

FOLLOW THE INFORMATION: COMETS, COMMUNICATIVE PRACTICES AND SWEDISH AMATEUR ASTRONOMERS IN THE TWENTIETH CENTURY

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Abstract: The aim of this paper is to demonstrate that important insights into the historical development of amateur astronomy can be gleaned through studies of its communicative practices, particularly organised means of circulating information. The case discussed here concerns the tradition of Swedish amateur astronomy in the twentieth century, with the focus on cometary astronomy.

Keywords: Amateur astronomy, Sweden, cometary astronomy, communicative practices, observational networks

1 INTRODUCTION

In 1944 the Swedish amateur astronomer Thorvald Eriksson sent the following question and complaint to Knut Emil Lundmark (1889–1958; Figure 1), Professor of Astronomy at Lund Observatory (Holmberg, 1999; Smith, 2009; Kärnfelt, 2014) and a well-known public figure in Swedish astronomy:

Isn't there a journal where I can read about new findings about approaching comets, etc.? Last year, when the great comet in Ursa Major was seen, I first read about it in a newspaper after it had already been visible for a whole month, which was annoying. It would have been interesting to follow it the entire time. (Eriksson, 1944).¹

If we assume that Eriksson is asking for a journal in Swedish, the answer to his question is 'no', for at that time no such journal was available. Until the 1960s amateurs were generally left in the dark when it came to comets, with the exception of the few times that approaching comets were predicted to be so bright that newspapers took an interest.

Eriksson's frustration illustrates the main argument of this paper: that amateur endeavours are largely dependent on the accessibility of vital information about celestial events. If you do not have access to relevant information, you cannot, for example, engage in amateur cometary astronomy. From that perspective, the aim of this paper is to demonstrate that important insights into the historical development of amateur astronomy can be gleaned through studies of its communicative practices, particularly organised means of circulating information.

Swedish amateur astronomy emerged rather late, the first practitioners appearing just after the turn of the twentieth century. Even though the number of active amateurs subsequently increased, it has always been a relatively small enterprise, currently involving approximately 1,000 Swedes. To put this number into perspective, it has been suggested that there are approximate-

ly 10,000 counterparts in the UK (British Astronomical Society, 2013) and at least 200,000 in the United States (Fraknoi, 2013). For our purposes, the relatively-modest Swedish tradition is an advantage since it permits an overview of the many communicative practices involved. Still, we need a focus for the argument. As it so happens, the very nature of comets makes them an excellent point of departure.



Figure 1: Professor Knut Lundmark (after *Dictionary of Swedish National Biography*).

From an observational point of view, there are three categories of comets. First there are the spectacular 'Great Comets' (e.g. see Burnham, 2000; Seargent, 2008). Big and bright, but few and far between, they attract the interest of not only professionals and amateurs, but also the general public due to reports in the media.

The appearances of Comet 1P/Halley in 1910 and 1986, Comet Hyakutake (C/1996 B2) in 1996 and Comet Hale-Bopp (C/1995 O1) in 1997 are good examples. Reading the daily newspaper is more than sufficient to find the information needed to observe comets like these. Since they are big and bright, fairly general information about their position is good enough. Comets belonging to the second group are not as spectacular as the Great Comets but are still visible to the naked eye, and it is much more difficult to track down information about them. One example is Comet Whipple-Fedtke-Tevezadze (C/1942 X1; Figure 2), which is mentioned above by Eriksson. This comet reached a maximum visual magnitude of 3.5 before fading (Ashbrook, 1943). Newspapers generally ignore such comets, so amateurs have to rely on other sources. Since these comets are not so bright, more precise information about their right ascensions and declinations is required in order to locate them. The third group, representing the lion's share observed by amateurs, are those comets that are only visible in a telescope. To track these comets, access to detailed finder charts (or ephemerides) is required and positions must be specified in increments of 24 hours or less.

This is the background that makes cometary astronomy a suitable starting point for studying the circulation of information. Eriksson was not able to observe the 1943 comet before the newspaper happened to mention it, simply because he did not know about it. Amateur astronomy devoted to comets requires that someone distributes the necessary information through channels that are accessible to its practitioners.²

Before we continue, a few words need to be said about the nature of the amateur endeavour. The basic quality that defines amateur astronomy is the do-it-yourself attitude that permeates the domain (Holmberg and Kärfelt, n.d.). In contrast to someone who passively 'consumes' popular astronomy from the comfort of their favourite armchair, amateurs take action. They build telescopes, run observatories, engage in various kinds of observation projects and so on. For the purpose of this paper, and drawing on the work of Dr Tom Williams (2000), a second distinction needs to be made—between amateurs who actively contribute to science and those who engage in astronomy for recreational purposes. Within the Swedish tradition, the majority of amateurs fall into this second category—they pursue astronomy just for the fun of it, without any ambition to make a scientific contribution. Of today's 1,000 Swedish amateurs, no more than 10% occasionally contribute to science (cf. Gada, et al., 2000).

Returning to cometary astronomy, the two types of amateurs described above have quite different requirements when it comes to information infrastructure. Recreational amateurs, to the extent that they take an interest in comets, can settle on being at the receiving end of a flow of information that alerts them to approaching comets and gives them the means of locating them in the sky. Scientifically-inclined amateurs, on the other hand, need access to channels through which they can submit their reports. The latter case gives rise to a more complicated communicative practice that might be called an *observation network*. Drawing on the work of Jeremy Vetter (2011a: 259), an observational net-



Figure 2: Two photographs of C/1942 X1 (Whipple-Fedtke-Tevezadze) taken by Cuno Hoffmeister on successive nights in March 1943 showing the changing nature of the tail (courtesy: Patrick Moore Collection).

work—in his case a *field network*—can be defined as “... a mode of knowledge production in modern science that has linked together geographically dispersed lay people whose activities are co-ordinated and directed from a central location ...” Vetter uses Kansas weather-watchers in the early twentieth century as his case, but his argument can easily be extended to include other kinds of amateurs who actively contribute to science (cf. McCray, 2008; Macdonald, 2002; Vetter, 2011b).

Astronomical observational networks emanate often, but not always, from the needs of professional astronomers. Amateurs with the proper discipline are invaluable resources when astronomers need to collect certain kinds of data, such as magnitude estimates of variable stars (e.g. see Williams and Saladyga, 2011), meteor counts (e.g. Kärfelt, 2014; Littmann and Suomela, 2014) or data on comets (e.g. Sekanina and Fry, 1991). The success of the enterprise hinges on the ability of the experts, or their proxies, to attract interest, circulate information and relevant protocols, and maintain an infrastructure that allows amateurs to provide feedback in the form of observational reports.

Turning to Swedish amateur cometary astronomy, a fully-developed observational network is the culmination of our history, and was achieved in the 1990s. In the following Section we start in the early twentieth century, and see how amateurs first gained access to basic information about comets. Then we follow the information.

