# 55 YEARS OF COMETS
# (1970 – 2024)

## PART I
## OBSERVATIONAL AND STATISTICAL ANALYSIS

## INTRODUCTION

On Monday evening, February 2, 1970, when I was 11 years old and living on the southern outskirts of Alamogordo, New Mexico, I used information from the latest issue of the magazine Sky & Telescope to locate and observe my first comet, Comet Tago-Sato-Kosaka 1969g, which had been independently discovered by three Japanese amateur astronomers in October 1969 and which in January 1970 had become the first comet ever observed from space. On that fateful night, the comet appeared as a diffuse 5$^{th}$-magnitude object near the bright star Hamal (Alpha Arietis), easily visible in 7x35 binoculars and dimly visible to the naked eye. In the 4.5-inch telescope that I had acquired a little over two weeks earlier, I could see a distinct central condensation within the diffuse coma. My best friend, Mark Bakke, had come over to my house (bringing his own 60-mm refractor), and we both enjoyed our first cometary observation; meanwhile, we showed the comet to the other members of my family, including my father and mother, my paternal grandmother, and my older brother Barry.

I would end up observing Comet Tago-Sato-Kosaka every night for the next week, noting on one night towards the end of that time that it appeared to be brighter and easier to see than it had been on that first night. I would later learn that the comet had undergone a brief upsurge in brightness near the time of this observation.

A little over a month and a half later, I was thrilled to see a very bright comet, Comet Bennett 1969i, in the morning sky. Initially as bright as magnitude 0 and with a bright dust tail 10 degrees long or longer, it was a lovely sight in the pre-dawn eastern sky, and I followed it for the next month and a half as it faded. The morning after my first sighting, I made my first attempt at photographing a comet, with a handheld Brownie camera from the front doorstep of our house; although the results could hardly be considered "good" photographs, the comet was nevertheless "there."

From that point on, I was "hooked," and have attempted to observe just about every comet that has been within my capability to see, given the telescopes and information I had available at the respective times. (I have subsequently learned, of course, that the fortuitous circumstance of two consecutive bright comets, one of these being one of the 20th Century's "Great" comets, in such short order is definitely not the norm.) In addition to larger and better telescopes, and more and quicker access to information regarding comets (and other celestial phenomena) – and the advances in communications technology that have gone hand-in-hand with this increase in information access – my personal life that underlies my comet observation activities has undergone a number of changes, twists and turns. These include graduation from high school (1976); attendance at and graduation (1980) from the U.S. Naval Academy; time in Naval service in southern California during the early 1980s; working at the Jet Propulsion Laboratory, including participating in various space missions, during the mid-1980s; attending graduate school at New Mexico State University and earning a Ph.D. (1992); initial employment at the New Mexico Museum of Space History and the later founding of my own research and educational organization in the early- to mid-1990s, and, since 1995, residing in the Sacramento Mountains east of Cloudcroft, New Mexico. They also include my first marriage (1985); the birth and raising of two sons; divorce (2010); a deep relationship in the early 2010s that, unfortunately, ended badly; a new relationship that began in 2017 and which has now resulted in a second marriage (2024); and (as of now) three grandchildren. Of the five

people who shared that first comet observation with me, only one (my brother Barry) is still alive; my grandmother passed away in 1973, my father in 2002, and my mother in 2013, while Mark was tragically killed in a firearms accident in 1984.

In at least some respects, the pinnacle of all this came with my discovery of Comet Hale-Bopp C/1995 O1 in July 1995 (just four months after my family and I had relocated to our mountain residence east of Cloudcroft). A year and a half later that object became the final "Great Comet" of the 20th Century and an icon in pop culture, both of which have contributed to its being the most widely-viewed comet in history. The fame and recognition (and, for a while, financial success) that comet brought me made it possible for me to have a reasonably successful, if unusual, career, which has included involvement in the commercial space industry, the leading of "science diplomacy" expeditions to Iran and elsewhere, eight years of teaching on-line University classes, and various types of scientific research involving comets and near-Earth asteroids.

Throughout all of this, I have continued to make visual observations of whatever comets were within my range of capability on a regular and systematic basis. However, various health issues that have come with advancing age, including a week-long period of hospitalization in mid-2018 which has required me to be on oxygen therapy ever since, have made this activity more and more physically challenging. Then, in September 2024 I suffered a bacterial lung infection and collapsed lung that forced me to spend three weeks hospitalized (including two weeks in Intensive Care), followed by over a week at a physical rehab facility. While I have since recovered from this, the entire episode, combined with all the other various physical challenges I have been dealing with, has convinced me that the time has come to bring this activity of systematic visual comet observing to a close. Accordingly, as of the end of 2024 I have "retired" from this lifelong endeavor. As of that time I had visually observed 760 comets (533 of these being "separate" comets with the remainder being additional returns of periodic comets within

that group of 533), and had made a total of 8147 visual observations of these comets.

At this time it feels appropriate to perform a detailed statistical analysis of all these observations of all these comets. There may not be any formal scientific significance to this, and of course there are numerous selection effects involved (such as my increasing capabilities as an observer over time as well as the increasing rate of comet discoveries over that same interval). But, it is important and interesting to me, so, for whatever it is worth, here goes . . .

I should note that, despite my "retirement," I have not walked away from visual observing entirely. For at least the near- to intermediate-term future, I expect to attempt observations of bright and/or interesting comets that might come along, although this will only be on an occasional, as opposed to a systematic, basis.

In that vein, one of the brightest and most interesting comets of recent years, Comet ATLAS C/2024 G3, passed through perihelion just two weeks after my "retirement," and although it was primarily an object for the southern hemisphere, I nevertheless succeeded in obtaining a couple of observations of it. I am accordingly including it within this analysis. I have also obtained one "post-retirement" observation of Comet 29P/Schwassmann-Wachmann 1, which I am also including within this analysis. With these inclusions, my lifetime comet tally is 761, which includes 534 separate comets, and a grand total of 8150 visual observations.

## DESIGNATIONS AND NOMENCLATURE

Prior to 1995 the IAU designated comets via a dual scheme: a discovery designation which included the year of discovery and a lower-case letter indicating the order of discovery (or recovery, for periodic comets) within that year, and a perihelion designation (usually assigned one to two years later) which included the year of perihelion passage and a

Roman numeral indicating the sequential order of perihelion passage within that year. (For example, my first comet, Tago-Sato-Kosaka, has a discovery designation of 1969g, denoting the 7th comet to be discovered in 1969, and a perihelion designation of 1969 IX, denoting the 9th comet known to have passed perihelion in 1969.) Beginning in 1995 the IAU switched to a single scheme: the year of discovery, followed by an uppercase letter signifying the half-month of a comet's discovery and a number indicating the sequential order of discovery within that half-month, for example, Comet Hale-Bopp's designation is C/1995 O1, denoting the first comet discovered during the second half of July 1995 (hence the letter "O"), with the "C" denoting a long-period comet (i.e., an orbital period in excess of 30 years. (An object originally designated as an asteroid, the scheme for which had long followed something similar except that the sequential number was instead another uppercase letter indicating the order of discovery, and numerical subscripts when necessary, would retain this designation if later found to be cometary.) When the IAU implemented this scheme it retroactively assigned the new scheme designations to pre-1995 comet discoveries, however for my purposes (in overall record-keeping and in this analysis) I am retaining the pre-1995 discovery designations for these comets. These were the designations the comets had been assigned at the times I was observing them, and accordingly are the ones I "know" them by.

