

Schmidt Telescope Plate Archives

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Abstract. The contemporary state of the Schmidt/Maksutov telescope plate archives and their unification in an Index Plate Catalogue as part of the Wide Field Plate Database is presented.

1. Introduction: The Wide-Field Plate Database Project

The Wide-Field Plate Database (WFPDB) Project was initiated in 1991 during the 21st General Assembly of the IAU in Buenos Aires within the frames of the new Working Group on Wide Field Imaging (WG WFI; West 1991; Tsvetkov 1992). The main goal of this project is to make an inventory of all wide field photographic plates obtained in professional astronomical institutes and observatories all over the world since the end of last century and to organize an on-line access to the data for the plates. Detailed description of the WFPDB Project is given by Tsvetkov et al. (1994). Since 1991, several versions of a list of the wide field plate archives which are to be included in the WFPDB have been prepared and distributed in the astronomical community (WG WFI Newsletter No. 2, 1992; ESO/OAT Workshop in Trieste, 1993, and IAU Symposium 161 "Astronomy from Wide Field Imaging", 1993). The last (4th) version, distributed during the present IAU Colloquium 148, contains information about archives with a total of more than 1,700,000 wide field plates, 351,000 of which have already been included in the WFPDB.

2. Schmidt Telescopes and their Plate Archives

Since the invention of the Schmidt-type optical system by Bernhard Schmidt in 1929–1930 and the first observations with his telescope in Hamburg Bergdorf in 1931 (Mürsepp & Weismann 1984), followed by the wide acceptance of this system and its analogues (including Maksutov systems) in many observatories in the world, about half a million Schmidt plates have been obtained.

TABLE I. List of Schmidt/Maksutov Telescopes

Instrument Identifier	Observatory	East Longitude	Latitude			Clear Mirror Aperture Diameter			Scale Type size			Field size		Years of operation		No. of direct plates		No. Obj. Arch. Prism Plates	
			o	'	''	m	m	m	m	m	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17			
ABA039	Abastumani Obs.	42 49.5	41 45.3	1580	0.39	0.44	0.63	330	S	8.3	1938	F	30398	T					
ABA070	Abastumani Obs.	42 49.5	41 45.3	1580	0.70	0.98	2.10	98	M	4.9	1955		20193	T					T
ALM050	Alma Ata Mountain Obs.	76 57.4	43 11.3	1450	0.50	0.67	1.20	172	M	4.2	1950								
DYE055	Arthur J. Dyer Obs.	-86 48.3	36 3.1	345	0.55	0.58	2.08	99	S	5.0	1950								
ASI040	Asiago Obs.	11 31.7	45 51.7	1045	0.40	0.50	1.00	206	S	6.8	1958	F	18301	C	2006	T	C		
ASI067	Asiago Obs.	11 31.7	45 51.7	1045	0.67	0.92	2.15	96	S	5.3	1965		15050	C	680	T	C		
BEI060	Beijing Obs.	117 34.5	40 23.7	870	0.60	0.90	1.80	115	S	5.5	1963		3000	C					
BL0081	Bloemfontein	26 24.3	-29 2.3	1771	0.81	0.90	3.03	68	S	4.8	1950	1963	6632	T					
BON030	Bonn Univ. Obs.	6 51.0	50 9.8	533	0.30		1.30	159	S	3.5	1954		4000	T					
BOS051	Bosscha Obs.	107 37.0	-6 49.5	1300	0.51	0.71	1.27	162	S	5.0	1960		5000	T					
BYU053	Byurakan Obs.	44 17.5	40 20.1	1500	0.53	0.53	1.83	113	S	5.0	1958		20380	T					
BYU100	Byurakan Obs.	44 17.5	40 20.1	1500	1.00	1.50	2.13	97	S	4.0	1961		20600	T	4050	T			
CER090	Calern Obs., CERGA	6 55.6	43 44.9	1272	0.90	1.52	3.16	65	S	5.2	1976		3000	T	C				
CAT044	Catania Astr. Obs.	14 58.4	37 41.5	1735	0.44	0.61	1.22	169	S	4.2	1965	1993	1300	T					
ROB070	Cerro El Roble Obs.	-71 1.2	-32 58.9	2220	0.70	0.98	2.10	98	M	4.9									
CUR061	Cerro Tololo Int.-Amer. Obs	-70 48.9	-30 9.9	2215	0.61	0.91	2.13	97	S	5.0	1967		1400	T	600	T			
COP045	Copenhagen Univ. Obs.	11 39.9	55 37.3	90	0.45	0.77	1.50	137	S	5.3	1966								
CSS050	Crimean South St.	34 1.0	44 43.7	550	0.50	0.70	2.00	103	M	4.5	1960								
HAR060	Harvard Obs.	-71 33.5	42 30.2	185	0.60		2.10	98	S	5.0	1942	1957	4770	T					
JAG035	Jagellonian Fr. Skala Obs.	19 49.6	50 3.3	314	0.35	0.37	3.44	60	M	1.0	1964		4000	T					
JEN060	Jena Univ. Obs.	11 29.0	50 55.8	356	0.60	0.90	1.80	115	S	5.0	1963		1132	T					
KIS105	Kiso Obs.	137 37.7	35 47.6	1130	1.05	1.50	3.25	63	S	5.2	1974		6700	C					
KLE040	Klet Obs.	14 17.3	48 51.8	1070	0.40	0.50	1.03	200	M	7.0	1968	F	1800	C					
KLE063	Klet Obs.	14 17.3	48 51.8	1070	0.63	0.85	1.87	110	M	5.0	1976		4500	C					
KON060	Konkoly Obs.	19 54.0	47 55.0	946	0.60	0.90	1.80	115	S	5.0	1962		12000	C	800	C			
ESO100	La Silla, ESO	-70 43.8	-29 15.4	2347	1.00	1.60	3.06	67	S	3.6	1969		10000	C					

