

A short history of Hamburg Observatory

Stuart R. Anderson & Dieter Engels

This paper's aim is to provide a short history of Hamburg Observatory, its astronomers and instruments, its contribution to astronomy and to the popularisation and educational development of astronomy in Germany.

Introduction

Hamburg Observatory is located in Bergedorf, near the port city of Hamburg, Germany. Its history throughout its approximately 170 years of existence has been interesting and varied, and at one stage it was one of the largest observatories in Europe. The observatory and its astronomers have produced some contributions of outstanding importance to astronomy, including the celebrated Schmidt corrector plate. Several minor planets, comets and novae were discovered and catalogues of crucial significance were and continue to



Figure 1. Johann Georg Repsold, founder of the Hamburg observatory.¹⁸

be produced. More recently, research efforts have turned to extragalactic astronomy, most notably in the field of gravitational lenses and quasar astronomy. The broad scope of astrophysical research is nowadays represented by research groups on stars and planets, and quasars, through observational and theoretical work. The historical dearth of contributions by the observatory to astronomical education and popularisation is noted, although more recent initiatives in this area signal an era of more public visibility.

Hamburg Observatory was chosen for two reasons. Firstly, its physical proximity to SRA's location at the time of the research and secondly, the apparent shortage of English-language material covering the observatory's history. Materials were gathered for this paper by literature searches and oral history interviews. Those involved are acknowledged.

Early history of the observatory

The current location of the Hamburg Observatory is in Bergedorf (the observatory is referred to by the staff simply as

'Bergedorf', and this name will sometimes be used in this paper, although its official name is Hamburger Sternwarte), a small community just east of the city of Hamburg in northern Germany. This was not always the case, however. Johann Georg Repsold (1770–1830) was a fireman in the city who also maintained lighthouse equipment in his own workshop. For extra income, he was permitted to use this workshop for private purposes and having taken lessons in astronomy and mathematics, had an interest in building astronomical observing instruments. In 1799, the Swiss Johann Caspar Horner received a commission to survey the Weser, Elbe and Eider rivers and needed good quality optical equipment. Repsold's workshop seemed well suited to the task, and the order for the equipment awakened his astronomical interests. In 1802, with the permission of the Senate, he built a private observatory in the city itself. He equipped the observatory with instruments built in his own workshop, which included an 8-foot meridian circle, three and a half feet (1.1m) in diameter. This was installed in 1803 and observations began in August that year.^{1,18}

Napoleon's occupation of the city from 1810 December 13 effectively put an end to the observatory's activities, and it was demolished in 1811. Undeterred, Repsold wished to build a new observatory and in the same year wrote a letter to the Senate elaborating his plans. It was not, however, until 1820 that the Senate agreed to this, on the condition that Repsold

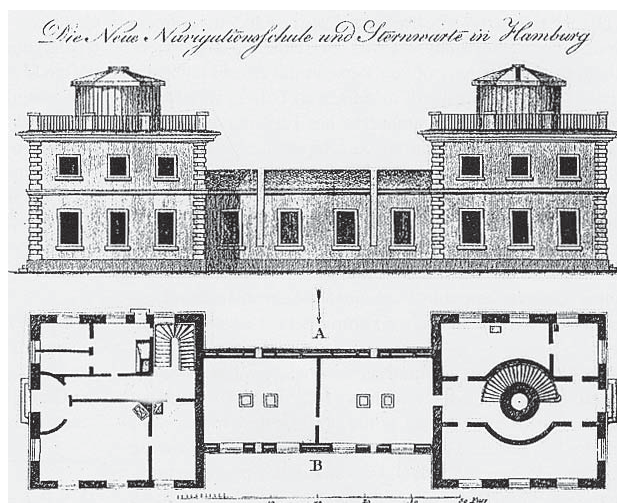


Figure 2. First publication of a view of Hamburg Observatory in 1829.²⁰

provide all the instrumentation free of charge. By this time of course, shipping had become extremely important to the growing port city, and there was a growing realisation that an observatory would support navigation and boost the reputation and respect of the city worldwide.

Building work on the new observatory started in 1824 and was completed the following year. The new observatory was located at Millerntor (currently the site of the Museum of the History of Hamburg) and was unified with the Navigation School (which occupied the east wing). Repsold himself was director, although he still had his fire-fighting duties to attend to. On 1830 January 14 he died unexpectedly fighting a fire in the centre of the city. Today, Repsold has a street in central Hamburg named after him and his statue stands outside the Museum for the History of Hamburg.^{2,19}



Figure 3. A relief of Carl Rümker, found today in the entrance to Hamburg's town hall.²⁰

On 1833 December 10 the Senate formally took over the observatory and Christian Carl Ludwig Rümker (1788–1862) was offered the directorship. Rümker had helped to found and run the Paramatta Observatory in Sydney, Australia and had recently returned to London, partly to publish his observations with the Royal Society.

Rümker had a Fraunhofer refractor at his disposal, and ordered a new meridian circle from the now-famous Repsold workshops – a 1.62m focal length instrument. Observations focused on comets, asteroids, eclipses and astrometry. In 1852 Rümker published a catalogue of the positions of 12,000 fixed stars and in 1854 the Royal Society awarded him a Gold Medal for this work. He retired in 1857, moving on health grounds to Lisbon, Portugal to escape Hamburg's notoriously poor weather, and his son Georg Rümker (1832–1900) took charge.^{3,19}

As a sign of the increasing importance of nautical affairs in the port city, in 1863 the Navigation School split with the observatory, and the capabilities of the observatory itself would be under question until more powerful instruments were available to supplement those already in use. Conse-



Figure 5. With an increase in trade, light and smoke from the busy harbour soon became a major problem for Hamburg Observatory.²⁰

quently, in 1867 a new 26cm equatorial refractor was delivered from the Repsold workshops and the capabilities of the observatory were secured for the near term. The equatorial can still be seen in the observatory today, and is its oldest instrument (Table 1).⁴

Georg Rümker was a traditionalist, preferring to remain with observations of comets and asteroids and astrometry, and the new instrument was put to work mainly on these tasks. The observatory began to lose influence within the German astronomical community and at the fifth general meeting of the *Astronomische Gesellschaft* in August 1873, which took place in Hamburg itself, the observatory played only a minor role in the most important discussions, which increasingly leaned towards the nature of the 'spiral nebulae' (which we now know as galaxies). Also, Hamburg observatory did not take part in the collection of the important AGK1 (*Astronomische Gesellschaft Katalog 1*) catalogue.⁵