"Routine" recoveries of periodic comets, which had been assigned letters in the old scheme, are no longer assigned designations in the new scheme. Instead, periodic comets have been assigned periodic numbers (in the style of "xxxP/<name>") in sequential order after a second return has been identified, either via recovery at a subsequent return or "pre-discovery" observations at an earlier return. For my purposes here, for routine periodic comets recovered during and after 1995, as well as for "annual" periodic comets which did not receive designations in the old scheme, I identify them by designations of the form "xxxP-yy" where "yy" are the last two digits of the year of perihelion passage. The first two digits of the year in question can be assumed to be "19" if "yy" is "69" to "99" and "20" if "yy" is "00" to "24" (for now, anyway). For

example, the return of Comet 6P/d'Arrest I observed in 1995 would be designated as "6P-95" and the return of this comet I observed in 2008 would be "6P-08."

With the implementation of the new scheme, the usage of numerals attached to multiple periodic comets discovered by the same discoverer was formally discontinued. For my purposes, I have opted to keep those numerals for the comets that had formally received them prior to that time.

In the various lists I will give for individual comets a "comet no." This is the comet's number on my lifetime tally, added sequentially from my first one (no. 1) to my most recent one (no. 761). It has happened on a handful of occasions that an object I observed as an "asteroid" is later found to exhibit (or to have exhibited in the past) cometary activity, and I have accordingly added it to my tally retroactively. Rather than insert it into my tally at the time I observed it (which would accordingly affect the tally numbers for all subsequent comets), I have added such objects to my tally after the tally number for the most recently added comet at that time. (For example, if my tally at the time I made the retroactive addition was 460, the retroactively added comet would be no. 461.)

## WHAT ARE AND WHAT ARE NOT "COMETS"

The comets on my tally are comets that I have observed visually, i.e., with my naked eye, through binoculars, and/or through the eyepiece of one or more telescopes. Between 2000 and 2011 (most heavily concentrated during the first few years of that time interval) I imaged several comets with the CCD system I had operational at the time, but I do not include these comets unless I also observed them visually. Similarly, since 2017 I have imaged numerous comets remotely with CCDs attached to various telescopes of the Las Cumbres Observatory network, but, again, I do not include these comets unless I also observed them visually.

After an interval of 55 years there are obviously numerous periodic comets that I have observed on multiple returns. When I observed Comet 2P/Encke on my 2nd return in 1974 I established the precedent of counting additional returns of periodic comets as "new" comets on my tally, and have maintained that precedent ever since. (Depending upon when a comet passes through perihelion during the course of a year, the viewing circumstances can vary widely, and sometimes – perhaps as a result of orbital changes due to planetary perturbations – a comet may behave differently from one return to another, and thus in some ways acts as a "different" comet each time it returns.) As mentioned above, my current comet tally of 761 includes 534 separate comets, with the remaining 227 comets being additional returns of periodic comets contained within that total of 534.

The unusual Comet 29P/Schwassmann-Wachmann 1, which travels in a near-circular orbit between Jupiter and Saturn and which undergoes frequent and unpredictable outbursts, constitutes somewhat of a special case, since it is often visually detectable around aphelion. I have applied the same precedent to this comet that I have applied to other periodic comets, i.e., each "return" is counted as a "new" comet, with "return" in this case being defined as aphelion to aphelion. When I first observed this comet in early 1981 it was outbound from its perihelion passage in 1974, and all observations I made between that first one and the comet's aphelion in 1982 constitute its first "return." All observations I made between that aphelion, through its next perihelion passage in late 1989 and its next aphelion in early 1997, constitute its second "return," and so on. I am presently on my fourth "return" of this comet, with its having been at aphelion in late 2011 and at perihelion in early 2019; it is now outbound towards its next aphelion in late 2026.

It has become obvious over the past few decades that there is a nebulous dividing line between "comet" and "asteroid," with quite a few objects exhibiting characteristics of both of these. The IAU has assigned "dual-designations" to some of these objects, i.e., both permanent asteroid

numbers and short-period comet numbers, and I include any of these objects I observe as “comets” for purposes of my tally.

There are also quite a few “asteroids” that have exhibited cometary activity but that have not been designated as “comets” by the IAU; such objects are usually collectively described under the term “active asteroids.” The activity in some of these objects does appear to be driven by sublimation of volatiles such as occurs in comets, but for other objects there are other mechanisms that appear to be responsible for the activity, for example, debris resulting from a collision with another object. At the same time, there have been some objects where the cometary activity appears to be due to one or more of these “other” mechanisms but where the IAU has nevertheless assigned periodic comet numbers to them.

Given all this, I have concluded that the most consistent course of action is to include any “active asteroid” as a “comet” for tally purposes, regardless of the mechanism that produced its cometary “activity,” as long as the evidence for that activity is clear and convincing. I came to this conclusion after I had already observed some of the objects in question, and in some other instances the evidence for this activity came some time after I had observed the object in question; in these various cases I added the objects to my tally retroactively.

The following “asteroids” that I have observed have exhibited cometary activity and are accordingly included as “comets” on my tally, but have not been assigned cometary designations by the IAU:

(493) Griseldis: exhibited one outburst of cometary activity in 2015 which was very probably the result of a collision with another object. When I observed it during its 2019 “return” it was added to my tally “in sequence.”

(596) Scheila: exhibited an outburst of cometary activity in late 2010 which detailed studies have indicated was almost certainly the result of

collision with another object. Scheila is bright enough such that it is visually detectable throughout its orbit, and I followed it on an occasional basis for several years after its outburst, during which time it passed through aphelion twice. Accordingly, following the precedent I have followed for Comet 29P, I have observed Scheila on three "returns" and thus it appears on my tally three times. (The first two "returns" were added retroactively, and the third "return" was added "in sequence.")

(3200) Phaethon: the apparent parent object of the Geminid meteor shower. While it has never appeared as anything other than stellar in observations made from the ground, it has on several occasions exhibited cometary activity such as a coma, tail, and non-asteroidal brightening in images taken with the STEREO spacecraft. The exact mechanism that produces this activity is still a matter of research – although it is clearly not due to sublimation of volatiles – and in some pieces of literature it has been described as a "rock comet." I have observed Phaethon on five separate returns. (The first three returns were added retroactively, and the latter two were added "in sequence.")

