P	10	1.2	
313	56	NGC6910	40'x40'	<14.3	129	33	P	4	5.3	
022	73	NGC6913	40'x40'	<13.9	228	22	Y	2	2.5	.89
160	57	NGC6939	1.x1.d	<15.	739	40	B	6	2.4	
370	70	NGC6939	16'x16'	<15.5	232	41	W1	3	0.9	
077	57	NGC6940	50'x40'	<13.0	216	40	A1	4	1.0	.94
282	77	NGC6940	1.0x1.0d	<15.0	1351	42	T	4	1.0	
002	70	NGC7062	40'x40'	<14.5	334	48	Y	4	0.7	.87

Table II, continued

ref	yr	cluster	field	range	stars	ep.	tel.	exp.	acc	ctr	sel
114	42	NGC7092	30'x30'	<13.0	50	23	Y	4	1.3		
159	57	NGC7092	0.6x0.6d	<13.2	128	40	B	8	2.5		
241	61	NGC7092	80'x80'	<14.8	1079	53	P	8	1.3		s
256	70	NGC7092	5.x5.d	<12.8	2964	67:	d*,M2	1*	6.0		
028	77	NGC7092	1.5x1.5d	<14.5	1710	52:	B,Y,A1	18	1.8		
047	30	NGC7209	2.0x2.0d	<13.5	35	32:	P	4			s
241	61	NGC7209	80'x80'	<14.5	1264	56	P	8	1.1		
252	61	NGC7209	1.5x1.5d	<12.9	332	62	d*,M1	1*	9.0		
167	66	NGC7209	1.1x1.0	<13.2	191	40	B	6	2.1		
225	37	NGC7243	1.6x1.3d	<13.5	814	34	P	4	2.0		
159	57	NGC7243	0.5x0.5d	<13.2	133	32	B	6	2.8		
318	53	NGC7380	100'x100'	<15	4443	16	Zo	2	8:		
319	66	NGC7380	100'x100'	<13.2	63	41:	Zo	8	1.8		
274	66	NGC7380	2.0x2.0d	<14.3	831	41	T	2	1.8		
285	27	NGC7654	2.0x2.0d	<13.8	1186	28	T	2			
287	28	NGC7654	2.0x2.0d	<13.4	1168	28	T	2			
286	30	NGC7654	2.0x2.0d	<13.8	860	30	T	2	3.3		
074	42	NGC7654	14'x14'	<13.2	84	33:	Y	16	0.7		
340	46	NGC7654	1.7x1.7d	<15.0	1937	42	U	6	2.3		
289	54	NGC7654	2.0x2.0d	<13.9	820	54:	T	6	3.7		
272	66	NGC7788	1.0x1.0d	<14.0	1088	42	T	6			
061	74	NGC7788	1.0x1.0d	<16.5	2170	49	T	2			
270	41	NGC7789	1.0x1.0d	<14.5	1183	40	T	6			
158	56	NGC7789	1.8x1.8d	<15	920	37	B	3	3.0		
031	81	NGC7789	30'x30'	<15.5	1387	68:	Y,A1	20	0.4	.98	
076	56	IC 348	45'x20'	<13.4	31	36:	S,	75	0.5		
					27	32	MC	60	0.4		
084	65	IC1805	50'x40'	<14	354	40	A1	4	1.6	.84	
075	55	IC4665	2.x2.d	<11.0	125	50:	jk*,*,L1	*,2	3.3		
006	72	IC4665	40'x40'	<13.8	275	33	Y	10	0.9	.84	
025	75	IC4756	8'x10'	<14	464	51:	A1	18	0.9	.97	
360	56	IC4996	1.4x1.4d	<15.5	157	59:	f,g,B,Wi	10	0.5		
168	67	IC4996	17'x17'	<14.2	79	43	B	6	2.3		
167	66	an.Bar.1	1.5x1.5d	<12.5	134	41:	B	4	2.1		

https://doi.org/10.1017/S0074180900147783 Published online by Cambridge University Press