The move to Bergedorf and the new century












Figure 6. Richard Schorr.²⁰

With increasing industrialisation and the growing importance of shipping to the city, the exact measurement of time became a crucial role of the observatory, and a time ball was installed in the port with an underground electrical link to the observatory. There was a price to pay for the development to which the observatory itself was contributing; light pollution, and vibration and dust from street traffic eventually became such serious problems that Rümker and Richard Reinhard Emil Schorr (1867–1951), then an 'observer' at the observatory, proposed to move the observatory to the current location in Bergedorf in 1892, although the official inauguration did not actually occur until 1912 under Schorr's directorship (12 years after Rümker's death in 1900). New instruments were ordered; the principal ones in the new observatory were the meridian circle and Great Refractor (60cm

O Stunde.															
No. der Catal. oder Stern Name.	Größe.	Rektascension, Januar 1, 1856.	Zahl der Beob.	Älteste Präzision.	Declination, Januar 1, 1856.	Zahl der Beob.	Älteste Präzision.	Logarithmen von				Logarithmen von			
								a	b	c	d	e'	f'	e''	f''
1	8	0 6 36,379	1	4,3070	-39 42 58,29	1	4,3004	8,9379	6,2135	-0,4871	+8,7433	+9,5219	9,8055	-1,3019	-7,3754
2	8	0 4 15,71	3	3,073	49 54 39,46	3	3,004	9,0151	6,5000	0,4875	8,8088	9,4428	8,8837	1,3019	-7,4849
3	4	0 0 48,571	1	3,073	49 54 39,67	1	3,004	9,0151	6,5580	0,4876	8,8088	9,4422	9,8837	1,3019	-7,5429
4	4	0 0 11,850	1	3,074	49 55 22,88	1	3,004	9,0152	6,5929	0,4877	8,8091	9,4417	9,8838	1,3019	-7,5777
5	0	0 23,212	1	3,077	63 2 29,40	1	3,004	9,1675	6,7452	0,4882	8,9175	9,2897	9,9500	1,3019	-7,7177
6	7	0 1 13,452	2	3,077	51 6 36,91	2	3,004	9,0261	6,7511	0,4881	8,9173	9,4288	9,8912	1,3019	-7,7250
7	0	1 19,983	2	3,078	51 7 44,03	2	3,004	9,0263	6,7910	0,4883	8,9176	9,4278	9,8913	1,3019	-7,7647
8	0	1 35,550	4	3,079	49 33 40,12	4	3,004	9,0149	6,5588	0,4884	8,8084	9,4382	9,8836	1,3019	-7,8439
9	0	1 44,757	20	3,079	14 16 17,07	20	3,004	8,8374	7,1885	0,4878	8,2292	9,6185	9,3917	1,3018	-8,3210
10	0	2 31,712	2	3,080	38 20 01,76	2	3,004	8,9265	6,9729	0,4880	8,7222	9,5531	9,7927	1,3019	-8,0435
11	0	2 54,156	1	3,101	63 1 18,50	1	3,004	9,1671	7,2743	0,4915	9,1170	9,2683	9,9500	1,3019	-8,1072
12	0	3 17,952	2	3,090	50 4 27,22	2	3,004	9,0166	7,1749	0,4900	8,9014	9,4272	9,8848	1,3019	-8,1353
13	0	4 30,147	2	3,120	63 26 14,88	2	3,004	9,1734	7,4633	0,4941	9,1250	9,2476	9,9519	1,3018	-8,2898
14	0	4 47,875	20	3,079	14 16 17,07	20	3,004	8,8374	7,1885	0,4878	8,2292	9,6185	9,3917	1,3018	-8,3210
15	0	4 53,652	3	3,124	63 4 13,18	3	3,004	9,1678	7,4978	0,4947	9,1179	9,2493	9,9500	1,3018	-8,3300
16	7	0 3 18,02	1	3,128	63 17 7,94	1	3,004	9,1812	7,5229	0,4933	9,1348	9,3527	9,9514	1,3018	-8,3416
17	0	5 17,069	1	3,128	62 49 48,73	1	3,004	9,1643	7,5271	0,4933	9,1133	9,2497	9,9491	1,3018	-8,3627
18	0	5 58,227	3	3,138	63 39 15,07	3	3,004	9,1769	7,5304	0,4967	9,1289	9,2284	9,9523	1,3018	-8,4167
19	6	0 5 50,691	2	3,078	15 43 47,49	2	3,004	8,8403	7,2584	0,4883	8,2754	9,6153	9,4329	1,3018	-8,4179
20	0	6 57,59	1	3,134	61 53 55,32	1	3,004	9,1811	7,5738	0,4991	9,0608	9,2577	9,9466	1,3018	-8,4227
21	0	6 7,630	3	3,081	19 17 39,03	3	3,003	8,8488	7,2765	0,4886	8,2679	9,6000	9,4189	1,3017	-8,4275
22	0	6 27,275	2	3,142	62 49 31,02	2	3,003	9,1642	7,6170	0,4972	9,1134	9,2380	9,9490	1,3017	-8,4326
23	0	6 29,139	2	3,073	15 43 53,11	2	3,003	8,8278	7,2929	0,4876	7,9664	9,6294	9,1384	1,3017	-8,4349
24	7	0 7 3,896	3	3,078	19 30 39,82	3	3,003	8,8342	7,3334	0,4882	8,1700	9,6201	9,3357	1,3017	-8,4910
25	0	7 23,693	3	3,101	37 50 48,43	3	3,003	8,9263	7,4374	0,4915	8,7141	9,5089	9,7876	1,3017	-8,5109
26	9	0 7 49,577	3	3,081	16 44 17,35	2	3,003	8,8401	7,3790	0,4886	8,2739	9,6111	9,4334	1,3016	-8,5392
27	0	8 57,85	7	3,100	62 38 26,61	8	3,003	9,1611	7,7134	0,4997	9,1098	9,2248	9,9481	1,3016	-8,5518
28	0	8 10,287	3	3,123	48 33 22,33	3	3,003	9,0928	7,6905	0,4945	8,8776	9,4975	9,8743	1,3016	-8,5575
29	7	0 8 18,579	2	3,079	13 0 17,32	2	3,003	8,8349	7,3837	0,4884	8,1871	9,6178	9,3519	1,3016	-8,5685
30	0	8 29,654	2	3,122	47 39 49,57	2	3,003	8,9692	7,5638	0,4944	8,8638	9,4322	9,8684	1,3016	-8,5688
31	0	8 33,304	2	3,121	47 37 5,00	2	3,003	8,9691	7,5619	0,4943	8,8514	9,4291	9,8641	1,3016	-8,5708
32	5	0 8 32,524	3	3,107	37 40 13,84	3	3,003	8,9297	7,4968	0,4923	8,7128	9,5056	9,7868	1,3016	-8,5708
33	7	0 9 10,632	2	3,083	15 43 17,14	2	3,002	8,8401	7,4432	0,4890	8,2730	9,6006	9,4325	1,3015	-8,6027
34	0	9 19,837	2	3,083	15 23 14,31	2	3,002	8,8394	7,4495	0,4889	8,2640	9,6102	9,4322	1,3015	-8,6027
35	0	10 0,096	4	3,065	23 13 47,24	4	3,002	8,8671	7,5072	0,4907	8,8028	9,2729	9,6293	1,3015	-8,6027
36	8	10 65,24	6	3,182	62 39 30,10	6	3,002	9,1615	7,8529	0,5027	9,1060	9,2047	9,9481	1,3013	-8,6440
37	0	10 13,741	2	3,080	11 47 5,38	2	3,002	8,8328	7,4829	0,4886	8,1428	9,6188	9,3697	1,3013	-8,6497
38	0	10 35,898	3	3,137	48 1 11,84	3	3,002	8,9981	7,9929	0,4963	8,9893	9,1082	9,5707	1,3014	-8,6943
39	7	0 10 45,718	2	3,083	13 8 40,79	2	3,002	8,8349	7,3111	0,4889	8,1919	9,6147	9,3693	1,3014	-8,6972