2 CHRONICLES

Swedish amateur astronomy did not enjoy the same stature at the beginning of the twentieth century as the British or American traditions (cf. Chapman, 1998; Williams, 2000), but was limited to a handful of isolated individuals (Holmberg and Kärfelt, n.d.; Kärfelt, 2004). No organisations promoted astronomy or recruited amateurs. No astronomical journals were available to lay readers. No observatories offered the general public the opportunity to glimpse heavenly bodies. The fourteenth Scandinavian Scientists’ meeting in Copenhagen in 1892 first addressed this deficit, and Nils Christoffer Dunér (1839–1914; Figure 3), Director of the Uppsala Observatory, proposed the establishment of a Scandinavian society devoted to astronomy. The Royal Astronomical Society in Britain and the newly-formed British Astronomical Association were sources of inspiration. Dunér (1892) envisaged a similar organisation in Scandinavia and suggested that its chief aim be to recruit amateurs in the service of professionals. Even though the proposal was well received, the only immediate result was a resolution of support. The astronomical societies that eventually emerged were outside the ae-

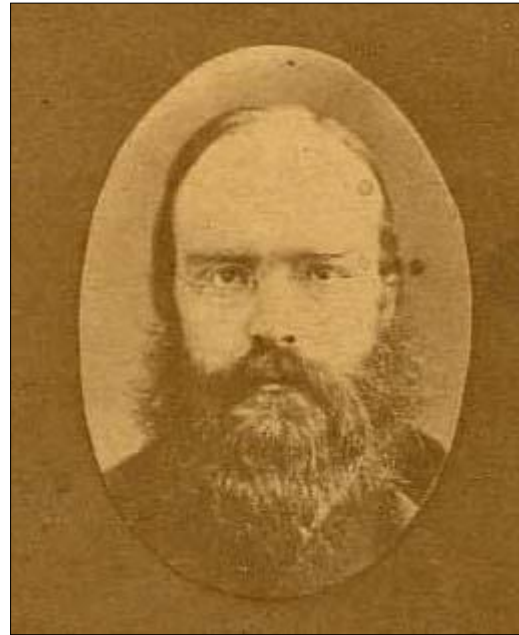


Figure 3: Nils Dunér (en.wikipedia.org).

gis of the Scandinavian Scientists’ meetings and operated on a national rather than international level. The Danish Astronomical Society was inaugurated in 1916. The Swedish Astronomical Society followed suit in 1919 at the initiative of Nils Viktor Emanuel Nordenmark (1867–1962; Figure 4), one of Dunér’s students. The Ursa Astronomical Association in Finland was founded in 1921 and the Norwegian Astronomical Society in 1938.

Like its counterparts in other Scandinavian countries, the Swedish Astronomical Society had a dual purpose: to serve both professionals (approximately 20, including geodesists and Ph.D. students) and members of the general public who



Figure 4: Nils Nordenmark (after *Dictionary of Swedish National Biography*).

were interested in astronomy, especially those who might become active amateurs (Kärfelt, 2004). The Society launched a number of projects, the most important one being the publication of *Populär Astronomisk Tidskrift* (*Journal of Popular Astronomy*), which started in 1920. This biannual magazine included a number of articles, often popularized versions of presentations at Society meetings, along with an extensive section of miscellaneous news, book reviews, professional updates, obituaries, etc.

After a few years, the Society had managed to attract approximately 250 members, most of whom joined not as active amateurs, but out of an interest in astronomy. In general, the journal targeted this larger group of interested lay persons, but during the first few years, the Society also tried to arouse interest in amateur astronomy. The *Populär Astronomisk Tidskrift* included articles about ways of making various kinds of observations suitable for amateurs, about amateur observatories and about the basics of astrophotography. The results were limited, with the number of active amateurs in the Society increasing to about 20 (Kärfelt, 2004). After a few years, and despite these partial results, the Board (which was dominated by professional astronomers) felt that the amateur initiative was not worth the effort and abandoned it altogether. The journal would not address the needs of the amateurs again until the 1940s (see below).

From the very first issue of the *Populär Astronomisk Tidskrift*, and continuing for half a century, the miscellaneous section contained quite informative 'comet chronicles'. Edited by a succession of professional astronomers, the chronicles were the first reliable source of cometary information for the few interested amateurs who were around. Each of the 1–2 page chronicles

reviewed appearances during the previous six months, and listed the periodic comets that were due to return during the coming year. The first chronicles named seven periodic comets that were expected to appear in 1920, and the author claimed that 10P/Tempel had the greatest potential (Anonymous, 1920a). Contrary to his expectation, this comet peaked at the eleventh magnitude (Anonymous, 1920b)!

Swedish amateur astronomers who read the comet chronicles during the 1920s were at the receiving end of a quite straightforward information structure (Figure 5). Whether new or periodic, and discovered by professionals or amateurs, comets were reported to the Central Bureau for Astronomical Telegrams, which was located in Copenhagen (Denmark) from 1922 (Sperling, 1991). Swedish-Danish astronomer Elis Strömberg (1870–1947; Figure 6) compiled the reports and circulated them through a telegram service and printed notices. Swedish and other observatories subscribed to the service, which enabled astronomers to keep up with the latest developments. Swedish astronomers used the information in the circulars to put together the bi-annual comet chronicles for the benefit of the Society's members.

These comet chronicles might have sparked interest in comet observations among Swedish amateur astronomers had it not been for one important fact: the chronicles did not provide the information required to actually locate any of the comets. Let us take a typical example dating to 1922:

The orbital period of comet Perrines (1896 VII) is 6.45 years. It was observed in 1909 and should also be visible this year. At the perihelion passage, around 10 October, the comet will be six hours (1.17 astronomical units) away