(3552) Don Quixote: an apparent "asteroid" in an orbit distinctly indicative of a short-period comet. The Spitzer Space Telescope (which is sensitive to infrared radiation) detected a coma and tail around this object during its 2009 return – the same return when I observed it – which appeared to be due to sublimation of volatiles. Weak cometary activity (coma and tail) was subsequently detected optically during its 2018 return. Don Quixote was added to my tally retroactively.

(65803) Didymos: the impact of the DART mission into Didymos' moon Dimorphos in 2022 produced a tail-like plume of debris that accompanied Didymos for the next few weeks. Didymos was added to my tally "in sequence."

(101955) Bennu: shortly after its arrival at Bennu in late 2018, the OSIRIS-REx mission detected numerous bursts of material off Bennu's surface over a period of several weeks. Ground-based studies, as well as

analysis by OSIRIS-REx itself, indicate that Bennu's surface contains hydrated clays, indicative of the presence of water which could, theoretically, be producing these bursts. I had observed Bennu during its discovery return and it was accordingly added to my tally retroactively.

A/2018 V3: images taken by the 3.6-meter Canada-France-Hawaii Telescope (CFHT) at Mauna Kea ten months after this object's perihelion passage show a distinct non-stellar appearance and a brightness profile indicative of very weak cometary activity. This object (which was discovered by PANSTARRS but which never received a formal name) was added to my tally retroactively.

There are some classes of objects that I do not consider as "comets" for tally purposes:

Two periodic comets have exhibited multiple components – that appeared as separate objects – on returns I have observed. In particular, I observed three additional components of Comet 73P/Schwassmann-Wachmann 3 during its return in 2006 (no. 385) and one additional component during its return in 2017 (no. 612), however I count this as only one comet during each of those returns. Similarly, I observed two additional components of Comet 141P/Machholz 2 during its discovery return in 1994 (no. 193) and one of these accompanying the main component during the subsequent return in 1999 (no. 273), however, again, I count this as only one comet during each of those returns.

Following the above discussion of "active asteroids," there are numerous objects that travel in cometary orbits but which have never exhibited cometary activity; these may very well be "extinct" or, perhaps, "dormant" comets. I have made attempts to observe several of these objects and have successfully done so for quite a few of them – three of them on two or more returns – but I do not include them as "comets" unless and until they exhibit some form of cometary activity (as indeed what happened with (3552) Don Quixote). One of these objects is one of

the recently-identified “dark comets,” i.e., objects that exhibit distinct non-gravitational accelerations indicative of cometary activity but which (thus far) have not exhibited such activity itself. Should any of these objects exhibit cometary activity in the future (or be found to have done so in the past), I will add the object(s) in question to my tally retroactively.

There are also some asteroids, including some in the main asteroid belt, which some researchers have claimed have exhibited brightness behavior inconsistent with an asteroidal nature and which are thus possibly weakly active comets. I have observed some of these objects, including one on two “returns.” Similarly, I have observed a non-asteroidal brightness behavior in the near-Earth asteroid (1566) Icarus, which has at some point also been considered as a possible weakly active comet. Should any of these objects – or, theoretically for that matter, any asteroid I have observed – be found to exhibit distinct cometary activity, I will add the object(s) in question to my tally retroactively.

There are a handful of objects that have exhibited what could be considered “cometary” activity but which I do not consider as “comets” for my tally:

Mercury: sodium atoms from its surface and (very thin) atmosphere are “blown” back by the solar wind to form a “tail” in the same manner that a comet’s tail is formed. Images of Mercury taken with detectors sensitive to the light of sodium atoms show this “tail,” which does in fact give it a cometary appearance.

Ceres: infrared data from the Herschel Space Telescope and in situ measurements taken by the Dawn spacecraft indicate the presence of water vapor emission around Ceres, likely caused by a sublimation process similar to what occurs in comets, probably due to some form of cryovolcanism.

Pluto: a thin atmosphere was detected around Pluto as it approached perihelion in 1989 and was studied in detail by the New Horizons mission when it passed by that world in 2015. Pluto's presence within the Kuiper Belt is also somewhat suggestive of a possible cometary nature.

From a purely practical perspective, since I have observed Mercury and Ceres numerous times over the decades I have been active, the matter of how many "returns" I have observed would be a problematical issue. At least for Pluto that would not be a problem, since all my observations would be included within one "return."

## POSSIBLE CONTINUING COMETS

The current (2019 perihelion passage) "return" of Comet 29P/Schwassmann-Wachmann 1 (no. 498) is still ongoing at this writing, and the comet does not pass through aphelion under September 2026. It continues to undergo outbursts – indeed, it was subsiding from a pair of large outbursts when I obtained my "final" observation in late December 2024, and has in fact undergone two more outbursts in early 2025. To mark the 55$^{th}$ anniversary of my first comet observation, I observed this comet on the evening of February 2, 2025. I do not necessarily plan to attempt any further observations, but it is theoretically possible that it might undergo one or more additional large outbursts that might prompt me to observe it again.

The "Centaur" Comet 174P/Echeclus P/2000 EC98 (no. 384) underwent an outburst in late 2005, over nine years before perihelion passage (April 2015) when it was located at a heliocentric distance of slightly over 13 AU, and I successfully obtained a handful of observations in early 2006 before the outburst subsided. During the years since then it has undergone three additional outbursts, two of which I have successfully observed (the most recent of which was in late 2017). Echeclus does not pass through aphelion until November 2032 and it is theoretically

possible it might undergo additional outbursts before then, although it is doubtful that I might attempt observations of any such event.

At this writing, Comets ATLAS C/2022 E2 (no. 750) and ATLAS C/2021 G2 (no. 756) are both still bright enough to be visually detectable with my 41-cm telescope, and Comet Tsuchinshan-ATLAS C/2023 A3 (no. 749) is now in the process of emerging into the morning sky after conjunction with the sun, however all of these comets are quite faint – no brighter than 13$^{th}$ or 14$^{th}$ magnitude – and I have no plans to attempt any observations of them, unless there are reports of large outbursts in which case it is possible I might make such attempts.

## PERIODIC COMETS/REPEAT COMETS

Of the 497 periodic comets that have been assigned periodic comet numbers as of this writing, I have successfully observed 154 of them (30.1%). There are a handful of periodic comets that I observed on their respective discovery returns that should be assigned periodic comet numbers when they are first recovered on a future return, and thus this number (and percentage) will change retroactively.

As I listed above, there are 6 numbered "active asteroids" I have observed that have not been designated as "comets" by the IAU but which I include as "comets" on my tally.

There are two "dual designated" comets that I have observed; both of these are Centaurs:

| | |
|---|---|
| 95P/Chiron = (2060) Chiron | 1 return: 1996 (no. 196) |
| 174P/Echeclus = (60558) Echeclus | 1 return: 2015 (no. 384) |

Of the 154 numbered periodic comets that I have observed, I have observed 88 of them (57.1%) on two or more returns, and 66 of them (42.9%) on just a single return. As listed above, of the 6 numbered "active asteroids" that I count as "comets," I have observed 2 of them on two or more returns and 4 of them on just a single return.