Figure 4. An excerpt from Carl Rümker's *Stellar Catalogue*, published in 1852.²⁰

Table 1. The principal instruments of Hamburg Observatory^{19,28,29}

<p>The Great Refractor 60cm objective, 9m focal length. Installed in 1906, used extensively by Kasimir Graf for planetary observations. This instrument was mainly an impressive technical achievement, rather than extensively used for ground-breaking observational work.</p> 		<p>1m Reflector</p> 	<p>Installed in 1911 with a Zeiss mount. Used by Walter Baade initially for comet and asteroid searches, later for photographic work on clusters, galaxies and nebulae. Crucial for Baade's work on his two-stellar-population theory.</p>	<p>The Equatorial</p> 	<p>26cm refractor, 3m focal length. The oldest instrument at the observatory, installed 1867, it was used initially for comet and asteroid work, mainly visual. It was later used for work on the 'spiral nebulae' (which we now know to be galaxies). The instrument fell somewhat into disuse after larger instruments were installed until local amateur Max Beyer used it 1946–1977 for his cometary and other observational work.</p>
<p>AG Astrograph</p> 	<p>('AG'='Astronomische Gesellschaft'). 8.5cm objective, focal length 2.06m. Built in 1924, it was used for the important AGK2 and AGK3 catalogues.</p>	<p>Lippert Astrograph</p> 	<p>34cm objective, 3.4m focal length. It was used for the <i>Bergedorfer Spektraldurchmusterung</i>, variable star research and comet/asteroid searches. Four new comets and four novae were discovered with this instrument. It is now used by the <i>Seh-Stern</i> project.</p>	<p>Oskar-Lühning Telescope</p> 	<p>1.2m aperture, 15.6m focal length. The largest instrument at Bergedorf, it was installed in 1975 and used initially to study planetary nebulae, novae and β-Cephei stars. Science observations ceased in the mid 1980s. It was modernised in 2001 for remote PC control and CCD imaging.</p>
<p>Meridian Circle</p> 	<p>19cm objective, 2.3m focal length. It was used for several catalogues, including one gathered in Perth, Australia in 1967 (Southern Reference Star catalogue) for which the telescope was temporarily on loan. It is now in the German National Museum. To 1969, 130,000 observations were made with the instrument.</p>	<p>Schmidt Telescope</p> 	<p>An 80cm telescope, originally conceived in 1937 but not delivered until 1951. Light pollution hampered its scientific contributions until it was moved in 1975 to Calar Alto, Spain. It was used for the northern hemisphere <i>Hamburg Quasar Survey</i> and is currently mothballed.</p>	<p>Zonenastrograph</p> 	<p>23cm telescope with 2.05m focal length. Built in 1973, used since 1975 for precision astrometry. Stellar positions determined from the instrument were used in many projects, including the <i>Hipparcos</i> satellite's input data.</p>

diameter) from Repsold, the 1m reflector from Carl Zeiss, the Lippert Astrograph (purchased with a generous donation from Eduard Lippert, a local merchant) and of course the 26cm equatorial from the previous location. The move to Bergedorf ushered in the peak of Hamburg Observatory's productivity; it was at this time one of Europe's largest observatories, with Germany's largest reflecting telescope and one of the world's most powerful refractors.^{6,19}

Throughout the 1910s and 1920s, the Great Refractor saw much use by Professor Kasimir Graf (1878–1950), who joined the observatory as an assistant in 1902, and became an 'observer' in 1909. His observations of the planets were particularly impressive (although in 1924 he convinced himself that he had seen the now-infamous Martian 'canals'). He left Bergedorf to become director of the Vienna observatory in 1928.^{7,19} In one of the few instances of professional–amateur collaboration at Bergedorf, his role in collaboration with local amateur Max Beyer is discussed below.

In 1920, Walter Baade (1893–1960), one of Hamburg's most illustrious astronomers, joined the observatory as Schorr's

assistant. This was despite his personally stated goal of working at one of the large American observatories, a goal which under the political and economic conditions of the time was quite unrealisable (during the founding of the International Astronomical Union, it was decided that German astronomers could not be members, a move justified at the time by the willing collaboration of some German scientists in the service of the military, and hence their perceived duplicity in World War I gas attacks in Belgium and France.⁸) Hamburg was literally Baade's 'next best choice'. From 1920 to 1931, Baade used the 1m reflector, first as



Figure 7. The construction of the domes for the meridian circle in Bergedorf, 1908.²⁰

an assistant, then as the sole observer. Initially he concentrated on the familiar Bergedorf material – comets, planets and asteroids – but then his observing programmes widened to stars in the galactic halo, and later he showed special interest in the ‘spiral nebulae’. The instrument was also critical for Baade’s work on his two-stellar-populations theory. In 1931 he achieved his dream, and accepted a position at the Mount Wilson observatory in California, much to Bergedorf’s disappointment.^{9,19}



Figure 8. Bernhard Schmidt (left) in 1935.²⁰

Bernhard Schmidt (1879–1935) was born in Estonia and had an interest in science and mathematics from a young age. In 1926 he sought a role at Potsdam Observatory, but was looking for independent work, rather than the sort of supervised, structured programme offered by Potsdam. Schmidt preferred Bergedorf’s more flexible approach, and the observatory provided him with rooms and materials. He was to become another of Bergedorf’s famous astronomers, and it was the observatory’s willingness to allow him his own personal, independent working style which undoubtedly contributed to his innovations.