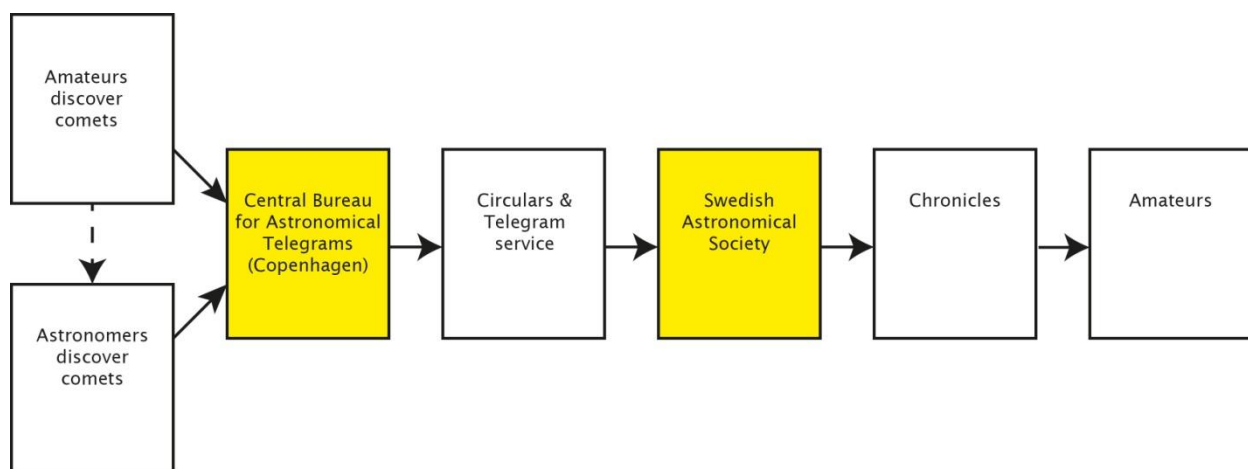


Figure 5: Circulation of comet information around 1920. The Central Bureau for Astronomical Telegrams, located in Copenhagen as of 1922, was the hub for information regarding comets. Both amateurs and professionals reported new discoveries to the Bureau, which distributed information about them to astronomers around the world by means of a news service. Astronomers at the Swedish Astronomical Society used the telegrams and circulars from the Bureau to put together the comet chronicles published in the society's journal. Up until the 1950s, this was the only organized source of comet information available to Swedish amateurs. During this period, amateurs were not encouraged to actually observe the comets, and there were no organized means for them to report.

from the sun. It should be observable even with small telescopes. The comet will pass through the constellations of Perseus, Auriga and Gemini from July to November. (Anonymous, 1922: 80).

This announcement is typical of the information contained in the comet chronicles. The trajectory of the comet is described in very general terms, which would have been useless to anyone who may have wanted to track it. There were no finder charts or ephemerides, not even the orbital elements. The main reason for this shortcoming seems to have been that the delivery dates of the chronicles were too few and far between, given the transient nature of comets. Without access to the actual telegrams from Copenhagen, amateurs could not benefit from the information that the Central Bureau supplied.

There is no evidence that the Society debated the issue, as successive editors of the chronicles stuck to the original format. It was only in 1939 with the discovery of Comet Jurlof-Achmarof-Hassel (C/1939 H1; Figure 7), which was fairly bright, that the chronicles actively encouraged observations by amateurs. One of the reasons that this particular comet attracted the attention of astronomers was because it was independently discovered by three amateur astronomers, one of whom was the deaf-mute Norwegian Olaf Hassel (1898–1972; Figure 8; Darsenius, 1961). Another reason was because the summer issue of the *Populär Astronomisk Tidskrift* was about to be printed, and the editor managed to insert a note about the comet, which already was at magnitude three, along with instructions about how to locate it. He did not include a full ephemeris, but specified the position on 18 April, as well as the estimated daily motions in right ascension and declination for the weeks to come (Anonymous, 1939).

The extent to which amateurs actually observed Comet Jurlof-Achmarof-Hassel is not clear. There were no reliable means of providing feedback, and the journal did not publish any reports. But Nils Tamm (1876–1957), who was then one of Sweden's most sophisticated amateurs (see Figure 9), managed to image it with the Schmidt camera at his observatory which was located on the Kvistaberg estate (Tamm and Wallenquist, 1942).

After the 1939 event, when comets appeared around the time that the journal was about to be published, the chronicles might encourage amateurs to observe them. But the Society did not set up a distribution channel better suited for the task until two decades later.

3 CIRCULARS

Until the late 1950s, amateur astronomy devel-



Figure 6: Svante Elis Strömgren (courtesy: Neils Bohr Institute, Copenhagen).



Figure 7: Comet C/1939 H1 (Jurlof-Achmarof-Hassel) imaged by Nils Tamm at the Kvistaberg Observatory (after Tamm and Wallenquist, 1942: 79).



Figure 8: Olaf Hassell (www.twu.edu/dsc/hassell.htm).



Figure 9: Nils Tamm's observatory, which housed a 13-cm (5-in) equatorially-mounted Zeiss refractor (from www.astro.uu.se/history/images/kvistaberg_tamm_obs.jpg).

oped slowly in Sweden. The number of members of the Swedish Astronomical Society (most of whom were not active amateurs) rose from 250 before World War II to 500 in 1950. In 1955 the first local amateur association—the Gothenburg Astronomical Club—was formed, soon to be followed by many others (Holmberg and Kärfelt, n.d.). Meanwhile, the Society once again took an interest in amateur astronomy, this time successfully promoting the North American amateur telescope making movement (Holmberg and Kärfelt, n.d.; cf. Cameron, 2010). Starting in the mid-1940s, in just a few years, they man-

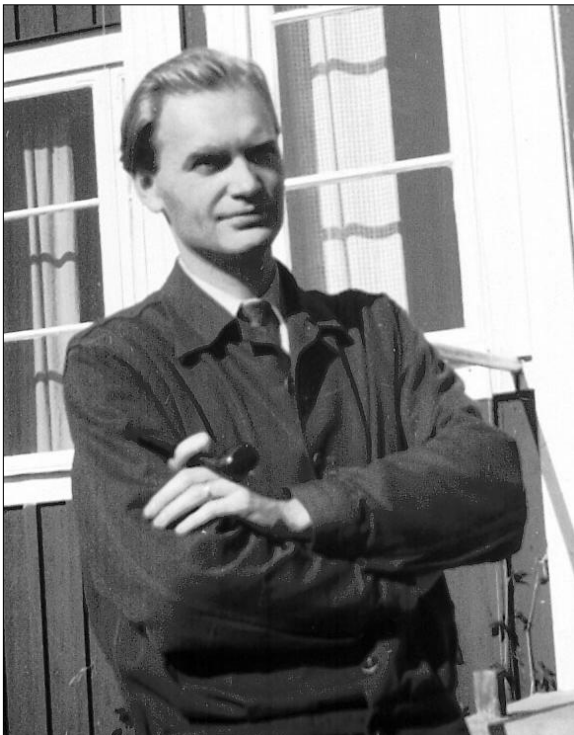


Figure 10: Rune Fogelquist (courtesy: Rune Fogelquist).

aged to raise the number of amateurs with access to telescopes to a couple of hundred. As always, these telescopes were mostly used to marvel at the Great Orion Nebula, the globular cluster in Hercules and other spectacular objects, while the handful of more sophisticated amateurs tended to focus on variable star observing. Comets still attracted little attention. Then, in the words of Professor Gunnar Larsson-Leander (b. 1918) from Lund University, in 1957 “... one of the most remarkable comets ever observed ...” turned up (Larsson-Leander, 1957: 115; cf. Anonymous, 1957a). This was Comet Arend-Roland (C/1956 R1), which became famous for its remarkable anti-tail.

