Cometography

A Catalog of Comets
Volume 6: 1983–1993

Cometography is a multi-volume catalog of every comet observed from ancient times up to the 1990s, when the internet took off as a medium of scientific record. It uses the most reliable orbits known to determine the distances from the Earth and Sun at the time of discovery and last observation, as well as the largest and smallest angular distance to the Sun, most northerly and southerly declination, closest distance to the Earth, and other details, to enable the reader to understand each comet's physical appearance. Volume 6, the final volume in the catalog, covers the observations and pertinent calculations for every comet seen between 1983 and 1993. The comets are listed in chronological order, with complete references to publications relating to each comet and physical descriptions of each comet's development throughout its apparition. *Cometography* is the definitive reference on comets through the ages, for astronomers and historians of science.

Gary Kronk has held a life-long passion for astronomy, and has been researching historical information on comets ever since sighting Comet Kohoutek in 1973/74. His work has been published in numerous magazines, and in two previous books: *Comets: A Descriptive Catalog* (1984) and *Meteor Showers: A Descriptive Catalog* (1988). Kronk holds positions in various astronomical societies, including Coordinator of the Comet Section of the Association of Lunar and Planetary Observers, and Consultant for the American Meteor Society. The International Astronomical Union named minor planet 48300 Kronk, in honor of the extensive research Gary Kronk has done in cometography.

Maik Meyer has observed comets since 1987. Besides comet observing, he is researching cometary orbits in order to link and identify historic comet apparitions. His speciality area is the history of comet hunting. In 2002, he discovered the Meyer group of sunskirting comets. Meyer was leader of the Comet Section of the German Vereinigung der Sternfreunde and served as assistant editor of the *International Comet Quarterly* (*ICQ*). The International Astronomical Union named minor planet 52005 Maik, in honor of his research work in comets.

David Seargent studied and tutored philosophy at the University of Newcastle, NSW, Australia; he has also written books and articles covering a variety of subjects. He has been an amateur astronomer since his early teens, with comets being his principal interest. Seargent directed the Australian Comet Section from early 1980s until early 2000s and acted as visual co-ordinator for Australia of International Halley Watch 1985/6. He is the discoverer of C/1978 T1 (Seargent).

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VOLUME 6: 1983–1993

Gary W. Kronk, Maik Meyer, and David A. J. Seargent

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Introduction

The period of 1983 through 1993 brought forth many improvements in the study of comets, including larger telescopes and an increasing use of digital photography. These led to more discoveries and longer periods of visibility than in the past.

Comet discoveries

The period covered by this volume marks the last hurrah of visual amateur comet hunters, as a result of the use of new technology in the last years of the twentieth century. Of the 167 new comet discoveries (including five rediscoveries of lost comets), amateurs were involved in 54 of these (32%). If one looks at the credited discoveries, i.e. comets named for a discoverer that can include up to three discoverers per comet, 132 were photographic discoveries and 59 were visual discoveries (31%). Photographic amateur discoveries amounted to 13 (7%). This shows that visual comet hunting was still dominant among amateur comet hunters during this time.

The USA leads with 89 discoveries, followed by Japan with 30 and Australia with 27. There were 21 discoveries made by the following satellites: the Infrared Astronomical Satellite (IRAS), SOLWIND, and the Solar Maximum Mission (SMM).

Of the observatory surveys, the major share of discoveries was grabbed by the Schmidt telescopes at Palomar Observatory (California, USA) and Siding Spring Observatory (New South Wales, Australia).

Looking at the individuals who discovered comets from 1983 through 1993, it can be seen that D. H. Levy found almost all of his credited comets (visual and photographic from Palomar) during this period (21). Also, C. S. and E. M. Shoemaker found all of their 32 comets during this time. Other successful professional astronomers were E. F. Helin (11), J. E. Mueller (10), R. H. McNaught (9), M. Hartley (9), and K. S. Russell (9). The most successful amateurs were (besides Levy) D. E. Machholz (8), W. A. Bradfield (5) and H. J. Brewington (4).