Schmidt began to think about how he might design and build an astronomical camera capable of working over wide angles with low focal ratios and with high resultant image quality. His now hugely celebrated ‘Schmidt corrector plate’ was born on an eclipse expedition (with Baade) in the Philippines. The first Schmidt corrector plate was built in the winter of 1929, and it was to revolutionise photographic astronomy. The first actual ‘Schmidt telescope’ was constructed in 1930 and produced images dramatically superior to their predecessors.²¹ The success of this innovation needs no further comment, and his work is commemorated at the observatory in a small museum inaugurated in 1979.²²

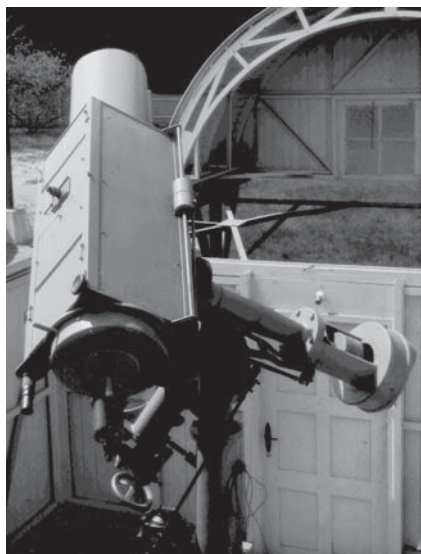


Figure 9. The world’s first Schmidt telescope (constructed in 1930 at Hamburg Observatory), seen here in 1932.²⁰

The AGK2 (*Astronomische Gesellschaft Katalog 2*) was a stellar position project consisting of 200,000 stars, for which observations began in 1928. Bergedorf completed 50% of the work, the rest being completed by Pulkovo and Bonn observato-

ries. Owing to the outbreak of World War II, however, it was not published until 1951.¹⁰ In addition to a large contribution to AGK2, between 1920 and 1953 Bergedorf astronomers Schwassmann and Wachmann used the Lippert astrograph to catalogue the spectra of 160,000 stars (the *Bergedorfer Spektraldurchmusterung*). Such work from Bergedorf and other ob-



Figure 10. Cover pages from the AGK2 catalogue.²⁰

servatories contributed significantly to the development of stellar evolution theory, including the Hertzsprung–Russell diagram familiar to astronomy students the world over.¹⁹

By the mid thirties, the question of a successor was increasingly on Schorr’s mind, and for him there was a natural choice: Walter Baade, who of course by now was at Mount Wilson in California. Mount Wilson was already in the process of building its own 1.2m Schmidt telescope, and Baade knew that Hamburg would require one with ur-

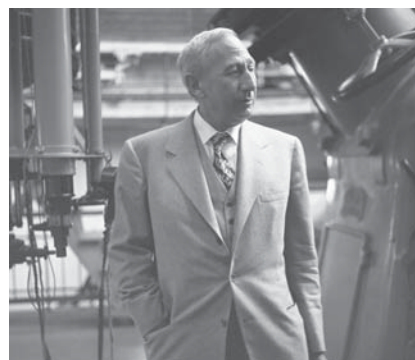


Figure 11. Walter Baade in 1956.²⁰

gency if it were to compete with the American facility. Financial delays in Bergedorf seemed increasingly likely, whereas the Mount Wilson project was progressing rapidly. In a telegram sent to Schorr on 1937 July 19 from Mount Wilson, Baade wrote (translation in brackets is SRA’s):

HABE MIT SCHWEREN HERZENS FUER MT WILSON ENTSCHEIDEN STOP HOFFE DASS DIE HEIMAT MICH VERSTEHT [I have with a heavy heart decided on Mt Wilson STOP I hope that the homeland understands].¹¹

This was a bitter blow to Schorr, whose next choice was Otto Heckmann. Heckmann had interests in cosmology, and in particular looked favourably on relativity theory, but the Nazi regime did not approve of such ‘non-German physics’. With the greatest difficulty on Schorr’s part, however, Heckmann became director in 1941.¹² In fact, owing to the outbreak of the war, the 1.2m Schmidt telescope was not delivered to Bergedorf until 14 years after Baade’s decision, in 1951.^{13,19}

In the years before the outbreak of World War II, light pollution from Hamburg city was becoming an increasing problem, and more frequent air traffic meant that pilots required better orientational assistance when flying at night. Regular

flights had begun between Hamburg and Berlin, and between Malmö in Sweden and Hannover. In 1925, the first navigational aid lights were installed in and around Hamburg, and this was the beginning of the era of light pollution with which so many near-city observatories became plagued. The observational side of Bergedorf's work was never fully to recover.¹⁴

The war years

The years of the Second World War could very easily have been much worse for the observatory. At the outset of the war, Bergedorf was immediately put to work for military purposes with many instruments packed away and put into cellars. Navigational tables and exact timings for Luftwaffe squadrons were produced, including tables for bombers (with calculations curiously made out to 1960). Anti-aircraft installations were placed in and near to the observatory grounds, including a small telescope used to sight enemy aircraft, but astonishingly the only damage to the observatory itself occurred on the evening of 1942 July 26 when a damaged British bomber (which later crashed) offloaded 100 firebombs to reduce weight as it fell, but little damage was done to the equipment or buildings (one chair was burnt).¹⁵ This is despite the fact that during the war 55% of the city's residential areas and 60% of the harbour installations were destroyed – thus it appears that Bergedorf was never a specific target of allied bombing, despite the military tasks it was assigned.

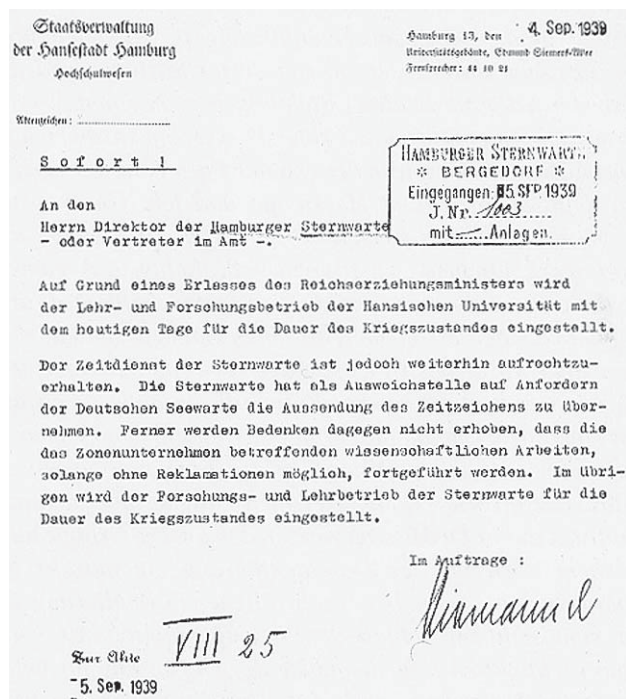


Figure 12. The order of 1939 September 4 that Hamburg observatory was to cease all teaching and research programmes with immediate effect 'for the duration of the war'. Instead, the observatory was to focus on military tasks. *Hamburger Sternwarte*.