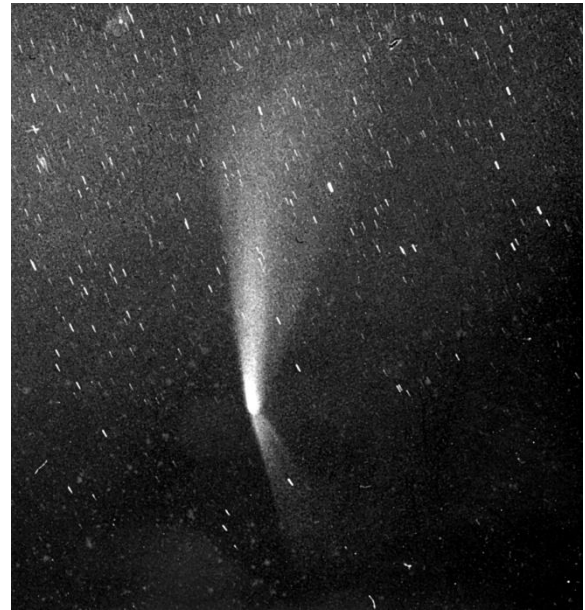


Figure 11: Comet C/1956 R1 (Arend-Roland) imaged by Rune Fogelquist on 22 April 1957 at UT 21:00-22:00. The image was acquired by means of an anastigmatic lens with a focal length of 120 mm and an aperture of 25 mm (courtesy: Rune Fogelquist).

This time the telegram from Copenhagen arrived just days after the latest issue of the journal had been circulated, and to make matters worse the comet would reach perihelion and start on its way back to the depths of space well before the next issue was due out. An obvious solution would have been to post a notice out to interested members, but Larsson-Leander, the editor of the chronicles, did nothing, and when C/1956 R1 (Arend-Roland) turned out to be one of the most memorable comets of the twentieth century his oversight became somewhat of an embarrassment to the Society.

Despite the Society's reluctance to communicate with amateurs, some of them received the information anyway. Rune Fogelquist (1924–2013; Figure 10), later to become one of the most influential amateurs, was not a member of the Swedish Society but of the Danish organisation, which posted a circular. The service, which started in the 1930s (Anonymous, 1933), inform-

ed members about all kinds of transient events, including interesting comets like Arend-Roland. As soon as Fogelquist learned of the approaching comet, he passed the news on to some of his fellow amateurs, and when the comet became visible to northern observers after its perihelion passage in mid-April 1957 they were prepared. At least four amateurs observed the comet before Swedish professional astronomers got around to it (Larsson-Leander, 1957, 117). On 22 April, Fogelquist took what would become an iconic image of the comet, showing its anti-tail (Figure 11). He reported his observations directly to the Central Bureau in Copenhagen (cited in Brahde and Brekke, 1957: 27), and a couple of months later the image was published as part of a photo collage in *Sky & Telescope* (see Anonymous, 1957b).

The Arend-Roland event made Swedish astronomers aware that amateurs could also be useful when it came to comet observations.³ Later that spring, while the comet was still visible in the western sky, the Society decided to start its own news service. The service was announced in the summer 1957 issue of the journal: the notice stated that there "... seems to be a general desire amongst the Society's amateur astronomers to receive news about new comets, novae, especially interesting variable stars, etc., as fast as possible ..." (Anonymous, 1957c: 75). As it turned out the service met a real



Figure 12: Comet C/1957 P1 (Mrkos) photographed by Alan McClure on 13 August 1957 (<http://stony-ridge.org/AlanMcClure.html>).

need, and by the end of that year it had more than 150 subscribers (Elvius, 1957). A couple of years later the number had almost doubled (Malmquist, 1961).

The first circular, announced the approach of Comet Mrkos (C/1957 P1; Figure 12) in August 1957 (Anonymous, 1957d; cf Anonymous, 1957e), and marked the beginning of a new era in Swedish cometary astronomy (Figure 13). At

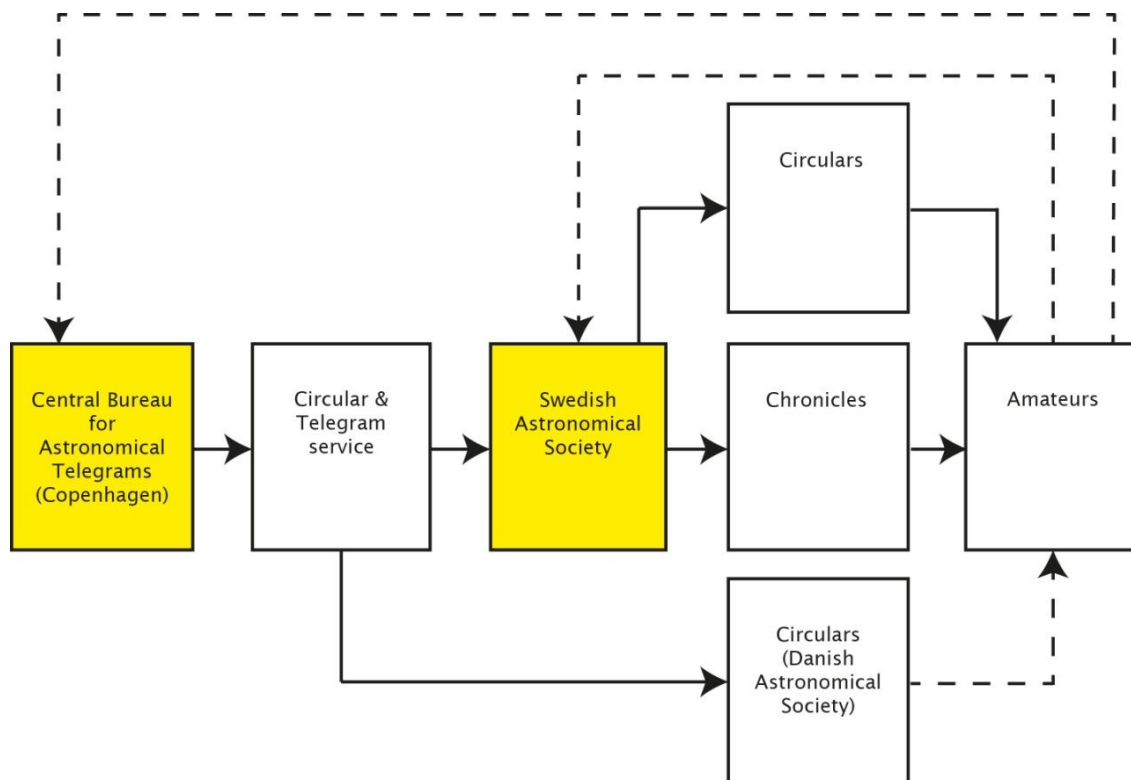


Figure 13: Circulation of comet information around 1960. The basic source of comet information was still the Central Bureau in Copenhagen, but Swedish amateurs could now access it from several different sources. The comet chronicles were still being published but did not contain the information needed to actually observe any of the comets. As of 1957, that information could be found in the Society's circular (some Swedish amateurs also subscribed to the Danish Society's circular). Even though some amateurs submitted reports, either directly to the Central Bureau, or to the Society, it was still very much a one-way street.

last amateurs had access to a rapid, reliable and affordable source of information about comets. About one-third of the circulars concerned comets, normally specifying the orbital elements and ephemeris spanning at least one full month. Meanwhile, the speed with which the information was distributed increased dramatically. Comet Mrkos is a good example. This comet was discovered by Antonín Mrkos (1918–1996) at the Skalnaté Pleso Observatory in Slovakia on the morning of 2 August 1957.⁴ He immediately sent a telegram to the Central Bureau in Copenhagen, which communicated the discovery later that morning through its news service (Hendrie, 1996). The telegram reached Larsson-Leander at Saltsjöbaden Observatory the very next morning, and he sent out the first Swedish circular later that day. Allowing time for postal delivery, the information reached amateurs three or four days after the comet was discovered.