I have observed the following periodic comets on 5 or more returns:

| Year of Perihelion Passage | No. |
|---|---|
| **2P/Encke (14 returns)** | |
| 1971 | 4 |
| 1974 | 11 |
| 1980 | 39 |
| 1984 | 65 |
| 1990 | 145 |
| 1994 | 183 |
| 1997 | 231 |
| 2000 | 280 |
| 2003 | 343 |
| 2007 | 402 |
| 2013 | 531 |
| 2017 | 610 |
| 2020 | 683 |
| 2023 | 744 |
| **81P/Wild 2 (8 returns)** | |
| 1978 (D) | 26 |
| 1984 | 67 |
| 1990 | 146 |
| 1997 | 223 |
| 2003 (s) | 332 |
| 2010 | 463 |
| 2016 | 590 |
| 2022 | 727 |

19P/Borrelly (7 returns)

| | |
|---|---|
| 1981 | 43 |
| 1987 | 107 |
| 1994 | 190 |
| 2001 (s) | 292 |
| 2008 | 436 |
| 2015 | 585 |
| 2022 | 711 |

45P/Honda-Mrkos-Pajdusakova (7 returns)

| | |
|---|---|
| 1974 | 13 |
| 1990 | 144 |
| 1995 | 207 |
| 2001 | 291 |
| 2011 | 490 |
| 2016 | 609 |
| 2022 | 718 |

22P/Kopff (6 returns)

| | |
|---|---|
| 1983 | 55 |
| 1996 | 213 |
| 2002 | 313 |
| 2009 | 448 |
| 2015 | 572 |
| 2022 | 719 |

41P/Tuttle-Giacobini-Kresak (6 returns)

| | |
|---|---|
| 1973 | 9 |
| 1990 | 137 |
| 1995 | 200 |
| 2001 | 286 |
| 2006 | 390 |
| 2017 | 613 |

46P/Wirtanen (6 returns)

| | |
|---|---|
| 1986 | 92 |
| 1991 | 162 |
| 1997 | 224 |
| 2002 | 316 |
| 2008 | 416 |
| 2018 | 653 |

65P/Gunn (6 returns)

| | |
|---|---|
| 1982 | 50 |
| 1989 | 126 |
| 1996 | 210 |
| 2003 | 331 |
| 2010 | 450 |
| 2017 | 619 |

67P/Churyumov-Gerasimenko (6 returns)

| | |
|---|---|
| 1982 | 53 |
| 1996 | 206 |
| 2002 | 315 |
| 2009 | 444 |
| 2015 (s) | 577 |
| 2021 | 704 |

73P/Schwassmann-Wachmann 3 (6 returns)

| | |
|---|---|
| 1990 | 140 |
| 1995 | 202 |
| 2001 | 284 |
| 2006 | 385 |
| 2017 | 612 |
| 2022 | 721 |

88P/Howell (6 returns)

| | |
|---|---|
| 1987 | 103 |
| 1998 | 245 |
| 2004 | 349 |
| 2009 | 457 |
| 2015 | 566 |
| 2020 | 678 |

96P/Machholz 1 (6 returns)

| | |
|---|---|
| 1986 (D-c) | 93 |
| 1991 | 161 |
| 2002 | 300 |
| 2007 | 405 |
| 2012 | 507 |
| 2023 | 733 |

116P/Wild 4 (6 returns)

| | |
|---|---|
| 1990 (D) | 138 |
| 1996 | 208 |
| 2003 | 327 |
| 2009 | 447 |
| 2016 | 589 |
| 2022 | 714 |

4P/Faye (5 returns)

| | |
|---|---|
| 1984 | 69 |
| 1991 | 163 |
| 1998 | 259 |
| 2006 | 393 |
| 2021 | 703 |

6P/d’Arrest (5 returns)

| | |
|---|---|
| 1976 | 23 |
| 1982 | 51 |
| 1995 | 198 |
| 2008 | 435 |
| 2021 | 705 |

10P/Tempel 2 (5 returns)

| | |
|---|---|
| 1983 | 57 |
| 1988 | 119 |
| 1999 | 265 |
| 2010 | 475 |
| 2015 | 584 |

21P/Giacobini-Zinner (5 returns)

| | |
|---|---|
| 1985 (s) | 82 |
| 1998 | 248 |
| 2005 | 370 |
| 2012 | 497 |
| 2018 | 642 |

26P/Grigg-Skjellerup (5 returns)

| | |
|---|---|
| 1977 | 24 |
| 1982 | 49 |
| 1987 | 102 |
| 2008 | 429 |
| 2013 | 526 |

43P/Wolf-Harrington (5 returns)

| | |
|---|---|
| 1984 | 72 |
| 1991 | 149 |
| 1997 | 233 |
| 2004 | 341 |
| 2016 | 601 |

62P/Tsuchinshan 1 (5 returns)

| | |
|---|---|
| 1985 | 80 |
| 1998 | 240 |
| 2004 | 361 |
| 2017 | 630 |
| 2023 | 747 |

78P/Gehrels 2 (5 returns)

| | |
|---|---|
| 1989 | 131 |
| 1997 | 234 |
| 2004 | 353 |
| 2012 | 492 |
| 2019 | 654 |

141P/Machholz 2 (5 returns)

| | |
|---|---|
| 1994 (D) | 193 |
| 1999 | 273 |
| 2005 | 368 |
| 2015 | 581 |
| 2020 | 690 |

185P/Petriew (5 returns)

| | |
|---|---|
| 2001 (D-c) | 294 |
| 2007 | 400 |
| 2012 | 506 |
| 2018 | 636 |
| 2023 | 738 |

(3200) Phaethon (5 returns)

| | |
|---|---|
| 1985 (r) | 559 |
| 2005 (r) | 560 |
| 2008 (r) | 561 |
| 2016 | 607 |
| 2017 | 633 |

D: discovery return
D-c: discovery return, where I confirmed (or co-confirmed) the discovery
s: encountered by a spacecraft mission during the return
r: retroactive addition to my comet tally

Of the 154 numbered periodic comets I have observed, I observed 45 of them on their discovery return, and I observed one of the numbered "active asteroids" on my tally on its discovery return. Of the 45 numbered periodic comets I observed on their discovery returns, I confirmed (or co-confirmed) 4 of them. I observed 8 of the numbered periodic comets on their "re-discovery" returns, and confirmed 2 of these re-discoveries. I also confirmed the recovery of Comet 109P/Swift-Tuttle on its 1992 return (no. 173).

I visually recovered Comet 37P/Forbes on its 1999 return (no. 262). Via the Las Cumbres Observatory network I recovered three of the returning periodic comets in my tally: 15P/Finlay on its 2021 return (no. 702); 13P/Olbers on its 2024 return (no. 752), and 333P/LINEAR on its 2024 return (no. 759).