Journal: Astronomy and Astrophysics

ref	year	Vol	page	subjects	type	Authors
001	1970	8	112	NGC2420	p	W.F.van Altena, B.F.Jones
002	1970	9	86	NGC7062	p	B.F.Jones, W.F.van Altena
003	1971	10	270	NGC6823	p	R.R.Erickson
004	1971	15	368	NGC6811	p	W.L.Sanders
005	1972	16	58	NGC6940,IC1805	r	W.L.Sanders
006	1972	17	193	IC4665	p	W.L.Sanders,W.F.van Altena
007	1972	19	155	NGC6819	p	W.L.Sanders
008	1972	20	425	NGC6530	p	W.F.van Altena, B.F.Jones
009	1975	43	423	Hyades	p	G.Pels, J.H.Oort, H.A.Pels-Kluyver
010	1977	54	569	NGC6705	r	B.J.McNamara, W.L.Sanders
011	1977	54	803	NGC 654	p	R.C.Stone
012	1980	88	102	NGC6494	p	W.L.Sanders, R.Schroeder
013	1981	104	185	distance OCl	r	B.Nicolet
014	1983	118	361	NGC6494	r	B.J.McNamara, W.L.Sanders

Journal: Astronomy and Astrophysics Supplement Series

ref	year	Vol	page	subjects	type	Authors
021	1973	9	213	NGC6633	p	W.L.Sanders
022	1973	9	221	NGC6913	p	W.L.Sanders
023	1973	9	313	Pleiades	p	B.F.Jones
024	1974	16	1	NGC6611	p	L.W.Kamp
025	1975	19	211	IC4756	p	A.D.Herzog, W.L.Sanders, W.Seggewiss
026	1977	27	89	NGC2682	p	W.L.Sanders
027	1977	27	117	NGC6705	p	B.J.McNamara, N.M.Pratt, W.L.Sanders
028	1977	30	45	NGC7092	p	B.J.McNamara, W.L.Sanders
029	1979	36	163	Cross references of numbering in 50 OCl	r	J.-C.Mermilliod / C.A.Murray
030	1979	37	333	Pleiades	p	S.Vasilevskis, F.van Leeuwen, W.Nicholson,
031	1981	43	337	NGC7789	p	B.J.McNamara, S.Solomon
032	1983	51	541	NGC6709	p	J.Hakkila, W.L.Sanders, R.Schroeder
033	1983	54	221	Orion	r	B.J.McNamara, S.Huels

Journal: Astrometriya i Astrofizika

ref	year	Vol	page	subjects	type	Authors
038	1981	45	56	NGC6913	r	E.A.Herts
039	1982	47	58	NGC6913	r	E.A.Herts
040	1983	50	52	NGC6910	r(p)	E.A.Herts

Journal: Astronomische Nachrichte

ref	year	Vol	page	subjects	type	Authors
043	1909	182	369	h & X Per	p	S.Kostinskij
044	1912	194	3	Hyades	r	A.Hnatek
045	1919	209	355	Pleiades	p	F.Hayn
046	1925	225	49	Praesepe	p	O.Heckmann
047	1930	238	245	NGC7209	p	S.Kostinskij
048	1940	269	303	Hyades	r	W.Losert
049	1947	275	73	Praesepe	r(p)	O.Heckmann,W.Kruse
050	1954	281	193	Hyades	p	V.V.Osvalds
051	1954	282	25	NGC1039	p	W.Dieckvoss
052	1956	283	1	Coma B.	p	A.König
053	1955	283	67	h & X Per	p	W.Dieckvoss
054	1955	283	109	a Per	p	O.Heckmann, W.Dieckvoss, H.Kox

Journal: Astronomisheskij Tsirkulyar

ref	year	No	page	subjects	type	Authors
055	1949	87	2	NGC6705	r	P.A.Savitskij
056	1950	108	1	NGC6885	r	P.A.Savitskij
057	1953	134	8	NGC7654	r	P.A.Savitskij
058	1953	136	16	NGC7654	r	P.A.Savitskij
059	1954	153	13	NGC6910	r	A.B.Onegina
060	1955	165	10	NGC6705	r	P.A.Savitskij
061	1974	845	5	NGC7788,NGC7790	r(p)	V.N.Frolov
062	1974	848	1	Berk.58,Anon.1	r(p)	V.N.Frolov
063	1975	863	3	Praesepe	r(p)	I.A.Zykov