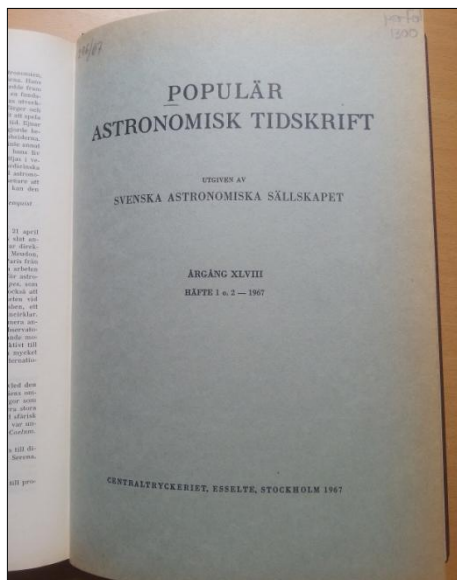


Figure 14: The 1967 issue of the *Populär Astronomisk Tidskrift*. By this time the journal had more or less abandoned amateur astronomy in order to focus on professional astronomy.

Even though amateurs suddenly had access to information that allowed them to observe new comets, they still had no organised means of reporting their observations, since the Society's approach was very much a one-way street. Thus, the comet circulars (or the chronicles for that matter) never once suggested that amateurs might submit a report. The most advanced amateurs found their own channels: Fogelquist and others reported directly to the Bureau in Copenhagen, while some wrote to Swedish astronomers, but they were exceptions.⁵ The Society did not fill the gap. Then by the end of the 1960s, it appeared to have lost interest in amateur astronomy altogether (Figure 14). The news service was discontinued in 1968, and around the same time the ambitious amateur observing sections formed back in 1960 were

discontinued.⁶ A shift towards a more professional orientation was formalised in 1968 when the journal was restarted as a joint venture of the Danish, Norwegian and Swedish societies. To mark this transition the adjective 'Popular' was dropped from the title—henceforward it was known as *Astronomisk Tidskrift* (*Astronomical Journal*). The era of 'top-down amateur astronomy' was ending, and a new era of 'bottom up astronomy' started to develop, prompted by the specific needs of Sweden's amateur astronomers. One of the areas that would soon be reformed was cometary astronomy.

4 NETWORKS

Swedish amateur astronomy matured in the 1960s and 1970s. Associations modelled after the very successful Gothenburg Astronomical Club started in many cities and towns. They mimeographed bulletins, arranged lecture series, conducted telescope-making workshops, held congresses, organised star parties and embarked on major observation projects. The number of active amateurs now ran into the thousands.

One of the new organisations was the Malmö Astronomy and Space Exploration Society. Started in 1962 as an upper secondary school club, it quickly evolved into a dynamic amateur association with international connections. Ulf R. Johansson (b. 1945), one of its leaders, befriended Patrick (later Sir Patrick) Moore (1923–2012) and in 1969 helped him launch the International Union of Amateur Astronomers (IUAA) (Johansson and Moore, 1966; cf. Moore, 1967).⁷ Besides hosting the second IUAA World Congress in Malmö in 1972 (Figure 15), Johansson and other members began collaborating with amateurs in Denmark.

Eventually this initiative led to a new multi-lateral amateur association when the Scandinavian Union of Amateur Astronomers (SUAA) was founded in 1973. According to the rules of procedure as published in the *Scandinavian Amateur Astronomer* (*Scanam*), the aim of the union was to act as an "... organ for communication and coordination ..." among amateurs in Denmark, Finland, Iceland, Norway and Sweden, and "The most important activities of the union are to be carried out by the sections. They are to coordinate, collect, edit and forward observations and studies conducted by Scandinavian amateurs." (Anonymous, 1973a: 15). The novelty of the Union was not so much Scandinavian collaboration as the consequences of the four verbs, *coordinate*, *collect*, *edit* and *forward*. These activities manifested the spirit of the observational networks.

Most of the Union's ten sections had an observational orientation, notable exceptions being amateur telescope making and the history of



Figure 15: Patrick Moore and Peter Linde at the 1972 Congress of the International Union of Amateur Astronomers in Malmö (courtesy: Peter Linde/ASTB).

astronomy. Ideally the observing sections were organised in accordance with the rules of procedure, and their leaders were supposed to establish contact with international organisations and networks in order to access information, protocols and communication channels. Then they were to set up relevant programmes for their sections, distribute information and protocols, and encourage participation. Members were to submit reports (according to international standards) of their observations to the leaders, who would edit and forward them to the American Association of Variable Star Observers (AAVSO), American Meteor Society (AMS), Association for Lunar and Planetary Observers (ALPO) and other international clearing houses. The background and objectives of the individual section leaders had a major impact on the activities of their observational networks, and some sections were more successful than others (Holmberg and Kärfelt, n.d.).

One of the Union's observing sections focused on comets. Founded in 1972, a year before the Union was formally started, it was first coordinated by Tor Nørretranders (b. 1955) and Michael Krogsgaard (b. 1953), who were then two young, enthusiastic but rather inexperienced Danes. The lack of experience was to some extent compensated by a thorough study of the American magazine *Sky & Telescope*, which be-

came an important source both for inspiration and information. The journal had become available to Scandinavian amateurs in the late 1940s and from that time on played a vital role in developing the field. Nørretranders and Krogsgaard used the reports on comets in the American magazine to write similar articles for *Scan-am*, and the account of their first observing project, which concerned C/1973 E1 (Kohoutek) (see Krogsgaard, 1973b), was based entirely on material taken from an article in *Sky & Telescope* (Anonymous, 1973b).

Unfortunately, these early initiatives produced few results. Members did not flock to the Comet Section, and few reports were submitted. Even Comet Kohoutek, which initially was predicted to become the 'comet of the century', failed to engage them. A few images by Scandinavian amateurs were published in the journal (Anonymous, 1974), but not a single report was dispatched to the Association of Lunar and Planetary Observers, the intended recipient. Not only did the Section have little status, but the Comet's appearance was far below expectations. On top of this, a huge low pressure area covered most of Scandinavia during the weeks after perihelion, making observations difficult or impossible.