## 10 LONGEST-PERIOD PERIODIC COMETS I HAVE OBSERVED ON TWO OR MORE RETURNS

(The given orbital periods are those that the comets in question exhibited at the most recent return during which I observed them.)

| Year of Perihelion | No. |
|---|---|
| 1. 38P/Stephan-Oterma (37.9 years) | |
| 1980 | 38 |
| 2018 | 649 |
| 2. 27P/Crommelin (27.9 years) | |
| 1984 | 64 |
| 2011 | 489 |
| 3. 473P/NEAT (22.5 years) | |
| 2001 (D) | 296 |
| 2024 | 754 |

4. 161P/Hartley-IRAS (21.5 years)

| | |
|---|---|
| 1984 (D) | 63 |
| 2005 | 374 |

5. 155P/Shoemaker 3 (17.1 years)

| | |
|---|---|
| 1985 (D) | 91 |
| 2002 | 328 |

6. 192P/Shoemaker-Levy 1 (16.4 years)

| | |
|---|---|
| 1990 (D) | 146 |
| 2007 | 423 |

7. 290P/Jaeger (15.2 years)

| | |
|---|---|
| 1999 (D) | 253 |
| 2014 | 534 |

8. 66P/du Toit (14.9 years)

| | |
|---|---|
| 2003 | 337 |
| 2018 | 640 |

9. 29P/Schwassmann-Wachmann 1 (14.8 years)

| | |
|---|---|
| 1974 | 47 |
| 1989 | 111 |
| 2004 | 226 |
| 2019 | 498 |

10. 8P/Tuttle (13.6 years)

| | |
|---|---|
| 1980 | 40 |
| 2008 | 415 |

D: discovery return

I have observed the following as-yet-unnumbered periodic comets on their respective discovery returns. If/when they are recovered they should presumably receive permanent numbers.

Jupiter-family comets (P < 20 years):

| | | |
|---|---|---|
| Haneda-Campos 1978j | 30 | (probably disintegrated) |
| Shoemaker-Levy 9 1993e | 178 | (destroyed) |
| Vales P/2010 H2 | 473 | (possibly disintegrated) |
| McNaught P/2013 J2 | 528 | |
| NEOWISE P/2014 L2 | 547 | |
| ATLAS P/2021 Q5 | 708 | |

Halley-type comets (20 years < P < 200 years)

| | |
|---|---|
| Levy 1991q | 159 |
| LINEAR C/1999 S3 | 269 |

| | |
|---|---|
| BATTERS C/2001 W2 | 298 |
| LONEOS C/2001 OG108 | 302 |
| LINEAR C/2002 CE10 | 340 |
| SWAN P/2005 T4 | 382 |
| Siding Spring P/2006 HR30 | 394 |
| La Sagra P/2012 NJ | 505 |
| Nevski C/2013 V3 | 535 |
| Borisov C/2014 Q3 | 552 |
| PANSTARRS C/2014 W11 | 564 |
| SWAN-Xingming C/2015 F5 | 571 |
| NEOWISE C/2015 X8 | 588 |
| Weiland C/2018 K1 | 645 |
| ATLAS C/2020 M3 | 685 |
| NEOWISE C/2022 P1 | 724 |
| ATLAS C/2023 E1 | 735 |
| ATLAS C/2024 M1 | 760 |

Comet 75P/Kohoutek, which I observed on its 1987 return (no. 112), and Comet 85P/Boethin, which I observed on its 1986 return (no. 89), have not been seen since those respective returns, and have recently been reassigned the designations 75D/Kohoutek and 85D/Boethin, respectively. Comet 168P/Hergenrother, which I observed on its 2012 return (no. 511), underwent large outbursts and exhibited distinct signs of fragmentation and other evidence of disintegration on that return, and was missed on its subsequent return; it may, too, soon receive a “D” designation.

I have observed one interstellar comet:

2I/Borisov I/2019 Q4 no. 670

**COMET "FAMILIES"**

The following comets I've observed are members of apparent "families:"

Kreutz sungrazers

| | |
|---|---|
| Lovejoy C/2011 W3 | no. 500 |

Other "families"

| | |
|---|---|
| Liller 1988a | no. 116 |
| Tabur C/1996 Q1 | no. 219 |
| SWAN C/2015 F5 | no. 569 |
| ATLAS C/2019 Y1 | no. 671 |
| | |
| Levy 1988e | no. 117 |
| Shoemaker-Holt 1988g | no. 118 |

The following comets were found to share very similar orbits to comets that appeared in the past, and thus may also be members of "families:"

| | |
|---|---|
| Borisov C/2016 R3 | no. 606 |
| | |
| ATLAS C/2019 Y4 | no. 673 |

## PERIHELION

The 761 comets I have observed have ranged in perihelion distance (q) from 0.006 AU for Comet Lovejoy C/2011 W3 (no. 500) to 8.454 AU for Comet 95P/Chiron P/1977 UB (no. 196). The average perihelion distance for the 761 comets is 1.523 +/- 1.008 AU and the median perihelion distance is 1.368 AU.

28 comets (3.7%) have a perihelion distance less than 0.2 AU, and 15 comets (2.0%) have a perihelion distance greater than 5.0 AU; an additional 6 comets have a perihelion distance between 4.0 and 5.0 AU, giving a total of 21 comets (2.8%) with perihelion distances greater than 4.0 AU.

### Top 25 Smallest Perihelion Distances

| Rank | Comet | q (AU) | no. |
|---|---|---|---|
| 1. | Lovejoy C/2011 W3 | 0.006 | 500 |
| 2. | ISON C/2012 S1 | 0.012 | 529 |
| 3. | SOHO C/2015 D1 | 0.028 | 567 |
| 4. | ATLAS C/2024 G3 | 0.094 | 761 |
| 5. | NEAT C/2002 V1 | 0.099 | 323 |
| 6. | Machholz 1985e | 0.106 | 83 |
| 7. | ASAS C/2004 R2 | 0.113 | 356 |
| 8. | 96P/Machholz 1 96P-23 | 0.116 | 733 |
| 9. | 96P/Machholz 1 96P-12 | 0.124 | 507 |
| 10. | 96P/Machholz 1 96P-02 | 0.124 | 300 |
| 11. | 96P/Machholz 1 96P-07 | 0.125 | 405 |
| 12. | 96P/Machholz 1 96P-91 | 0.126 | 161 |
| 13. | 96P/Machholz 1 1986e | 0.127 | 93 |
| 14. | Phaethon (3200)-85 | 0.140 | 559 |
| 15. | Phaethon (3200)-05 | 0.140 | 560 |
| 16. | Phaethon (3200)-08 | 0.140 | 561 |

| | | | |
|---|---|---|---|
| 17. | Phaethon (3200)-18 | 0.140 | 633 |
| 18. | Phaethon (3200)-16 | 0.140 | 607 |
| 19. | Kohoutek 1973f | 0.142 | 10 |
| 20. | SOHO C/1998 J1 | 0.153 | 242 |
| 21. | Machholz 1988j | 0.165 | 120 |
| 22. | Bradfield C/2004 F4 | 0.168 | 350 |
| 23. | McNaught C/2006 P1 | 0.171 | 395 |
| 24. | SWAN C/2004 V13 | 0.181 | 364 |
| 25. | Kudo-Fujikawa C/2002 X5 | 0.190 | 324 |