Journal: Astronomical Journal

ref	year	Vol	page	subjects	type	Authors
069	1916	29	101	NGC2099	p	A.H.Joy
070	1919	32	117	NGC 663	p	V.M.Gushee
071	1938	46	197	Praesepe	p	J.Schilt, J.Titus
072	1938	47	25	Pleiades	p	J.Titus
073	1942	50	1	NGC2168	p	E.G.Ebbighausen
074	1942	50	91	NGC7654	p	E.G.Ebbighausen
075	1955	60	384	IC4665	p	S.Vasilevskis
076	1956	61	437	IC 348	p	L.W.Fredrick

077	1957	62	175	NGC6940	p	S.Vasilevskis, R.A.Rach
078	1958	63	387	NGC6633	p	S.Vasilevskis, A.Klemola, G.Preston
079	1959	64	170	NGC2281	p	S.Vasilevskis, A.G.A.Balz Jr
080	1961	66	16	NGC 129	p	A.P.Lenham, O.G.Franz
081	1962	67	532	NGC2099	p	W.H.Jefferys III
082	1962	67	699	** review **	r	S.Vasilevskis
083	1965	70	797	NGC2264	p	S.Vasilevskis, W.L.Sanders, A.G.A.Balz
084	1965	70	806	IC1805	p	S.Vasilevskis, W.L.Sanders, W.F.van Altena
085	1966	71	385	program US-naval Obs	r	H.H.Guetter, A.R.Upgren
086	1966	71	482	Hyades	p	W.F.van Altena
087	1966	71	736	NGC2099	p	A.R.Upgren
088	1968	73	44	Pleiades	p	W.F.van Altena
089	1970	75	563	Pleiades	p	B.F.Jones
090	1971	76	470	Praesepe	p	B.F.Jones
091	1971	76	475	NGC2168	p	K.M.Cudworth
092	1972	77	74	NGC 188	p	A.R.Upgren, W.S.Mesrobian, S.J.Kerridge
093	1973	78	53	NGC1664	p	S.J.Kerridge, R.M.Nelson, W.S.Mesrobian
094	1795	80	379	Hyades	p	R.B.Hanson
095	1976	81	375	Orion	p	B.J.McNamara
096	1980	85	66	a Per	p	A.Fresneau
097	1981	86	290	Pleiades	p	B.F.Jones
098	1982	87	1497	NGC2244	p	L.A.Marschall,W.F.van Altena, Liang-Tai G. Chiu
099	1983	88	215	Praesepe	p	B.F.Jones, K.M.Cudworth

Journal: Astrophysical Journal

ref	year	Vol	page	subjects	type	Authors
110	1934	81	297	Praesepe	p	P.van de Kamp
111	1939	89	431	NGC 752	p	E.G.Ebbighausen
112	1939	90	689	NGC2548	p	E.G.Ebbighausen
113	1942	91	244	NGC2682	p	E.G.Ebbighausen
114	1942	92	434	NGC7092	p	E.G.Ebbighausen
115	1942	94	399	Pleiades	p	A.van Maanen
116	1942	96	382	NGC2682	p	A.van Maanen
117	1944	100	31	h & X Per	p	A.van Maanen
118	1945	102	26	Pleiades	p	A.van Maanen
119	1955	119	188	NGC2287	r(p)	A.N.Cox
120	1958	128	14	Orion	p	K.A.Strand
121	1981	243	827	NGC2506	p	L.T.G.Chiu, W.F.van Altena
122	1981	243	841	NGC2506	r	R.D.McClure, B.A.Twarg, W.T.Forrester

Journal: Astrophysical Journal Supplement Series

ref	year	Vol	page	subjects	type	Authors
124	1976	30	451	evolved stars in OCl	r	G.L.H.Harris
125	1982	49	425	catalogue of OCl	r	K.Janes, D.Adler

Journal: Pis'ma v Astronomisheskij Zhurnal

ref	year	Vol	page	subjects	type	Authors
130	1975	1	3	NGC 129	r	V.N.Frolov

Journal: Annalen van de Sterrewacht te Leiden

ref	year	Vol	part	subjects	type	Authors
135	1947	19	1,A	Pleiades,catalogue	p	E.Hertzsprung
136	1949	19	1,B	Pleiades,measurements	r(p)	E.Hertzsprung
137	1946	19	2	Pleiades	r	L.Binnendijk