TABLE I. Cont

Instrument Identifier	Observatory	East Longitude		Latitude		Altitude		Clear Mirror Aperture		Focal Length		Scale		Field size		Years of operation		No. of direct plates		No. Obj. Arch. Prism Type Plates		
		0	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	2																					
MER100	Llano del Hato, Merida	-70	52.0	8	47.4	3610	1.00	1.52	3.00	69 S	5.7	1976	1184	T								
LOW020	Lowell Obs.	-111	39.9	35	12.2	2204	0.20	0.20	1031 S		1932	F	500									
MEU040	Méudon Obs.	2	13.9	48	48.3		0.40	0.60	1.00	206 S	10.0	1961	F	3293	T							
STRO50	Mount Stromlo Obs.	149	0.5	-35	19.3	767	0.50	0.65	1.73	119 S	3.8	1957										
CALO80	MPI-Calar Alto Obs.	-2	37.2	37	13.4	2188	0.80	1.20	2.40	86 S	5.5	1980										
DHP030	Obs. de Haute-Provence	5	42.8	43	55.9	655	0.30	0.41		S	7.7		F	5442	T							
DHP062	Obs. de Haute-Provence	5	42.8	43	55.9	655	0.62	0.90		S	4.4		F	7054	T							
PAL046	Palomar Obs.	-116	51.8	33	21.4	1706	0.46	0.60	0.91	227 S			F	10000	C							
PAL122	Palomar Obs.	-116	51.8	33	21.4	1706	1.22	1.83	3.07	67 S	6.5	1947										
RIG080	Riga Radio-Astroph. Obs.	24	24.0	56	47.0	75	0.80	1.20	2.40	86 S	5.7	1969	F	19000	T							
ROM060	Roma Obs.	13	33.6	42	26.6	2200	0.60	0.90	1.83	113 S	6.0	1961										
ROE040	Royal Obs. Edinburgh	-3	11.0	55	55.4	146	0.40	0.60	1.53	135 S	4.0	1962										
ROZ050	Rozen Obs.	24	45.0	41	43.0	1760	0.50	0.70	1.72	120 S	4.5	1979										
SID124	Siding Spring	149	4.2	-31	16.4	1130	1.24	1.83	3.07	67 S	6.4	1973										
SONO30	Sonneberg Obs.	11	11.5	50	22.7	640	0.30	0.30	0.30	690 S	11.5	1960										
SONO50	Sonneberg Obs.	11	11.5	50	22.7	640	0.50	0.70	1.72	120 S	4.3	1952										
STEG50	Sternberg Obs.	37	32.7	55	42.0	195	0.50	0.70	2.00	103 M	4.5	1958										
STO065	Stockholm Univ. Obs.	18	18.5	59	16.3	60	0.65	1.00	3.00	69 S	5.0	1967										
TAU134	Tautenburg Obs.	11	42.8	50	58.9	331	1.34	2.00	4.00	52 S	3.4	1960										
TONG66	Tonantzintla Obs.	-98	18.8	19	2.0	2150	0.66	0.76	2.17	95 S	5.5	1948										
TOR060	Torun Obs.	18	33.3	53	5.8	91	0.60	0.90	1.81	114 S	5.0	1962										
TUO050	Tuorla Obs.	22	26.8	60	25.0	40	0.50	0.60	1.03	200 S	5.5	1980										
TUO070	Tuorla Obs.	22	26.8	60	25.0	40	0.70	0.70	1.70	120 S	5.0	1975										
UPP100	Uppsala Univ. Obs.	17	36.4	59	30.1		1.00	1.35	3.00	69 S	4.5	1964										
VAT063	Vatican Obs.	12	39.1	41	44.8	450	0.63	0.98	2.40	86 S	4.5	1957										
BUR061	Warner and Swasey Obs.	-111	35.9	31	57.6	2084	0.61	0.91	2.14	97 S	5.2	1941										