**Top 25 Largest Perihelion Distances**

| Rank | Comet | q (AU) | no. |
|---|---|---|---|
| 1. | 95P/Chiron P/1977 UB | 8.454 | 196 |
| 2. | Skiff C/1999 J2 | 7.110 | 277 |
| 3. | LINEAR C/2010 S1 | 5.900 | 494 |
| 4. | 174P/Echeclus P/2000 EC98 | 5.817 | 384 |
| 5. | 29P/Schwassmann-Wachmann 1 29P-89 | 5.772 | 111 |
| 6. | 29P/Schwassmann-Wachmann 1 29P-19 | 5.767 | 498 |
| 7. | 29P/Schwassmann-Wachmann 1 29P-04 | 5.724 | 226 |
| 8. | McNaught C/2005 L3 | 5.593 | 408 |
| 9. | McNaught C/2009 F4 | 5.455 | 520 |
| 10. | 29P/Schwassmann-Wachmann 1 29P-74 | 5.448 | 47 |
| 11. | P/Shoemaker-Levy 9 1993e | 5.380 | 178 |
| 12. | NEAT C/2001 B2 | 5.306 | 289 |
| 13. | LINEAR C/2003 WT42 | 5.191 | 383 |
| 14. | LINEAR C/2001 K5 | 5.184 | 306 |
| 15. | LONEOS C/2006 S3 | 5.131 | 480 |
| 16. | ATLAS C/2021 G2 | 4.982 | 756 |
| 17. | Spacewatch C/2011 KP36 | 4.883 | 600 |
| 18. | Dalcanton C/1999 F2 | 4.719 | 266 |
| 19. | PANSTARRS C/2015 V1 | 4.267 | 632 |
| 20. | ATLAS C/2019 T4 | 4.242 | 715 |

| | | | |
|---|---|---|---|
| 21. | LINEAR C/1999 K8 | 4.201 | 270 |
| 22. | LINEAR C/2017 B3 | 3.921 | 664 |
| 23. | NEOWISE C/2014 N3 | 3.882 | 551 |
| 24. | PANSTARRS C/2015 O1 | 3.730 | 621 |
| 25. | ATLAS C/2022 E2 | 3.666 | 750 |

## OBSERVATIONAL INTERVAL

The average observational interval for all 761 comets is 144.24 +/- 361.67 days. The median observational interval is 66 days.

The longest observational interval is 5251 days, for the 2004 “return” of Comet 29P/Schwassmann-Wachmann 1 (no. 226). There are 39 comets (5.1% of the total) that have an observational interval of 0, i.e., only a single observation.

Of the 761 comets, 62 (8.1%) have an observational interval of over 1 year, 28 (3.7%) have an observational interval of over 18 months, 15 (2.0%) have an observational interval of over 2 years, 10 (1.3%) have an observational interval of over 3 years, and 5 (0.7%) have an observational interval of over 4 years.

### Top 25 Longest Observational Intervals

| Rank | Comet | Int (days) | No. |
|---|---|---|---|
| 1. | 29P/Schwassmann-Wachmann 1 29P-04 | 5251 | 226 |
| 2. | 29P/Schwassmann-Wachmann 1 29P-19 | 4783* | 498 |
| 3. | 174P/Echeclus P/2000 EC98 | 4362 | 384 |
| 4. | 29P/Schwassmann-Wachmann 1 29P-89 | 3140 | 111 |
| 5. | Scheila (596)-17 | 1827 | 624 |
| 6. | Scheila (596)-12 | 1434 | 623 |
| 7. | Scheila (596)-22 | 1416 | 669 |
| 8. | LONEOS C/2006 S3 | 1302 | 480 |
| 9. | 96P/Chiron P/1977 UB | 1189 | 196 |
| 10. | LINEAR C/2010 S1 | 1096 | 494 |
| 11. | PANSTARRS C/2017 K2 | 1047 | 699 |
| 12. | Hale-Bopp C/1995 O1 | 1038 | 199 |
| 13. | Christensen C/2006 W3 | 972 | 422 |
| 14. | McNaught C/2005 L3 | 769 | 408 |

| | | | |
|---|---|---|---|
| 15. | ATLAS C/2019 L3 | 737 | 692 |
| 16. | Garradd C/2009 P1 | 677 | 478 |
| 17. | Spacewatch C/1997 BA6 | 672 | 256 |
| 18. | Siding Spring C/2007 Q3 | 643 | 441 |
| 19. | Broughton C/2006 OF2 | 624 | 410 |
| 20. | 1P/Halley 1982i | 622 | 85 |
| 21. | Catalina C/2013 US10 | 614 | 550 |
| 22. | PANSTARRS C/2012 K1 | 595 | 525 |
| 23. | Wilson 1986l | 573 | 95 |
| 24. | LINEAR C/2003 K4 | 569 | 348 |
| 25. | Bowell 1980b | 565 | 46 |

*some possibility of additional observations in the future

**WITH RESPECT TO PERIHELION**

Average comet: My first observation was 72.11 +/- 237.21 days before perihelion, and my final observation was 72.03 +/- 211.14 days after perihelion.

Median comet: My first observation was 39 days before perihelion, and my final observation was 44 days after perihelion.

For 193 comets (25.4%), I did not obtain my first observation until after perihelion. Of these, 60 (31.1%, 7.9% of the total) were not discovered or recovered until after perihelion.

My first observation for 22 comets (2.9%) came more than one year before perihelion, and my first observation for 2 comets (0.3%) did not come until more than one year after perihelion.

My final observation for 168 comets (22.1%) came before perihelion. My final observation for 17 comets (2.2%) came more than one year after perihelion.