Post-war years to 1968

After the war, the work of the observatory returned to normal and the AGK2 and *Hamburger Durchmusterung* catalogues were completed. When Baade was offered the post of Director in 1937, the Senate had promised the observatory a new Schmidt telescope, and in 1950, despite the tough post-war economic environment, this money was set aside. The order was made with Zeiss in Jena and in 1951 a new building was founded for the telescope, which was first used for observations in 1954. The delay from 1937 was most unfortunate for Bergedorf, since by the time the telescope was in operation, the Palomar Schmidt in the USA had surpassed that of Bergedorf, and by 1954 light pollution in Hamburg had become a major problem. For example, exposures of more than 10–15 minutes were simply not possible owing to the level of light pollution (originally one hour exposures were planned). Had the delays and war not intervened, Schramm believes¹³ that the Palomar Observatory Sky Survey (POSS I, taken 1950–1957 with the 48 inch Oschin Schmidt telescope) might have been Bergedorf's. Eventually in 1969, work began to move the telescope to a more favourable observing location in Calar Alto, Spain.¹⁹

At the 1952 meeting of the International Astronomical Union in Rome, a successor to the AGK2 catalogue was discussed and the AGK3 project was born. It was decided that Bergedorf and Bonn observatories should perform the photographic portion of the work, but in the end Bergedorf covered the whole northern sky owing to extensive changes being made to the Bonn astrograph. The project lasted from 1956–1964 and the catalogue of 180,000 stars was published in 1975. AGK3 was aided by two important additions to the observatory's data-processing armoury. In 1958, the observatory was able to use Hamburg University's IBM 650 computer for its data processing (400,000 punched cards were loaded for AGK3) and by 1967, Bergedorf had its own on-site computer. These instruments obviously greatly improved the speed with which the catalogues could be brought to publication.¹⁶

A few years after the AGK3 project commenced, Otto Heckmann's career was about to take a new direction. He



Figure 13. The AGK3 team.²⁰

was appointed first director of the European Southern Observatory (ESO), founded in October 1957. The first headquarters of the ESO was in Bergedorf, to enable Heckmann to be director of both. The increasing demands of the ESO however meant that Heckmann could focus fewer of his efforts on Bergedorf, and in 1968 he was emerited so that he could concentrate on the ESO. In the early 1970s, ESO headquarters were moved to Munich, and the last ESO files left Bergedorf in 1975.¹⁷



Figure 14. Otto Heckmann, 1965.²⁰

A notable episode in professional–amateur collaboration at Bergedorf was the astonishing case of Max Beyer (1894–1982). Born in Hamburg, Beyer developed a lifelong passion for astronomy at a young age, and kept in touch with the professionals at Bergedorf whilst he worked as a teacher. Kasimir Graf seems to have appreciated the role amateurs might play in astronomy, and invited Beyer to informal monthly meetings at the observatory in the 1920s. Beyer had access to various telescopes of his own and of his acquaintances and in 1950, at Graf’s persuasion, published his own star atlas, the *Beyer–Graf Star Atlas*. In 1960, Beyer moved to quarters close to the observatory, so as to be near the professional community, and the observatory let him have use of the 26cm equatorial, his favourite instrument. This was the beginning of an astonishing period of observation for Beyer, who specialised in comet and variable star observations, and he published many valuable papers in *Astronomische Nachrichten*.

Beyer observed at Bergedorf with the equatorial from 1946–1977. As an amateur his contributions were very considerable, and included a new method of determining comet magnitudes (Beyer’s method, or ‘Extrafocal-Extinction’).^{23,24} Graf’s early inspirations undoubtedly played a role in the thoroughness of Beyer’s work and in 1972 the Astronomical Society of the Pacific awarded him their Comet Medal.²² His observing work at Bergedorf ended in 1977 after an accident left him unable to walk without crutches,²⁴ an event which must have caused the utmost disappointment. His enthusiasm for observing can be glimpsed by his mention in some of the annual reports of the observatory; for example, in 1968 Beyer made 2764 observations over 127 nights with the equatorial.²²

This one piece of collaboration was unique, and professional–amateur collaborations never revived after Beyer, because observational activities in Bergedorf decreased generally.



Figure 15. Max Beyer.²⁰

Recent history (1968–2000)

In 1968, the observatory became part of Hamburg University, which gave the observatory greater access to the wider

academic community both within Germany itself, and the outside world. The contact with other departments at the university had obvious benefits, but of course the observatory also lost a certain amount of its independence, and was no longer a collection of ‘observers’. Among the important consequences was that directors were now elected by committee every two years, and that observatory staff became involved more deeply in astronomical teaching at the University physics department.

Astronomical work of the observatory

As the observatory became part of the University of Hamburg, Prof Alfred Behr replaced Otto Heckmann as Director. One year later Prof Alfred Weigert joined the observatory and shared directorship with Behr through the 1970s. Behr was involved in the development of astronomical instrumentation, including a polarimeter for the new ESO. Under his direction, the Bergedorf Schmidt telescope was moved to Calar Alto, Spain and regular observations were started in 1980. Behr himself retired in 1979. Weigert was a theoretician, who headed the largest group at the observatory, working on stellar interiors and binary stars. During the period 1968–2000, we may reasonably split the work of the observatory into two distinct epochs: 1970–mid 1980s, and the mid 1980s onwards.

1970s–mid 1980s

Towards the end of the 1960s, the importance of observations carried out at Bergedorf itself declined, and beginning in the 1970s the Bergedorf astronomers travelled with increasing frequency to observatories such as ESO in Chile and Calar Alto in Spain. A consequence of this was that the astronomers no longer needed to live at the observatory, and unused accommodation could be converted into office buildings. For example, the Director’s villa was converted in 1989 to house the extragalactic astronomy groups (Quasars and Gravitational Lenses),²² and in 2002 the ‘Beamtenwohnhaus’, containing apartments for staff, was converted into offices for the Stellar Astrophysics group.

The focus of the work during this period was very much on stellar astronomy, on the observational side covering astrometry (measurement of the positions and movements of the stars), research on the mass-loss process during the late stages of stellar evolution, observations of ‘special’ stars such as variables and double stars, and some solar system work on comets and asteroids. The astrometry work ended in 2001, having been actively pursued at the observatory almost since its foundation in 1833. On the theoretical side, represented by Prof Weigert (who joined the observatory in 1969), research covered stellar evolution and modelling of the interiors of stars.