In 1976 the Comet Section was reactivated under the auspices of Karl Gustav Andersson (b.

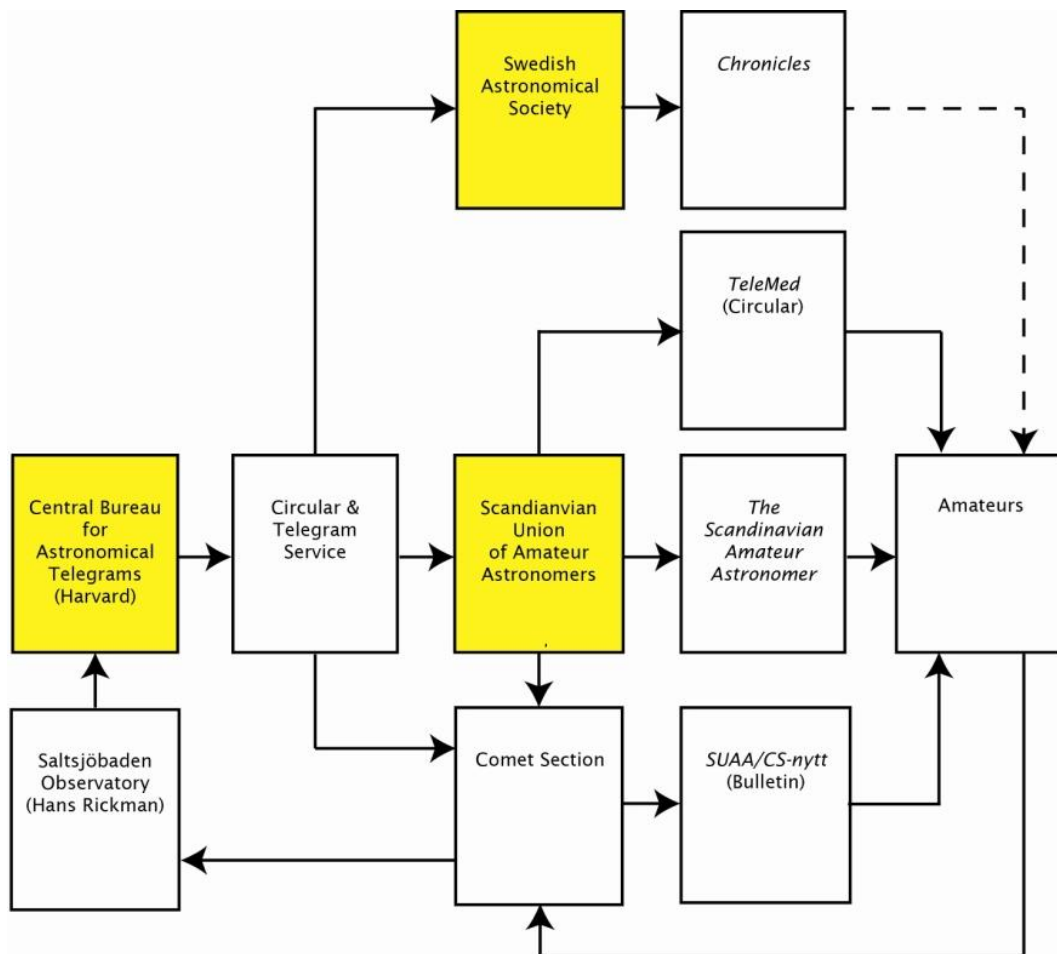


Figure 16: Circulation of comet information around 1975. With the foundation of the Scandinavian Union of Amateur Astronomers in 1972, a more complex pattern of communication emerged. The Central Bureau was still the basic source of information, but now the Union, or rather its Comet Section, acted as a go-between. Both the quality and the quantity of information reaching the amateurs increased. The Section also managed to create the first hierarchical observation network, for which amateur reports were collected by the Section leader and submitted to Dr Hans Rickman at the Saltsjöbaden Observatory, who later resubmitted them to the Central Bureau. Still the level of activity was low, and only occasional reports were sent off to Dr Rickman. The Society still published its 'Comet Chronicles', but ceded its previous role in practice.

1950), and he established the first proper observational network for comets. He contacted Dr Hans Rickman (b. 1949), a cometary expert from the Saltsjöbaden Observatory, who promised to act as a go-between, forwarding comet reports to Brian Marsden at the Central Bureau for Astronomical Telegrams, which was relocated to Harvard College Observatory in 1965. Andersson also arranged for the Section to subscribe to comet circulars from the Bureau (Andersson and Jürisoo, 1975). Thus the landscape of comet information changed significantly.

The Swedish Astronomical Society was still publishing its comet chronicles in the 1970s but had essentially ceded its previous role. Amateurs relied on their own channels for accessing cometary information (Figure 16), and the circulars from the Bureau were edited and distributed directly to the 100 members of the Comet Section. In addition, the Union's *TeleMed*, a general newsletter launched in 1974 (Krogsgård, 1973a) and aimed at all members, included a good deal of information about comets.

Eventually the Comet Section started its own bulletin under the name *SUUA/CS-Nytt*, and Swedish amateurs now had easy and reliable access to the information they needed in order to pursue cometary astronomy. They were encouraged not only to observe, but also to submit reports to the Section. After being edited by Andersson, the reports were forwarded to the Central Bureau in the United States with Rickman's assistance. Finally, the information channels of Swedish cometary astronomy had come full circle.

5 INTERNET

Despite ten successful years, the Scandinavian Union of Amateur Astronomers did not last. Mainly because of language issues, the Finns started to leave the organisation. As a consequence, the Union more or less came into the hands of Swedish amateurs, who from the start had comprised the largest national population group in the association. Eventually it was decided to disband the Union, and to carry on the

activities on a national basis (Minutes ..., 1982). The Swedish Amateur Astronomical Society was founded in 1982, the surviving Sections were restarted, and *Astro*, a new journal, was launched. The new Society and its Comet Section marked the last chapter in this story, and the dawn of the digital era.

In 1988, Anders Lindquist (b. 1953), an amateur astronomer and professional computer technician, set up a Bulletin Board System on a spare computer and invited amateurs to start using it (Lindquist, 2012). The system required that users had access to a computer and modem, which was not very common in the late 1980s. Nevertheless, it was a success among a small group of advanced amateurs, who immediately realised its potential. In just a few years, *Astrobase* (*Astrobasen*) became the hub for all kinds of information about amateur astronomy, not the least about comets, linking practitioners and their clubs with international networks (Danielsson, 1989).⁸

One of the amateurs who made good use of the new information technology was Jörgen Danielsson (b. 1947; Figure 17), for several years the leader of the new Comet Section. Danielsson (1996) had become interested in comets during the 1986 appearance of 1P/Halley, and he evolved into an enthusiastic, skilled observer. He was also among the few amateurs who realized the potential of the new 'information highways', and under his supervision the Comet Section more or less moved to *Astrobase*.