**TOP 25 EARLIEST FIRST OBSERVATIONS WITH RESPECT TO PERIHELION**

| Rank | Comet | Pre-T (days) | No. |
|---|---|---|---|
| 1. | 174P/Echeclus P/2000 EC98 | 3389 | 384 |
| 2. | 29P/Schwassmann-Wachmann 1 29P-04 | 2707 | 226 |
| 3. | 29P/Schwassmann-Wachmann 1 29P-19 | 2624 | 498 |
| 4. | Scheila (596)-22 | 915 | 669 |
| 5. | Scheila (596)-17 | 913 | 624 |
| 6. | 29P/Schwassmann-Wachmann 1 29P-89 | 742 | 111 |
| 7. | PANSTARRS C/2017 K2 | 638 | 699 |
| 8. | LINEAR C/2010 S1 | 631 | 494 |
| 9. | Hale-Bopp C/1995 O1 | 618 | 199 |
| 10. | Christensen C/2006 W3 | 573 | 422 |
| 11. | LONEOS C/2006 S3 | 568 | 480 |
| 12. | Scheila (596)-12 | 523 | 623 |
| 13. | Garradd C/2009 P1 | 504 | 478 |
| 14. | PANSTARRS C/2012 K1 | 450 | 525 |
| 15. | Catalina C/2013 US10 | 443 | 550 |
| 16. | Broughton C/2006 OF2 | 404 | 410 |
| 17. | ATLAS C/2019 L3 | 390 | 692 |
| 18. | P/Shoemaker-Levy 9 1993e | 386 | 178 |
| 19. | 95P/Chiron P/1977 UB | 382 | 196 |
| 20.-T | Spacewatch C/1997 BA6 | 375 | 256 |
| 20.-T | LINEAR C/2011 F1 | 375 | 499 |
| 22. | 65P/Gunn 65P-10 | 371 | 450 |
| 23. | Siding Spring C/2007 Q3 | 365 | 441 |
| 24. | Mueller 1993a | 362 | 176 |
| 25. | Bowell 1980b | 354 | 46 |

**TOP 25 LATEST FIRST OBSERVATIONS WITH RESPECT TO PERIHELION**

| Rank | Comet | Pre-T (days) | No. |
|---|---|---|---|
| 1. | 29P/Schwassmann-Wachmann 1 29P-74 | -2637 | 47 |
| 2. | McNaught C/2009 F4 | -402 | 520 |
| 3. | Dalcanton C1999 F2 | -289 | 266 |
| 4. | 213P/Van Ness P/2005 R2 | -228 | 381 |
| 5. | 33P/Daniel 33P-08 | -217 | 449 |
| 6. | 121P/Shoemaker-Holt 2 1989j | -214 | 125 |
| 7. | NEAT C/2001 B2 | -195 | 289 |
| 8. | 17P/Holmes 17P-07 | -173 | 414 |
| 9. | Russell-Watson C/1996 P2 | -165 | 218 |
| 10. | LINEAR C/2017 B3 | -161 | 664 |
| 11. | Heck-Sause 1973a | -147 | 8 |
| 12. | 57P/du Toit-Neujmin-Delporte 57P-96 | -143 | 217 |
| 13. | 19P/Borrelly 19P-15 | -139 | 585 |
| 14. | 121P/Shoemaker-Holt 2 P/1995 Q3 | -136 | 225 |
| 15. | Borisov C/2013 V2 | -127 | 565 |
| 16. | 205P/Giacobini 205P-15 | -126 | 583 |
| 17. | PANSTARRS C/2022 JK5 | -115 | 743 |
| 18. | Levy 1988e | -114 | 117 |
| 19. | IRAS 1983o | -101 | 66 |
| 20. | Shoemaker-Holt 1988g | -96 | 118 |
| 21. | McNaught C/2011 R1 | -91 | 517 |
| 22. | 154P/Brewington 1992p | -85 | 171 |
| 23. | Churyumov-Solodovnikov 1986i | -84 | 94 |
| 24. | 88P/Howell 1987h | -76 | 103 |
| 25.-T | LINEAR C/2002 CE10 | -71 | 340 |
| 25.-T | 22P/Kopff 22P-22 | -71 | 719 |

**TOP 25 EARLIEST FINAL OBSERVATIONS WITH RESPECT TO PERIHELION**

| Rank | Comet | Post-T (days) | No. |
|---|---|---|---|
| 1. | P/Shoemaker-Levy 9 1993e | -364 | 178 |
| 2.-T | Shoemaker-Holt-Rodriquez 1988h | -254 | 121 |
| 2.-T | PANSTARRS C/2020 K1 | -254 | 723 |
| 4. | 240P/NEAT 240P-18 | -231 | 627 |
| 5. | 199P/Shoemaker 4 P/2008 G2 | -220 | 437 |
| 6. | Helin-Lawrence 1991l | -201 | 156 |
| 7. | Evans-Drinkwater C/1996 J1 | -195 | 214 |
| 8. | Helin-Lawrence 1992q | -171 | 172 |
| 9. | 65P/Gunn 65P-17 | -148 | 619 |
| 10. | 116P/Wild 4 1994v | -141 | 208 |
| 11.-T | 65P/Gunn 65P-82 | -139 | 50 |
| 11.-T | 4P/Faye 4P-99 | -139 | 259 |
| 13. | 22P/Kopff 22P-02 | -131 | 313 |
| 14. | 78P/Gehrels 2 78P-19 | -127 | 654 |
| 15. | NEOWISE C/2014 N3 | -122 | 551 |
| 16. | 81P/Wild 2 1983s | -121 | 67 |
| 17. | LINEAR C/2007 G1 | -107 | 428 |
| 18.-T | 116P/Wild 4 116P-22 | -105 | 714 |
| 18.-T | ATLAS C/2021 G2 | -105 | 756 |
| 20. | 47P/Ashbrook-Jackson 1985a | -97 | 84 |
| 21. | LINEAR C/2011 F1 | -96 | 499 |
| 22. | 110P/Hartley 3 110P-01 | -94 | 283 |
| 23. | ATLAS C/2021 P4 | -89 | 716 |
| 24. | Phaethon (3200)-05 | -86 | 560 |
| 25. | LINEAR C/2002 O7 | -85 | 333 |

**TOP 25 LATEST FINAL OBSERVATIONS WITH RESPECT TO PERIHELION**

| Rank | Comet | Post-T (days) | No. |
|---|---|---|---|
| 1. | 29P/Schwassmann-Wachmann 1 29P-74 | 2985 | 47 |
| 2. | 29P/Schwassmann-Wachmann 1 29P-04 | 2544 | 226 |
| 3. | 29P/Schwassmann-Wachmann 1 29P-89 | 2398 | 111 |
| 4. | 29P/Schwassmann-Wachmann 1 29P-19 | 2159* | 498 |
| 5. | 174P/Echeclus P/2000 EC98 | 973 | 384 |
| 6. | Scheila (596)-17 | 914 | 624 |
| 7. | Scheila (596)-12 | 911 | 623 |
| 8. | 95P/Chiron P/1977 UB | 808 | 196 |
| 9. | LONEOS C/2006 S3 | 734 | 480 |
| 10. | McNaught C/2005 L3 | 547 | 408 |
| 11. | Scheila (596)-22 | 501 | 669 |
| 12. | LINEAR C/2010 S1 | 465 | 494 |
| 13. | 1P/Halley 1982i | 438 | 85 |
| 14. | McNaught C/2009 F4 | 426 | 520 |
| 15. | Hale-Bopp C/1995 O1 | 420 | 199 |
| 16. | PANSTARRS C/2017 K2 | 409 | 699 |
| 17. | Christensen C/2006 W3 | 399 | 422 |
| 18. | 17P/Holmes 17P-07 | 357 | 414 |
| 19. | ATLAS C/2019 L3 | 347 | 692 |
| 20. | Griseldis (493)-19 | 344 | 651 |
| 21. | ATLAS C/2019 T4 | 343 | 715 |
| 22. | LINEAR C/2003 K4 | 331 | 348 |
| 23. | Wilson 1986l | 323 | 95 |
| 24. | 17P/Holmes 17P-14 | 320 | 545 |
| 25. | Meier 1978f | 312 | 28 |

*some possibility of additional observations in the future

## NUMBER OF OBSERVATIONS

For this analysis an "observation" is defined as one observation of a given comet on one given night. Observations of multiple components of a comet on one given night are collectively considered as one "observation."