The latter half of the 1990s saw the advent of the large professional Charged Coupled Device (CCD) surveys (e.g. LINEAR, CSS, Spacewatch, etc.), which led to a significant drop in amateur comet discoveries. In recent times, amateurs have become quite successful in discovering comets by using CCD cameras.

Comet observations

Several very active comet observers mentioned in *Cometography* volume 5 continued to observe during most, if not all, of the period covered by this

present volume. The most notable include A. F. A. L. Jones, J. E. Bortle, T. Seki, and C. S. Morris. The most notable observers to make their first impression during the years covered by this volume were J. V. Scotti, A. Hale, R. J. Bouma, and A. Nakamura.

Scotti and Nakamura particularly stood out. Although the major goal of their work was to precisely measure the positions of comets, they were frequently the first person to recover periodic comets, the only people to provide physical descriptions when a comet was too faint for amateur astronomers, and made the final observation of numerous comets.

Although visual observations remained the most abundant type of observation, film photography was falling out of favor, being replaced by digital cameras using the Charged Coupled Device (CCD). The CCD could digitally capture the light from celestial objects and a computer could then combine these images to uncover fainter objects and fainter detail. In just a matter of a few minutes, amateur astronomers could capture images showing objects as faint as magnitude 20, which equaled what observatories could accomplish with larger telescopes and exposure times of an hour or more from the 1950s into the 1980s.

The methods of determining a comet's magnitude changed little since the last volume of *Cometography*. The most preferred was the "Sidgwick method," which began with the observer memorizing both the size and brightness of a comet. He/she then defocused the stars until their disks were the same diameter as the in-focus comet. At that point, the magnitudes of these star disks were compared to the memorized brightness of the in-focus comet.

Astronomical periodicals

For the period covered by this volume, the most dominant publication providing comet observations and analysis was the *International Comet Quarterly*. It had become the clearing house for comet observations.

The Central Bureau for Astronomical Telegrams remained the official clearing house for comet discoveries and recoveries. It continued to disseminate this information through the *International Astronomical Union Circular* at irregular intervals.

The Minor Planet Center began incorporating precise positions of comets in the *Minor Planet Circulars* in the late 1970s. Observer notes, which provided descriptive information of comets, would sometimes be included.

Something new appeared in the final years covered by this volume: the World Wide Web (WWW). The very first websites dealing with astronomy were created in 1992 and 1993, including G. W. Kronk's Cometography website, which would provide observations and digital images of comets, both past and present.

The most interesting comets from 1983 to 1993

Because of the shorter period of time covered by this volume, there were no spectacular comets; however, four comets did become fairly easy naked-eye targets, while two others became memorable for other reasons.

Comet C/1983 H1 (IRAS–Araki–Alcock) was discovered in late April of 1983 and is the brightest comet listed in this volume. It brightened rapidly as it approached both the Sun and Earth. The comet made the fourth closest approach of a comet to Earth (0.0312 AU) on May 11, at which time the magnitude was about 2, while the coma was 2–3° across. In addition, the comet traveled just over 44° across the sky in 24 hours. Its rapid movement across the starry background could not only be detected through a telescope in a matter of minutes, but such motion could even be observed with the naked eye. This comet was a naked-eye object from May 6 to May 18.

Comet C/1989 W1 (Aarseth–Brewington) became the brightest comet since 1983, ultimately becoming visible to the naked eye from December 18 to December 29. It reached a maximum magnitude of about 3 and its visual tail length exceeded 2°.

Comet C/1989 X1 (Austin) was discovered about three weeks after C/1989 W1. Hopes were raised that it would become a bright comet when initial calculations of its orbit indicated that it could reach magnitude 2 in 1990 April. Although it did become a naked eye object from April 21 to June 4, it barely reached a peak magnitude of 4. When closest to Earth on 1990 May 25, experienced observers reported a coma 1° across and a tail extending at least 2°.

Comet C/1990 K1 (Levy) was discovered while comet C/1989 X1 was at its brightest. It was visible to the naked eye from July 23 to September 20, reaching a maximum brightness of about 3.5. Experienced observers reported a maximum coma diameter of nearly 1° and a tail length of between 3° and 5°.