During this period Bergedorf made an important step: a move away from purely optical observations (using light

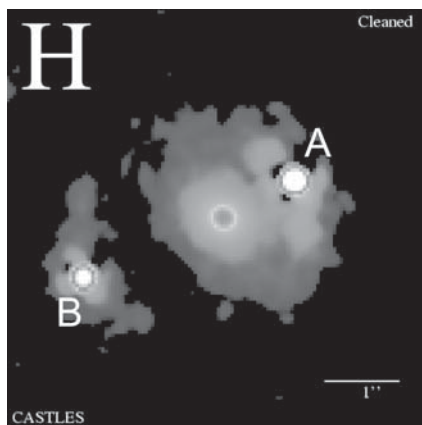


Figure 16. Gravitational lens HE1104-1805 discovered by the Hamburg/ESO Survey. A and B are images of the quasar. The lensing galaxy is in the centre. CASTLE: CfA-Arizona Space Telescope LEns Survey <http://cfa-www.harvard.edu/castles/noimages.html>

which the human eye can see) to the utilisation of all types of light (in scientific terms, all parts of the electromagnetic spectrum). When Prof Wendker, a radio astronomer, joined the observatory in 1972, radio and X-ray astronomical work on the interstellar medium became

an active area of research – solidifying the move away from purely optical astronomy.

The observatory’s work on extragalactic astronomy (the astronomy of objects which lie outside our own Milky Way galaxy) was first mentioned in the annual reports in 1973,²² and this was destined to become one of Bergedorf’s most prominent fields in the last decade of the 20th century. The extragalactic work started with radio astronomical observations of galaxies with the German 100m radio telescope in Effelsberg, near Bonn, and with theoretical studies of the gravitational lens effect.

In the early 1980s there was also a brief excursion into space research with the development of an ‘artificial Sun’ to calibrate a spectrometer for the European ‘Spacelab’. This was launched in 1983 on the Space Shuttle *Columbia*.

Mid 1980s–2000

The decision to move the Schmidt telescope to Spain and thence to begin work on an important survey of quasi-stellar objects, or ‘quasars’, shifted the focus of the observatory’s work in this epoch to extragalactic astronomy, away from mostly stellar research. Following the work in radio astronomy, use was made in the 1990s of observations from satellites such as IUE and ROSAT, extending the observable electromagnetic spectrum into the ultraviolet and X-rays. Bergedorf also became the major German user of the Hubble Space Telescope. The use of satellites and ground-based observatories worldwide in all regions of the electromagnetic spectrum is now commonplace.

The work of the observatory in this period was split into roughly three broad groups: Gravitational Lenses under Professor Sjur Refsdal, Extragalactic Astronomy under Professor Dieter Reimers and Stellar Astrophysics under Professor Alfred Weigert until 1991.

The Gravitational Lenses group was formed in 1980 when Refsdal moved back into his former field of research after the first discovery of a gravitational lens in 1979. Refsdal had joined the observatory in 1970 and worked during his first

years with Weigert on stellar interiors. The Gravitational Lens group focused on the determination of the Hubble constant, a parameter which determines the expansion rate of the universe, and on microlensing, which deals with the distortion of the optical light of distant quasars by intervening stars. Refsdal retired in 2001 and was replaced in 2002 by P. Hauschildt, a theoretician specialising in the modelling of stars and planets.

The Extragalactic Astronomy group under Reimers (who joined the observatory in May 1980) has from 1985 managed

one of the observatory’s most important activities – the All Sky Objective Prism Survey, carried out at the Calar Alto observatory in Spain with the Schmidt telescope moved from Bergedorf in 1975. Known as the *Hamburg Quasar Survey*, this involves scanning plates (with a PDS machine purchased in 1983) taken with the telescope and identifying potential quasar candidates. A similar survey being carried out at La Silla in Chile, known as the *Hamburg/*

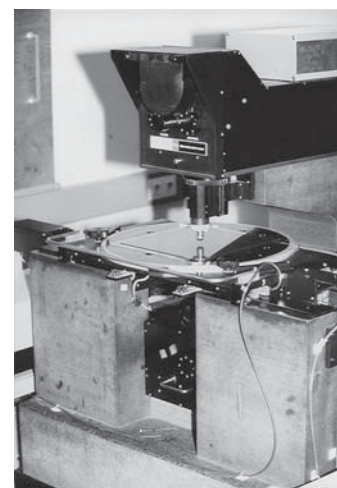


Figure 17. The crucial PDS scanning machine, workhorse of the Hamburg Quasar Survey. *Hamburger Sternwarte*.

European Southern Observatory Survey, covers the southern hemisphere sky not visible from Spain. The plates are digitised and the data used all over the world (in the near future, the data will be put onto the internet for all to download). The plates are also extensively used for stellar work, for example to find extremely metal deficient stars or hot stars, such as white dwarfs and subdwarfs. A major effort was also the identification of X-ray sources from the ROSAT All-Sky Survey, a German X-ray satellite.

A new Stellar Astrophysics group was formed in 1998 by Professor Jürgen Schmitt. The work of this group includes a

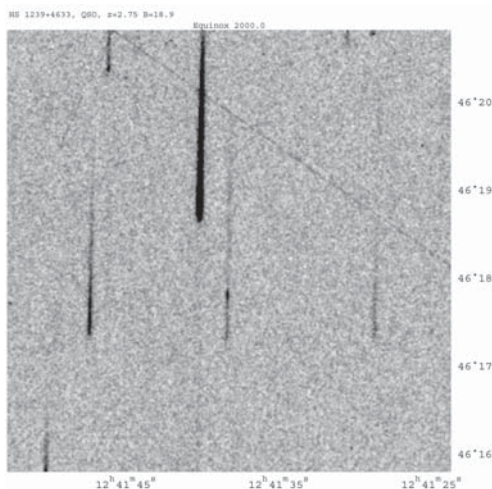


Figure 18. Discovery plate of the quasar HS 1239+4633 with a redshift $z=2.75$. The image shows objective-prism spectra in a 5x5 arcminute field. The weak spectrum in the centre corresponds to the quasar. A strong hydrogen emission line is easily visible as black dot superposed on the spectrum. *Hamburger Sternwarte*.



Figure 19. STELLA (STELLar Activity), the new 1.2m robotic telescope to be operated on Tenerife to study stellar activity. *Hamburger Sternwarte.*

very large project for the future: the analysis of sun-like stars and a robotic telescope which will be built for installation on Tenerife. Called STELLA, this will be a 1–2m class telescope, controlled entirely robotically.