During the era of the Scandinavian Union, the



Figure 17: Jörgen Danielsson (after Danielsson, 1984).

basis for the activities of the Comet Section had been the dispatches from the Central Bureau of Astronomical Telegrams. Judging by the many posts in *Astrobase*'s 'comet meeting', the sources had now multiplied (Figure 18). Starting in the 1990s, the circulars from the Bureau were down-

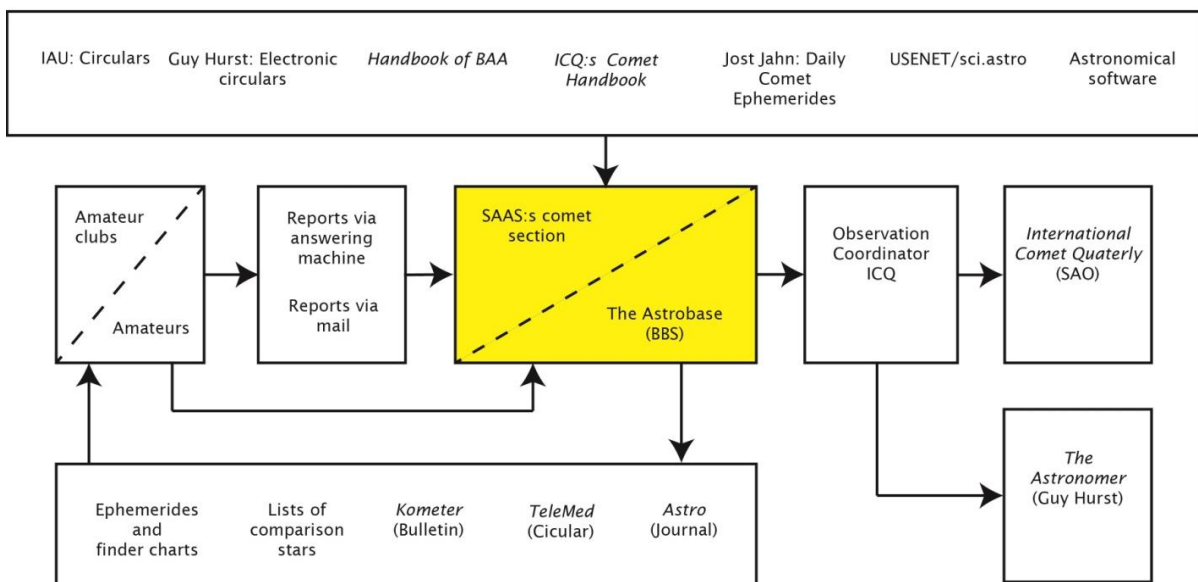


Figure 18: Circulation of comet information around 1990. With the launch of *Astrobase*, a Bulletin Board System, communicative patterns changed dramatically. The Swedish Amateur Astronomical Society's Comet Section, to a large extent administered inside the *Astrobase*, utilised a variety of sources for comet information, including electronic circulars from the Central Bureau of Astronomical Telegrams and *The Astronomer*. Together with other sources, they were used to put together information distributed by various channels directly to the amateurs or to their local clubs. With the assistance of the information, amateurs could observe comets and submit reports. The reports were either submitted directly to *Astrobase* via an answering service or by filling out a special form and sending it to the Section leader. Later the reports were edited and submitted to the *International Comet Quarterly* and to *The Astronomer*.

loaded to Astrobases in digital format. They were supplemented by the *Electronic Circulars* produced by Guy Hurst, editor of the British amateur journal *The Astronomer*. In addition, the Section frequently used information from the annual handbooks of the British Astronomical Association and from the editors of the newly-launched *International Comet Quarterly* (ICQ). While these four sources became the basic building blocks of the new information structure, they were accompanied by a variety of others. Discussions in various USENET groups, especially *sci.astro*, trickled down to Astrobases. The Section also relied on efforts of amateurs in other countries. Starting in 1991, they downloaded the daily ephemerides produced by German comet enthusiast Jost Jahn (Danielsson, 1991a). The introduction of astronomy software like *Megastar* (Willmann-Bell), *Superstar* (Pico Science) and *Dance of the Planets* (ARC Software) also



Figure 19: The naked eye appearance of Comet C/1996 B2 Hyakutake as sketched by Hans-Göran Lindberg early in the morning on 3 March 1996 (courtesy: Hans-Göran Lindberg).

had an impact, allowing Swedish amateurs to generate their own finder charts, ephemerides, lists of comparison stars and predictions of comet light curves (Bengtsson, 1994).

In the mid-1990s, the wealth of information in Astrobases was still for the chosen few. It needed to be made available to the majority of amateurs. As a result, Jörgen Danielsson and his successors published *Kometer*, a mimeographed monthly that described Section activities, distributed protocols for observations and reports, and announced approaching comets by means of ephemerides, finder charts, etc. The bulletin had about 80 subscribers (Anonymous, 1991). Some of the material was also published in the Swedish Amateur Astronomical Society journal *Astro*, thereby reaching practitioners who were

not members of the Comet Section. Much of the information in Astrobases was recirculated in the bulletins of many local amateur clubs. There were also sources not under the control of the Section, especially magazines like *Astronomy* and *Sky & Telescope* that had become popular with Swedish amateurs.⁹

Due to the plethora of channels, amateurs now had access to an abundance of information about comets. Many of them were content to track a particular comet, especially if it was among the brighter ones, but more scientifically-minded amateurs also needed channels through which they could submit reports. Several such channels were available. The easiest way for those who could log in to Astrobases was to file the report directly to the comet meeting. Others could either phone in a report to an answering service, which would transcribe it to Astrobases or fill out a special form and post it to the Section (Danielsson, 1990; 1991b). Later, all the reports were compiled by the Section leader and forwarded to *The Astronomer*, and to the *International Comet Quarterly* (which from 1990 was the global clearing house for cometary observations).

The information infrastructure needed for serious cometary astronomy was in place by the early 1990s. Swedish amateur astronomers had strong links with international networks of comet observers and thereby with some professional astronomers who conducted research on comets. That did not change the fact that Swedish amateur astronomy still was a rather small enterprise. The number of amateurs who actually submitted reports was even smaller. In 1991, for example, the Section forwarded a total of 57 observations to the *International Comet Quarterly*, which were supplied by just nine amateurs. Half of the reports concerned the rather unassuming Comet 4P/Faye, which peaked at magnitude 9 (Schlyter, 1992). The next year's results were similar: in total 60 observations were submitted by seven observers; half of the observations concerned Comet 109P/Swift-Tuttle (Danielsson, 1992; Schlyter, 1993). A few years later, Comet Hale-Bopp (C/1995 O1) became one of the most observed comets of the 1990s, generating close to 150 reports submitted by ten observers.¹⁰ It was followed soon after by Comet Hyakutake (C/1996 B2). Needless to say, many amateurs simply enjoyed making naked eye (see Figure 19) or telescopic observations of these comets without feeling the need to formally report their observations.