Journal: Bulletin of the American Astronomical Society

ref	year	Vol	page	subjects	type	Authors
138	1975	7	435	NGC1039	p	P.A.Ianna, H.A.Alister
139	1975	7	509	NGC 654	r	R.C.Stone
140	1976	8	524	Hyades	r	S.C.Morris,G.Hill, W.J.Luyten
141	1977	9	333	Orion	p	F.W.Fallow

Journal: Bulletin of the Astronomical Society of India

ref	year	Vol	page	subjects	type	Authors
145	1976	4	82	NGC6530	r	R.Sagar, U.C.Joshi
146	1976	4	82	Tr.1	r	R.Sagar, U.C.Joshi

Journal: Bulletin of the Astronomical Institutes of the Netherlands

ref	year	Vol	page	subjects	type	Authors
147	1923	1	218	h & X Per	r	E.Hertzsprung
148	1924	2	55	Pleiades	p	E.A.Kreiken
149	1924	2	183	Praesepe	p	W.J.Kleyn Wassink
150	1934	7	168	Hyades	r(p)	W.Chr.Martin
151	1936	7	305	Hyades	r(p)	G.van Herk
152	1952	11	385	Hyades	p	H.G.van Bueren
153	1959	14	265	NGC3532	p	D.Koelbloed

Journal: Veroffentligungen der Astronomischen Institute Bonn

ref	year	No	subjects	type	Authors
155	1924	19	NGC1960	p	J.Hopmann
156	1953	40	Praesepe	p	K.-W.Schrick
157	1954	41	NGC6705	p	J.Meurers, W.Richels
158	1956	43	NGC7789	p	J.Meurers, O.Bahr,H.H.Thomas
159	1957	47	NGC7092, NGC7243	p	H.van Schewick
160	1957	48	NGC6939	p	J.Meurers, K.J.Scharf
161	1958	49	NGC6885, NGC1960	p	J.Meurers, K.Zentgraf, H.F.Mohn
162	1958	51	NGC2244, NGC2252	p	H.van Schewick
163	1960	53	NGC2168, NGC2158, NGC2099	p	J.Meurers, A.Schwarz
164	1960	56	h & X Per	p	J.Meurers, A.Acksoy
165	1962	61	NGC2437	p	J.Meurers, H.J.Grandjean
166	1962	62	NGC6611, Cr.401	p	H.van Schewick
167	1966	74	NGC2422, NGC2423, NGC7209, An.Barkh.1	p	H.van Schewick, H.S.Haase, G.Heidrich, H.Nentwig
168	1967	76	NGC2301 (r), IC4996	p	H.van Schewick, H.Bergeder, M.Kohl, R.Ober,
169	1972	84	abs.prop.mot.61 OCl	r	H.van Schewick G.Vogler

Journal: Bulletin d'information du Centre des Donnees Stellaires

ref	year	No	page	subjects	type	Authors
171	1979	16	2	Bibl.rad.vel. OCl	r	J.-C.Mermilliod
172	1984	26	9	Bibl.rad.vel. OCl	r	J.-C.Mermilliod

Journal: Groningen, Publications of the Kapteyn Astronomical Laboratory

ref	year	No	subjects	type	Authors
177	1904	13	Hyades	r(p)	H.A.Weersma
178	1904	14	Hyades	p	A.Donner, W.de Sitter, J.C.Kapteyn
179	1916	26	Praesepe	p	P.J.van Rhijn
180	1922	33	NGC2682	p	P.J.van Rhijn
181	1924	35	Hyades	p	A.Donner, W.J.Kleyn Wassink, P.J.van Rhijn
182	1927	41	Praesepe	p	W.J.Klein Wassink
183	1955	56	NGC2301	r(p)	P.J.van Rhijn, L.Plaut

Journal: Lick Observatory Bulletin

ref	year	Vol	page	subjects	type	Authors
185	1921	333	110	Pleiades	p	R.Trumpler
186	1938	494	167	Coma	r(p)	R.Trumpler