A good indicator of the activity of the institute is the number of graduate students and postdocs working in Bergedorf. These people are usually paid for several years by grants from

official and private institutions supporting science. Applications for these grants must be made by the permanent staff, and are approved by an independent committee. Figure 20 shows clearly that the activity of the institute increased steadily in the 1980s reflecting the shift of the observatory to extragalactic astronomy. In the 1990s the number of third party staff levelled off at around 15.

Teaching

Astronomy lectures at Hamburg can be traced back to the 17th century, being given by mathematicians and physicists interested in astronomy. Since the foundation of the University of Hamburg in 1919 the director of the Observatory has had the right to conduct astronomy courses and laboratory exercises. It was also possible to take a doctorate in astronomy given by the faculty of natural sciences. With the integration of the observatory into the University, teaching became mandatory for observatory staff, and the lecture courses broadened and were integrated into the physics courses. From then on students took their diploma and doctorate awards in physics, with a focus on astronomy.²⁵

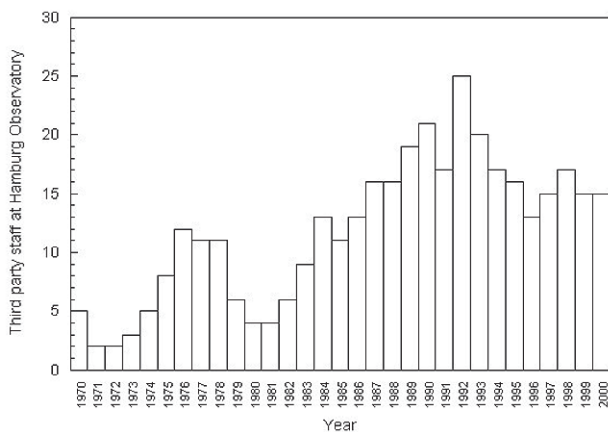


Figure 20. Number of third party staff working at Hamburg Observatory from 1969–2000.²²

Since 1968, Bergedorf has given lecture courses in astronomy for the physics department of the University of Hamburg. Bergedorf's offerings in the realm of astronomical education are one of the attractive points of the university's physics courses, helping to attract students from around Germany. Courses range from foundation courses, with lab exercises being carried out at Bergedorf itself, to specialised courses leading to diploma and doctorate awards.

In 1982, Weigert and Wendker published a foundation course in astronomy (*Astronomie und Astrophysik. Ein Grundkurs*. Latest edition Wiley-VCH Verlag, 2001) which is still used in courses at the University.

Working conditions

Despite the variety of work carried out at the observatory, the difficulty of funding is a concurrent theme in the history of Bergedorf. In 1968, a memorandum was written to the authorities explaining the urgent need for more working space and better facilities, notably the requirement for a separate laboratory building. It was not however until nearly 10 years later that the lab building was completed, and even then various planned features were dropped to cut costs.²²

The observatory has always depended to a certain extent on donations. For example, in 1969 a grant from the Volkswagen Foundation was obtained which resulted in the 1972 delivery of a Gitterspectrograph, and the Oskar–Lühning 1.2m telescope was the result of a donation. In 1975, the observatory reported that owing to cost cutting, its personnel budget between 1975 and 1977 would be cut 11%, and in 1976 a sick librarian was not replaced, with the result that some books were lost.²²

The first use of computing power at the observatory was in 1958 as already noted. Gradually the influence of computers on the work of the observatory increased: in 1974, a TR440 terminal was installed, linking the observatory to Hamburg University computing facilities, proving extremely valuable.²² More and more electronic devices were installed – in 1982, for example, the Great Refractor received a digital display, and in 1985 software was developed for the PDS scanning machine allowing for the first time semi-automatic detection of quasars on the *Hamburg Quasar Survey* plates (previously, the survey's plates had been scanned *by eye* in the search for quasars!).²² In 1996 came the first mention of CCD devices in the annual reports (the basis of modern digital cameras, allowing digital analysis and manipulation of images), and in 1992 the observatory received its first parallel computing device.²² Of course, computers are not invincible: an electrical surge in 1988 caused serious damage to electronic devices at the observatory.²²

Good relations with local authorities have been a strength of the observatory, and this enabled Bergedorf to reach an agreement in 1984 with neighbouring Wentorf district to use yellow street lighting to reduce sky brightness.²² Such an agreement was reached with the local Bergedorf authorities some time ago.

Public outreach activities

Bergedorf has for some time been involved in public outreach activities of one form or another. Up to 1999, tours were offered to the general public during daytime, and specialised tours for school classes and organised groups were arranged. Twice a year, weather permitting, the telescopes were open to the public for a week. After 1999, the observatory introduced monthly open evenings, including talks about current astronomical issues, and viewings through the telescopes. Annual numbers attending these events have remained static with a slight increase in recent years, but are nonetheless impressive (see Figure 21).

Special open days are held every few years at weekends. Each group in the observatory presents their work in the form of posters and the telescope buildings are opened for all to see. These open days are advertised locally and typically attract around 1000 visitors. In 1998, a special exhibition entitled *Sterne Über Hamburg* [*Stars Over Hamburg*] was held in a commercial centre in Bergedorf town in collaboration with a local historical society, detailing the history of astronomy in Hamburg. This event attracted over 2000 visitors.

In recent years there have been discussions about moving the observatory elsewhere, and using the site and its instruments for perhaps commercial purposes. The *Förderverein Hamburger Sternwarte* [*Promotional Union of Hamburg Observatory* – translation is SRA's] was formed in 1998 with 90 members, to both promote and protect the heritage of Bergedorf, its site and historical instruments, to enhance the visibility of the observatory and astronomy amongst the local population, and to engage the public.¹⁸ Details of some of the group's activities can be found on the internet.²⁶ This recently active group represents the most positive step towards greater public understanding of the observatory and its work.

Major astronomical events such as the appearance of bright comets (e.g. comets Kohoutek in 1973, Halley in 1986, Hyakutake in 1996 and Hale–Bopp in 1997), and solar eclipses such as that of 1999 August cause a surge in public interest, often bringing several hundred people to the observatory and causing significant extra work staffing the telescopes.²²

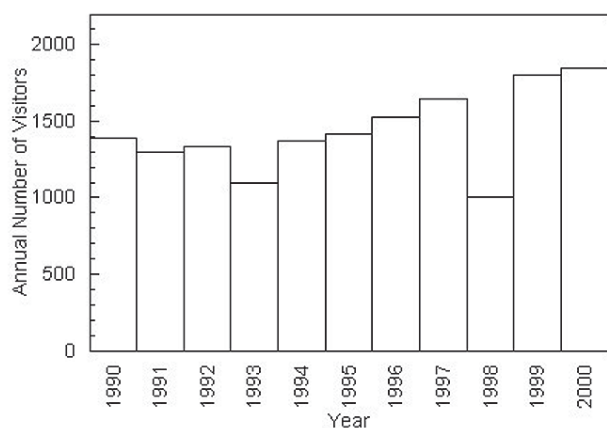


Figure 21. Annual number of visitors to Hamburg Observatory open days, 1990–2000.²²



Figure 22. Comet Kohoutek in 1974. *Hamburger Sternwarte*.