Comet 109P/1992 S2 (Swift–Tuttle) barely reached naked-eye visibility, but was of interest to astronomers ever sense it was identified as the parent of August's Perseid meteor shower in the nineteenth century. Although its appearance in 1992–1993 was that of a fine binocular object, large telescopes revealed fine structure within the coma, including hoods, fountains, and jets. But the most notable aspect of this comet's apparition was that activity levels of the Perseid meteor shower increased. The normal Zenithal Hourly Rate (ZHR) for the Perseids is about 120 meteors. As the comet moved through the inner solar system, the ZHR rose to 350 in 1991, 220 in 1992, 300 in 1993, and 250 in 1994.

Comet D/1993 F2 (Shoemaker–Levy 9) never became particularly bright, with only a handful of visual observations ever being reported. But it did become newsworthy. When the comet was discovered in 1993, it had a very unusual appearance, being referred to as a "squashed comet" and a "string of pearls." It turned out that the comet had been torn apart during an

extremely close approach to Jupiter in 1992 and all of the pieces were on a collision course with that planet. When the comet pieces hit Jupiter over several days in July 1994, the event was covered by newspapers around the world and even made the front covers of the magazines *Time* and *Newsweek*.

Cometography

Perhaps the biggest change to this volume is one that was never seen by the reader. When *Cometography* was originally proposed to Cambridge University Press back in 1995, the series was planned to end with 1999. Work had then barely started on this last volume and we did not begin working on it full time until after the publication of volume 5 in 2010. By that time, the Solar and Heliospheric Observatory (SOHO) had discovered 2000 comets since it went into operation in 1996, nearly 300 of which were during 1996–1999. In addition, systematic surveys by other observatories resulted in increasing the number of comets found each year. Where the period of 1990–1995 saw an average of 12 comet discoveries per year, there were 44 discoveries in 1996 (most of which were from SOHO) and then 104 discoveries in 1997, 140 in 1998, and 135 in 1999. These numbers do not include the normal returns of periodic comets. Needless to say, the final volume of *Cometography* was becoming far bigger than we had imagined two decades ago. So, it was decided to end the series with the comets of 1993. As it turns out, this volume is still one of the largest of the *Cometography* series.

As with volume 5, the biggest change in volume 6 is the condensing of well-observed comets. We have continued to concentrate on presenting the observations of experienced observers, but we also began presenting the observations of the most prolific observers. The reason for adding the latter was to present a better picture of how some individual observers saw changes in the course of a month. As can be imagined, this in itself presented challenges, as it seems some inexperienced observers reported all observations regardless of atmospheric conditions. This sometimes led to wild variations in the magnitude and coma diameter that they reported, while experienced observers reported few such variations. So, we used our own judgment by looking at all reported observations for each month and using those two, three, or four observers who provided the best picture of a comet's appearance.

We chose to leave out the term "total magnitude" in this volume. Every reference to "magnitude" is the observer's "total magnitude" estimate. It should be noted that even though some observers occasionally provide "nuclear magnitude" estimates, it is highly likely that this is not the magnitude of the true nucleus, but of the much larger nuclear condensation, meaning the nucleus and bright material emanating from it. Exceptions would be the nuclear magnitude estimates reported by observers who specifically image comets that are very far away from the Sun and show little or no emissions.

It should also be noted that the positions given in this volume are representative of those initially reported by the people making the discoveries/recoveries and final observations, but have been converted to equinox 2000.0.

Brian G. Marsden

A long-time inspiration to the three authors of this volume was Brian G. Marsden, who passed away in 2010. Each of us has our own stories as to how Brian encouraged us in our observing, research, and writing that span several decades. No other astronomer of the modern era has shown more of a willingness to listen to amateur astronomers, answer their letters and e-mail, give constructive help, and encourage them like Brian did. In fact, the *Cometography* books became a reality because of Brian. Not only did he encourage G. W. Kronk to do this project, but also approached Cambridge University Press in 1995 and suggested they contact Kronk about publishing this series. He will be missed.

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