Journal: Lowell Observatory Bulletin

ref	year	Vol	page	subjects	type	Authors
191	1962	5	257	Hyades	p	H.L.Giclas, R.Burnham, N.G.Thomas

Journal: Mitteilungen des Astronomisches Geselschaft

ref	year	Vol	page	subjects	type	Authors
195	1954		44	NGC6705	r	J.Meurers
196	1966	21	123	prop.mot. OCl	r	H.van Schewick
197	1968	25	172	IC4756	r	W.Seggewiss

Journal: Monthly Notices of the Astronomical Society of South Africa

ref	year	Vol	page	subjects	type	Authors
201	1960	19	120	NGC2547	p	J.D.Fernie

Journal: Monthly Notices of the Royal Astronomical Society

ref	year	Vol	page	subjects	type	Authors
203	1921	81	213	NGC6633	r(p)	W.J.Luyten
204	1921	81	536	Pleiades	p	W.M.Smart
205	1922	83	79	h & X Per	r	W.M.Smart
206	1923	83	334	NGC1960	p	C.H.Payne
207	1925	85	257	NGC2168	p	W.M.Smart
208	1926	86	645	NGC 225	p	O.J.Lee
209	1939	99	168	Hyades	r	W.M.Smart
210	1939	100	378	Praesepe	p	P.C.Chaudhuri
211	1940	100	560	a Per	r	W.M.Smart, A.Ali
212	1969	146	479	Coma B	r(p)	A.N.Argue, C.M.Kenworthy
213	1970	150	279	NGC2420	p	R.D.Cannon, C.Lloyd

Journal: Publications of the Leander McCormic Observatory

ref	year	Vol	page	subjects	type	Authors
215	1967	11	191	Praesepe	p	J.L.Hershey

Journal: Publications of the Astronomical Society of the Pacific

ref	year	Vol	page	subjects	type	Authors
220	1920	32	43	Pleiades	r(p)	R.Trumpler
221	1960	72	85	IC2391	r(p)	A.R.Hogg

Journal: Bulletin of the Pulkovo Astronomical Observatory

ref	year	Vol	Nr	page	subjects	type	Authors
223	1924	9	92	277	h & X Per	r	J.Balanovskij
224	1930	12	108	1	NGC6885	p	I.Lehmann-Balanovskaja
225	1937	15	126	1	NGC7243	p	G.G.Lengauer
226	1938	16	131	1	Coma B.	r	G.Shajn
227	1958	21	161	144	NGC1513, NGC1960, NGC2099, NGC6750	r	N.M.Bronnikova

228	1962	23	171	121	NGC 129, NGC 457, NGC 581, NGC7209 Tr.1	r	V.V.Lavdovskij
229	1964	23	174	144	NGC1960, NGC2099, NGC6705	r	N.M.Bronnikova
230	1965	23	176	138	NGC1907, NGC1912, NGC2168, NGC6882, NGC6885, NGC7092, h & X Per	r	V.V.Lavdovskij
231	1971		189	207	NGC6866	p	L.S.Koroleva
232	1975		193	80	NGC 129	p	V.N.Frolov
233	1979		196	69	NGC7788, NGC7790, Berk.58	r	V.N.Frolov

Journal: Transactions of the Pulkovo Astronomical Observatory

ref	year	Vol	page	subjects	type	Authors
240	1958	72	77	NGC1513, NGC1960, NGC2099, NGC6705	p	N.M.Bronnikova
241	1961	73	5	NGC 129, NGC 457, NGC 581, NGC 752, NGC1907, NGC1912, NGC2168, NGC6882, NGC6885, NGC7092, NGC7209, h & X Per	p	V.V.Lavdovskij

Journal: Communications from the Sternberg Astronomical Observatory

ref	year	Vol	page	subjects	type	Authors
245	1971	172	3	Praesepe	p	N.M.Artiukhina

Journal: Transactions from the Sternberg Astronomical Observatory

ref	year	Vol	page	subjects	type	Authors
250	1954	25		Orion	p	P.P.Parenago
251	1956	27	3	NGC6838, Har.20	p	N.M.Arthyukhina
252	1961	30	196	NGC7209	p	N.M.Arthyukhina
253	1961	30	219	NGC6866	p	N.M.Arthyukhina
254	1966	34	181	Praesepe	p	N.M.Arthyukhina