As an additional motivation for local youngsters to study physics, pupils in the last three years of their school studies (aged 16–18 years) are offered the opportunity to visit the observatory to gain practical experience of how astronomy and physics is actually carried out in a working environment. This programme (offered since 1999) is undertaken by around 60 pupils per year.

Recently the observatory become involved in a local schools project, the so-called *Seh-Stern* [See-Star – translation is SRA's] project.²⁷ This is driven by a former Bergedorf astronomer, Dr Ulf Borgeest, in conjunction with the local authority for youth and vocational training. Bergedorf has provided support, and the project aims to provide opportunities for youngsters in local schools to become involved in astronomy at a young age, and since September 2000 has had the Lippert telescope with a CCD camera at its disposal. With the shift of the Lippert dome into the responsibility of *Seh-Stern* and perhaps with the modernisation of the Oskar–Lühning telescope, a new focus for professional–amateur collaboration may emerge.



Figure 23. An experiment during the 2002 astronomy course for local pupils. *Hamburger Sternwarte*.

Concluding remarks

In a large body of output, we may reasonably select three major contributions to astronomy by Bergedorf and its associated observers which stand out. The first must clearly be the Schmidt telescope, whose corrector plate has become famous throughout the entire world astronomical community.

The second are the AGK2 and AGK3 precision stellar catalogues, the AGK2 being among the first large stellar catalogues. They have found important uses

in and outside the visible wavelengths, and were considered amongst the standard catalogues until the *Hipparcos* satellite (launched in 1989 by the European Space Agency) became a major source for stellar catalogues. Even today, they are important for proper motion studies and statistical analyses.

Finally, one of Bergedorf's most important recent contributions was the completion of the *Hamburg Quasar Survey*, now used globally throughout the astronomical community.

Although the glorious observational days of the past are now over at Bergedorf, valuable observational and theoretical work continues to be carried out. Many of the observatory's original instruments are still in Bergedorf (although some are now in a neglected state) and the site is protected under local monument protection laws.

Recent initiatives such as the founding of the *Förderverein Hamburger Sternwarte* and the *Seh-Stern* project signal an era of a more publicly visible Bergedorf. The people of the city of Hamburg have in their observatory an institution of which they can be justly proud.

Acknowledgments

Materials were gathered for this paper by literature searches and oral history interviews. For information on Bergedorf's more recent history the annual reports ('Jahresberichte') of the observatory were used, together with oral interviews with H. Kähler, S. Refsdal, D. Reimers and H. J. Wendker.

We wish to thank Dr Jochen Schramm for very helpful discussions and permission to use images. SRA also wishes to thank Dr Wayne Orchiston for his valuable advice and encouragement.

Addresses: SRA: Flat 4, 42 Hereford Road, London W2 5AJ. [anderson@homeinw2.fsnet.co.uk]

DE: Dr D. Engels, Hamburger Sternwarte, Gojenbergsweg 112, D-21029 Hamburg, Germany. [dengels@hs.uni-hamburg.de]

Bibliography and websites

1–17 Schramm J., *Sterne Über Hamburg. Die Geschichte der Astronomie in Hamburg*, Kultur- & Geschichtskontor, Hamburg, 1996

J. Br. Astron. Assoc. **114**, 2, 2004



Figure 24. Hamburg Observatory in 1983. *Hamburger Sternwarte*.

- | | |
|---------------|----------------|
| 1 pp. 77–79 | 10 p. 203 |
| 2 pp. 80–84 | 11 p. 230 |
| 3 pp. 105–111 | 12 p. 238 |
| 4 pp. 111–114 | 13 pp. 229–230 |
| 5 pp. 114–115 | 14 pp. 207–208 |
| 6 pp. 141–148 | 15 p. 243 |
| 7 pp. 195–196 | 16 pp. 247–250 |
| 8 p. 197 | 17 pp. 250–252 |
| 9 pp. 196–201 | |
- 18 Wolfschmidt G., *Förderverein Hamburger Sternwarte*, <http://www.fhsev.de/>
- 19 Wolfschmidt G., Seemann A. & Kühl, D., *Hamburger Sternwarte—Geschichte und Erhaltung*, Hamburg, 2001
- 20 Schramm J., *Sterne Über Hamburg. Die Geschichte der Astronomie in Hamburg*, <http://www.friedensblitz.de/sterne/>
- 21 Christensen M., 'Schmidt – The man and the camera', <http://www.fvastro.org/articles/schmidtp1.htm>
- 22 *Jahresberichte Hamburger Sternwarte 1968–2000, Annual Report of the Hamburg Observatory, 1968–2000*
- 23 Bortle J., 'How to Estimate a Comet's Brightness', *Sky & Tel.*, 1997 April, p.31
- 24 Lüthen H. *et al.*, 'Max Beyer (1894–1982): A master of comet observing', *International Comet Quarterly* **22**, 105–114, 2000
- 25 Weigert A., 'Hamburger Sternwarte 1833–1983', in *150 Jahre Hamburger Sternwarte*, Uni HH Forschung Nr. XVI, 1983
- 26 *Förderverein Hamburger Sternwarte*, <http://www.fhsev.de>
- 27 Seh-Stern web site, Hamburg. 'Behörde für Schule, Jugend und Berufsbildung. Seh-Stern'. <http://www.seh-stern.de/>
- 28 Wolfschmidt G. *et al.*, *op. cit.* (ref. 19)
- 29 Ness J. U., 'Hamburger Sternwarte – Buildings and Telescopes', <http://www.hs.uni-hamburg.de/EN/Oef/Stw/gebte1.html>

Received 2003 February 15; accepted 2003 May 21

**Sir Patrick Moore, President. Members on 5 continents
Publications & recordings re. the Herschel family.
Free admission to Herschel House Museum. Newsletter.
Public Lectures on astronomy/space**

JOIN

Herschel

**The William Herschel Society,
19, New King Street, Bath BA1 2BL U.K.
where William Herschel discovered Uranus in 1781.
Membership only £7.50 year UK, £10 overseas.
Society tie with '7ft. Herschel telescope' logo.
Write or ring 01225 311342 for details.**