The List of the Wide Field Plate Archives mentioned above contains 56 Schmidt and Maksutov telescope archives for 44 instruments. The data for these telescopes and their archives, as well as for 8 other Schmidt telescopes, for whose plate archives we have no information yet, are given in Table I, whose successive columns contain: 1. Telescope identifier (introduced as a unique instrument identifier in the WFPDB, Tsvetkov et al. 1994); 2. Observatory; 3. Observatory longitude [deg, min]; 4. Observatory latitude [deg, min]; 5. Observatory altitude [m]; 6. Clear telescope aperture [m]; 7. Diameter of telescope mirror [m]; 8. Focal length of the telescope [m]; 9. Plate scale [arcsec/mm]; 10. Instrument type: S – Schmidt, M – Maksutov; 11. Field angular size [deg]; 12. Years of telescope operation (from – to); 13. Symbol F for “film”, otherwise “plate”; 14. Number of direct plates; 15. Form of the archive data for the direct plates: T – printed, C – computer-readable, TC – partly computer-readable; 16. Number of objective prism plates; 17. Form of the archive data for the objective prism plates: same as for column 15.

The distribution of the number of Schmidt/Maksutov plates as well as of all other wide field plates from the List of Wide-Field Plate Archives by archive type (C+TC – in computer-readable and partly in computer-readable form, T – in printed form), separately for the direct and the objective prism plates, is given in Table II. As seen, the total number of Schmidt/Maksutov plates is 381,087, which is 22% of all 1,770,607 wide-field plates. Forty four per cent of the Schmidt/Maksutov plates are from archives, which are completely or partly in computer-readable form.

TABLE II Number of Wide-field Plates by Archive and Telescope Type

Archive Type	→	Direct plates		Objective-prism plates		Total
		C+TC	T	C+TC	T	
Telescope Type	↓					
Schmidt		146249	204371	21824	8643	381087
All others		678902	695241	560	14817	1389520
Total		825151	899612	22384	23460	1770607

The geographical distribution of the Schmidt/Maksutov telescopes is shown in Fig. 1.

3. Index Catalogue of Schmidt Plates

We have extracted from the WFPDB (351,000 plates) a subcatalogue for the Schmidt/Maksutov plates only. The so formed Index Catalogue of Schmidt Plates contains 88,649 entries, or 25% of all WFPDB plates. They have been obtained with the 11 Schmidt telescopes listed in Table III.



Figure 1. Worldwide distribution of Schmidt/Maksutov telescopes

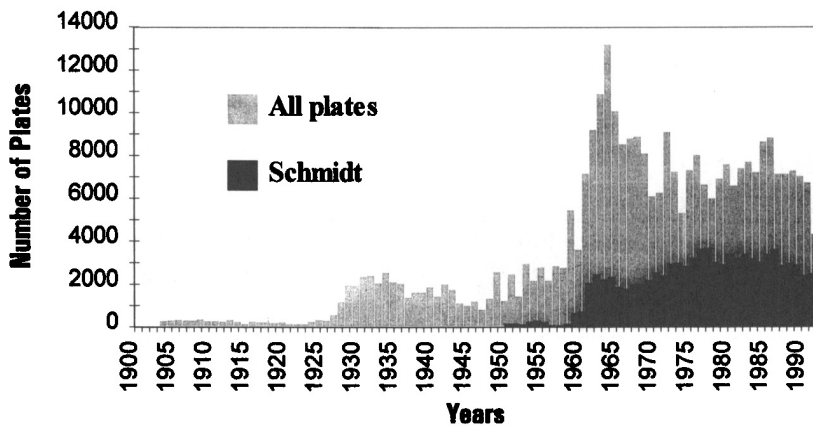


Figure 2. Distribution of the number of Schmidt telescope plates in the WFPDB versus time (years) in comparison with the distribution of all wide field plates in the database.