255	1970	39	111	Pleiades	p	N.M.Arthyukhina, E.P.Kalinina
256	1970	40	3	NGC7092	p	N.M.Arthyukhina, E.P.Kalinina
257	1975	46	57	Hyades	p	N.M.Arthyukhina, P.N.Kholopov
258	1976	47	105	Hyades	p	N.M.Arthyukhina, P.N.Kholopov

Journal: Sydney Observatory Papers

ref	year	No	subjects	type	Authors
261	1977	75	NGC6025	p	W.H.Robertson
262	1978	79	NGC3532	p	D.S.King
263	1978	81	NGC2516	p	D.S.King
264	1979	83	NGC4103	p	D.S.King
265	1979	86	NGC2669, IC2391	p	D.S.King
266	1980	87	NGC5662	p	D.S.King
267	1981	89	NGC4755	p	D.S.King
268	1982	93	NGC6087	p	D.S.King

Journal: Bulletin of the Tashkent Astronomical Observatory

ref	year	Vol	No	page	subjects	type	Authors
270	1941	2	5(15)	201	NGC7789	p	J.P.Tsukervanik

Journal: Circulars of the Astronomical Observatory in Tashkent

ref	year	Nol	No	page	subjects	type	Authors
272	1966	345		1	NGC7788	p	Kh.Ishmukhamedov
273	1966	346		16	NGC2422	p	Kh.Ishmukhamedov
274	1966	347		1	NGC1502	p	Kh.Ishmukhamedov
275	1972	(384)	37	11	NGC 457	p	A.A.Latypov
276	1973	(386)	39	12	NGC 663	p	A.A.Latypov
277	1973	(388)	41	1	NGC1039, NGC2682	p	A.A.Latypov
278	1973	(389)	42	11	NGC6633	p	A.A.Latypov
279	1973	(390)	43	10	NGC6755	p	A.A.Latypov
280	1975	(405)	58	1	NGC6705, NGC6694	p	A.A.Latypov
281	1977	(421)	74	1	NGC6709, NGC6940	p	A.A.Latypov
282	1977	(423)	76	1	NGC6940	p	A.A.Latypov
283	1982	(445)	98	3	h & X Per	p	M.Muminov

Journal: Publications de l'Observatoire de Tashkent

ref	year	Vol	page	subjects	type	Authors
285	1927	1	3	NGC7654 (1)	p	M.T.Subbotin
286	1930	3	3	NGC7654 (3)	p	P.A.Savitskij

Journal: Transactions of the Tashkent Astronomical Observatory

ref	year	Ser	Vol	page	subjects	type	Authors
287	1928	1	1	3	NGC7654 (2)	p	P.A.Savitskij
288	1954	2	3	3	NGC6885	p	P.A.Savitskij
289	1954	2	4	3	NGC7654 (4)	p	P.A.Savitskij
290	1978	3	2	3	catalogues of Tashkent p.m. studies	r(p)	A.A.Latypov

Journal: Astronomical Society of the Pacific, Leaflets

ref	year	No	subjects	type	Authors
295	1949	240	Table of Messier's nebulae and st.cl	r	J.C.Duncan

Journal: Sovjet Astronomy, Astronomical Journal

ref	year	Vol	No	page	subjects	type	Authors
300	1970	14	1	130	NGC7092	r	N.M.Arthyukhina
301	1972	16	2	317	a Per	r	N.M.Arthyukhina
302	1975	18	5	584	NGC7789	r	L.S.Koroleva

Journal: Publications of the American Astronomical Society

ref	year	Vol	page	subjects	type	Authors
308	1940	10	11	NGC2682	r	E.G.Ebbighausen
309	1941	10	124	NGC2168	r	E.G.Ebbighausen
310	1942	10	161	NGC7654	r	E.G.Ebbighausen

Journal: Ukrainian Academy of Sciences, Bulletin of the Main Astronomical Observatory

ref	year	Vol	No	page	subjects	type	Authors
313	1956	1	2	61	NGC6910	p	A.B.Onegina

Journal: Annals of the Sheshan (Zo-Se) Section of Shanghai Observatory

ref	year	Vol	page	subjects	type	Authors
317	1930	18	1	Orion	p	S.Chevalier, S.J.
318	1953	23	1	NGC1750, NGC1817, NGC2286, NGC2548, NGC7380	p	Li Khen
319	1966	26	63	NGC1960, NGC6530, NGC7380	p	Chian Bay-tzen, Zhu Guo-liang