6 DISCUSSION AND CONCLUDING REMARKS

Swedish amateur cometary astronomy arguably was born in August 1957 when the Swedish Astronomical Society distributed its first circular.

Two decades later, fully-operational observational networks emerged, enabling amateurs to join forces with their counterparts in other countries as a means of promoting astronomical research. The relationship between Swedish amateurs and professionals was transformed in the process. While the Society was still in charge of comet information, a handful of astronomers acted as rather strict 'gatekeepers'. The information circulated in the comet chronicles was fairly useless, at least for someone who wanted to make observations. With the advent of the circulars later on, the Society encouraged amateurs to observe comets. Not until amateurs themselves started to organize the flow of information, however, did the situation really improve. They essentially sidestepped Swedish professionals and hooked up directly with international organisations. New 'gatekeepers' emerged, and starting in the 1970s, the Section leaders controlled the flow of information.

There was also an increase in the frequency of information delivery. The comet chronicles of the 1920s had two delivery dates per year; while the circulars of the 1950s and 1960s had about ten. The Comet Sections of the 1970s and 1980s upped the pace, and Astrobases in the early 1990s generated daily or hourly posts. But changing patterns of communications also impacted on the speed of information. A major breakthrough in this respect was the Society's circular, which reduced the amount of time it took for amateurs to find out about the discovery of a new comet from several months to about one week. Then hooking up with international networks through Astrobases accelerated the process further.

Cometary astronomy is but one of many branches of amateur astronomy that is very dependent upon information. Another striking example is variable star observing, which hinges on infrastructure maintained by organisations such as the American Association of Variable Star Observers, the Association Française des Observateurs d'Etoiles Variables (AFOEV) and Variable Stars South (operated by the Royal Astronomical Society of New Zealand, and the international clearing house for observations of variable stars in the southern sky). This is also true to a lesser degree of planetary, solar and deep sky observing.¹¹ Thus one important driving force for the development of amateur astronomy, regardless of context, has always been its information infrastructure. In the case of Swedish cometary astronomy, a number of technologies were used in the service of the amateurs—printed journals, telegrams, circulars, mimeographed bulletins, answering machines, computers, software, BBS systems and the Internet—enabling more sophisticated activities, and links to international networks.

The history of amateur astronomy obviously needs to focus on the evolution of organisational structures, not just on telescopes and other instrumentation, and on observational efforts. As previous research has shown, clubs, societies, sections and the like have played a vital role in promoting astronomy, recruiting and organising new generations of amateurs, and negotiating the relationship between amateurs and professionals (e.g. see Lankford, 1981; Chapman, 1998; Orchiston, 1988; 1989; 1998a; Orchiston and Bhathal, 1991; Rothenberg, 1981; Williams, 2000). Moreover, such a history also needs to pay attention to instrumental developments. Recent research has demonstrated that new technologies and manufacturing techniques were fundamental in facilitating amateur astronomy well into the twentieth century (Cameron, 2010). History, as I have tried to show in this paper, also needs to address changing communicative practices. Particularly in an observational context, access to relevant information (or lack thereof) largely determines what amateurs can or cannot accomplish.

7 NOTES

1. All quotes from primary sources have been translated into English by the author.
2. Obviously access to, and the speed and reliability of, information infrastructure comes to the forefront when discoveries of new comets are made (e.g. see Orchiston, 1997), but since Swedish amateurs have not been very successful in comet hunting I will not discuss this matter further (see Note 4 below). A case in point, though, is discussed by Wayne Orchiston in a research paper about early twentieth century Australian and New Zealand cometary astronomy. He shows that drawbacks in communicative structures became a major source of tension between amateurs and professionals with respect to reporting on newly-discovered comets (Orchiston, 1999b). In addition to this research paper, Orchiston has written extensively on the history of amateur cometary astronomy (including Orchiston, 1982; 1983; 1993; 1998b; 1999a; and 2003).
3. Three years later, Gunnar Larsson-Leander (1960) published a research paper on the physics of the anti-tail and Fogelquist's observations represent part of his empirical material.
4. Mrkos is so far the only comet discovered by a Swedish amateur. Georg Hugo Neumann at the Institute for Meteorology in Stockholm discovered it independently the day after Mrkos, but unfortunately, his report did not reach relevant parties in time to be considered when naming the comet (Lodén, 1957: 143).

5. One of these exceptions was Erik Alexandersson who submitted several observations to the Society. Five of them concerned Comet Burnham (C/1959 K1) and six concerned Comet Seki-Lines (C/1962 C1) (Alexandersson, 1960; Alexandersson, 1962). Astronomer Per-Olof Lindblad replied positively, but apparently did not forward the observations (Lindblad, 1960; Lindblad, 1962).
6. After a couple of years the circulars appeared at increasingly long intervals. They still had many subscribers, so the reason seems to have been of an organisational nature. A total of 30 circulars was distributed between 1957 and 1968. The amateur sections mentioned were launched in 1960. There were sections for the Sun, Moon, meteors, artificial satellites, Aurora Borealis, variable stars, astrophotography, mirror grinding and telescope construction, as well as a Junior Section, but not for comets. The development of the sections follows a similar pattern as the circulars: they were quite active the first year but eventually the organization fell apart and their activities basically ceased.
7. Although the Union initially managed to attract amateurs from around the world, for a number of reasons it failed to prosper. It never officially closed down and traces of it could still be found on the Internet until recently. However, its website is no longer active.
8. With the development of the web and html-based forum engines, Astrobases became obsolete. After several years of inactivity, the system was permanently discontinued in 2006. Astrobases have been preserved in their entirety, and the author has a complete digital copy. The database consists of about 9,000 posts from 1988 to 2001. The posts are organised in different meetings or subforums, one of the largest of which is the comet meeting. During its first year, Astrobases had about 20 active members who logged in 2,000 times (Danielsson, 1989).
9. How many Swedish subscribers these journals had is not clear, but according to an article in *Astro* in 1995, about 200 single copies of *Astronomy* and 150 of *Sky & Telescope* were sold every month (Nilsson, 1995).
10. Numbers obtained by counting the many reports posted in Astrobases. See for example Warell (1997).
11. Except for beginners, any amateur can readily point out the brighter planets, but they might need finder charts or ephemerides for the fainter ones like Uranus and Neptune. Obviously you do not need access to specialised information to find the Sun, but you need channels for submitting reports if you are counting sunspots. A case can also be

made for deep sky observing. The number of visible galaxies, nebulae and clusters is determined by the aperture of your telescope, your visual acuity and the quality of the local sky, as well as the objects that happen to be plotted on the star charts that you use.

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