The distribution of the number of Schmidt telescope plates in the WFPDB versus time (years) compared with the distribution of all wide field plates in the database is shown in Fig. 2. Let us note that these distributions reflect only 20–25% of the complete numbers of plates.

4. Conclusions and Remarks

The WFPDB now contains the information for 351,000 plates including 88,659 Schmidt plates unified in an Index Plate Catalogue. In this way the data for about 25% of all Schmidt plates is already easily accessible by the help of computers. Requests for search in the database for Schmidt telescope plates of special interest can be sent to WFPA@BGEARN.BITNET. After the realization in the near future of an INTERNET connection with the Institute of Astronomy in Sofia, an on-line access and search in the WFPDB will be available.

Some institutes/observatories have sent us their Schmidt plate catalogues only in printed form (for example, ROE, Monte Porzio, etc.) and we are now converting them in computer-readable form, in order to join them to the database. Also, we have the possibility of preparing computer-readable versions of other plate catalogues if the printed versions are sent to us.

We have estimated roughly that all Schmidt plates contain about 200 TB digitized information (several thousand Schmidt plates are already completely digitized). The effective time necessary for the digitization of these plates is estimated to be 13,000 hours. It is obvious that the task for the Schmidt plate digitization can be fulfilled only if good collaboration and coordination among the centres for plate digitization (Baltimore, Edinburgh, Flagstaff, Minnesota, Muenster, Paris, Tokyo, etc.) could be accomplished. The creation of regional and national centres for plate archiving and digitization may play an important role for future progress in this direction.

Acknowledgements

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TABLE III List of Schmidt Telescopes with Observation Catalogues Included in the WFPDB till March 1994

No.	Instrument identifier	Observatory	Instrument aperture (m)	Number of plates
1	ASI040	Asiago	0.40	15267
2	ASI067	Asiago	0.67	18411
3	BEI060	Beijing	0.60	1509
4	ESO100	ESO-La Silla	1.00	8055
5	KIS105	Kiso	1.05	6728
6	PAL122	Palomar	1.22	1159
7	ROZ050	Rozhen	0.50	6750
8	SID124	ROE-Siding Spring	1.24	14383
9	SON030	Sonneberg	0.30	5322
10	TAU134	Tautenburg	1.34	8239
11	TOR060	Torun	0.60	2826

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Discussion

MacConnell: I think this is very important work and you should be commended for doing it. Does the database contain the details of plate centres, emulsions, filters, exposure times etc? It seems you really need the observing logs from the telescopes and it would be an enormous task to enter all that material into machine-readable form. What can those of us who take plates do to help?

Tsvetkov: Thank you very much for your attention Dr MacConnell. Really I am happy for the possibility, here in Bandung, to see the data of the American wide-field telescopes, during our joint discussions, especially for the Burrell and Curtis Schmidts. Of course, the index plate catalogue of the database contains all this information for each plate - recorded there from the original log book. I shall appreciate also your co-operation in future to include the log books data of the US wide-field telescopes in the database. We are able in Sofia to put in a computer readable form, the data from the log books which are still in a printed (table) form.

Ward Moody: What information do you have on the condition of these plates? Do you know how things like the "gold mould" have degraded plate quality?

Tsvetkov: In the list of archives, there is only general information given about the quality of a given archive (the "Q" parameter in the WFPA list). The plate quality is sometimes given in the original log books and if such information exists, it is included in the Index Plate Catalogue of the database. We also have a "pointer" which will refer to the plate quality and availability for each plate.

Maury: How wide does an image have to be for you to incorporate it in your archive, i.e. is a 33 arcmin CCD field large enough?

Tsvetkov: It is difficult at present to discuss the status of the CCD archives in the WFP database. In the list of archives we included photographic plate collections $\gtrsim 1^\circ$. The question of wide-field CCD archives is very important and this problem will arise in the near future. For example, observations with comparatively wide-field CCDs will acquire 15–50 Gbytes of digitized data per night.

Malin: I have a comment. Your listing is a very impressive compilation of what has been taken with many of the world's photographic telescopes. But like a listing of the books in a library, the list itself is not very useful unless the books are available. This is a plea for those holding photographic plates to return them to the institution from which they came.

Tsvetkov: I agree!