Journal: Annals of Shanghai Observatory, Academia Sinica

ref	year	Vol	page	subjects	type	Authors
323	1981	3	151	NGC6530	p	Mi Liang-liang, Jiang Pei-fang, Qian Bo-chen
324	1982	4	17	NGC2682	p	Tian Kai-ping, Yin Ming-guan, Xu Zong-hai, Zhao Jun-liang

Journal: Stockholm Observatorium Annaler

ref	year	Band	No	subjects	type	Authors
327	1954	18	1	NGC2099	p	P.O.Lindblad
328	1956	19	6	NGC2099	r(p)	P.O.Lindblad

Journal: Journal des Observateurs

ref	year	Vol	page	subjects	type	Authors
330	1967	50	179	NGC1912	p	G.A.Mills

Journal: Contributions from the Mount Wilson Observatory

ref	year	Vol	page	subjects	type	Authors
335	1921	205		h & X Per	r(p)	A.van Maanen
336	1930	405		NGC2264	p	A.van Maanen

Journal: Uppsala Astronomiska Observatoriums Annaler

ref	year	Band	No	subjects	type	Authors
340	1946	1	10	NGC7654	p	A.Lundby

Journal: Meddelanden fran Astronomiska Observatorium Uppsala

ref	year	No	subjects	type	Authors
345	1939	77	NGC 581	r(p)	Å.Wallenquist
346	1965	153	NGC 581, Tr.1	p	T.Oja

Journal: Proceedings of the Astronomical Society of Australia

ref	year	Vol	page	subjects	type	Authors
350	1969	1	207	NGC6475	p	S.M.Constantine, B.J.Harris, I.Nikoloff

Journal: Recherches Astronomiques de l'Observatoire d'Utrecht

ref	year	No	subjects	type	Authors
354	1911	5	h & X Per	p	A.van Maanen

Journal: Vatican Observatory Publications

ref	year	Vol	No	subjects	type	Authors
356	1979	1	16	NGC 559	p	E.de Graeve, S.J.

Journal: Specola Vaticana, Ricerche Astronomiche

ref	year	Vol	No	subjects	type	Authors
358	1968	7	12	Pleiades	r(p)	M.F.McCarthy, S.J., P.J.Treanor, S.J.

Journal: Mitteilungen der Universitats-Sternwarte Wien

ref	year	Vol	No	page	subjects	type	Authors
360	1956	9	3		IC4996	p	J.Hopmann, K.Haidrich
361	1958	9	13		NGC1502	p	J.Hopmann
362	1960	10		129	NGC 663	p	J.Hopmann, K.Haidrich

Journal: Royal Observatory Bulletin

ref	year	No	subjects	type	Authors
365	1965	91	NGC2682	p	C.A.Murray, P.M.Corben, M.R.Allchorn
366	1965	98	Hyades	r	P.A.Wayman, L.S.T.Symon, K.C.Blackwell
367	1966	108	Hyades	p	C.A.Murray, C.M.Lowne, E.D.Clements
368	1968	139	NGC2682	p	C.A.Murray, E.D.Clements
369	1968	141	NGC2682	p	C.A.Murray
370	1970	158	NGC6939	p	R.D.Cannon, A.G.Purcell

Journal: others

ref	year		subjects	type	Authors
372	1971	Minnesota	Hyades	p	W.J.Luyten
373	1936	Leipzig Diss	Hyades	r(p)	G.Beulig
374	1960	Bonn Diss.	NGC2168, NGC2099	r(p)	A.Schwarz
375	1960	Bonn Diss.	h & X Per	r(p)	A.Aksoy
376	1967	Bonn Diss.	h & X Per	r(p)	E.Voosholz
377	1983	Leiden Diss.	Pleiades	r(p)	F.van Leeuwen
378	1983	Berk. Diss.	NGC2168, NGC2682, NGC6705, Hyades	r	R.D.Mathieu