For the 761 comets, the average number of observations per comet is (rounded to the nearest whole number) 11 (mathematically, 10.7 +/- 14.1). The median number of observations is 7.

The comet with the most observations is Comet Hale-Bopp C/1995 O1 (no. 199), with 182 observations. For periodic comets with all returns combined, the comet with the most observations is 29P/Schwassmann-Wachmann 1, with 383 observations over 4 returns.

Of the 761 comets, 39 (5.1%) have only a single observation, and an additional 79 comets (10.4%) have only two observations.

Of the 761 comets, 11 (1.4%) have 50 or more observations, and 4 (0.5%) have 100 or more observations.

## TOP 25 COMETS WITH MOST OBSERVATIONS

| Rank | Comet | Observations | No. |
|---|---|---|---|
| 1. | Hale-Bopp C/1995 O1 | 182 | 199 |
| 2. | 29P/Schwassmann-Wachmann 1 29P-04 | 181 | 226 |
| 3. | 29P/Schwassmann-Wachmann 1 29P-19 | 136* | 498 |
| 4. | 1P/Halley 1982i | 100 | 85 |
| 5. | Christensen C/2006 W3 | 64 | 422 |
| 6. | Garradd C/2009 P1 | 62 | 478 |
| 7.-T | 29P/Schwassmann-Wachmann 1 29P-89 | 58 | 111 |
| 7.-T | Machholz C/2004 Q2 | 58 | 355 |

| | | | |
|---|---|---|---|
| 9.-T | LONEOS C/2006 S3 | 54 | 480 |
| 9.-T | LINEAR C/2010 S1 | 54 | 494 |
| 11. | Lovejoy C/2014 Q2 | 51 | 556 |
| 12. | Bowell 1980b | 46 | 46 |
| 13.-T | Broughton C/2006 OF2 | 44 | 410 |
| 13.-T | PANSTARRS C/2011 L4 | 44 | 504 |
| 13.-T | PANSTARRS C/2012 K1 | 44 | 525 |
| 16. | LINEAR C/2002 T7 | 43 | 338 |
| 17.-T | Levy 1990c | 42 | 141 |
| 17.-T | McNaught C/2005 L3 | 42 | 408 |
| 19. | Wilson 1986l | 41 | 95 |
| 20. | Catalina C/2013 US10 | 38 | 550 |
| 21.-T | Bradfield 1987s | 37 | 105 |
| 21.-T | Meunier-Dupouy C/1997 J2 | 37 | 230 |
| 21.-T | 153P/Ikeya-Zhang P/2002 C1 | 37 | 301 |
| 21.-T | LINEAR C/2003 K4 | 37 | 348 |
| 21.-T | Lulin C/2007 N3 | 37 | 432 |

*some possibility of additional observations in the future

**TOP 25 PERIODIC COMETS WITH MOST OBSERVATIONS (ALL OBSERVED RETURNS COMBINED)**

| Rank | Comet | Observations | Returns |
|---|---|---|---|
| 1. | 29P/Schwassmann-Wachmann 1 | 383* | 4 |
| 2. | 81P/Wild 2 | 114 | 8 |
| 3. | 1P/Halley | 100 | 1 |
| 4. | 2P/Encke | 93 | 14 |
| 5. | 19P/Borrelly | 88 | 7 |
| 6. | 10P/Tempel 2 | 86 | 5 |
| 7. | 22P/Kopff | 84 | 6 |
| 8.-T | 88P/Howell | 81 | 6 |
| 8.-T | (596) Scheila | 81 | 3 |

| | | | |
|---|---|---|---|
| 10. | 21P/Giacobini-Zinner | 80 | 5 |
| 11. | 67P/Churyumov-Gerasimenko | 78 | 6 |
| 12. | 46P/Wirtanen | 75 | 6 |
| 13. | 65P/Gunn | 73 | 6 |
| 14. | 116P/Wild 4 | 72 | 6 |
| 15.-T | 9P/Tempel 1 | 69 | 4 |
| 15.-T | 73P/Schwassmann-Wachmann 3 | 69 | 6 |
| 17. | 103P/Hartley 2 | 67 | 4 |
| 18. | 6P/d'Arrest | 60 | 5 |
| 19. | 45P/Honda-Mrkos-Pajdusakova | 57 | 7 |
| 20. | 78P/Gehrels 2 | 52 | 5 |
| 21. | 71P/Clark | 50 | 4 |
| 22. | 4P/Faye | 48 | 5 |
| 23. | 43P/Wolf-Harrington | 47 | 5 |
| 24. | 62P/Tsuchinshan 1 | 44 | 5 |
| 25.-T | 17P/Holmes | 42 | 2 |
| 25.-T | 41P/Tuttle-Giacobini-Kresak | 42 | 6 |

*some possibility of additional observations in the future

## PEAK BRIGHTNESS

Of the 761 comets, the average peak brightness that I have observed is magnitude 10.7 +/- 3.0, and the median peak brightness is magnitude 11.4.

I have observed 69 comets (9.1%) for which I observed a peak brightness of magnitude 6.0 or brighter. Of these, I have observed 47 comets (6.2%) with my unaided eye.

I have observed 19 comets (2.5%) for which I observed a peak brightness of magnitude 14.5 or fainter. Of these, for 7 comets (0.9% of the total) I observed a peak brightness of magnitude 15.0 or fainter.

The brightest comet I have observed is Comet McNaught C/2006 P1 (no. 395), for which I measured a peak brightness of magnitude -4 (during daytime) on 2007 January 13. The faintest brightness I have ever measured is magnitude 15.4, for Comet 95P/Chiron P/1977 UB (no. 196) during my sole observation during its 1998 opposition (1998 May 2).

## TOP 20 BRIGHTEST COMETS

| Rank | Comet | Peak Mag. | No. |
|---|---|---|---|
| 1. | McNaught C/2006 P1 | -4 | 395 |
| 2. | West 1975n | -3 | 20 |
| 3. | ATLAS C/2024 G3 | -2 | 761 |
| 4. | Hale-Bopp C/1995 O1 | -1.1 | 199 |
| 5.-T | Bennett 1969i | 0 | 2 |
| 5.-T | Hyakutake C/1996 B2 | 0.1 | 212 |
| 7.-T | NEOWISE C/2020 F3 | 0.6 | 676 |
| 7.-T | Tsuchinshan-ATLAS C/2023 A3 | 1 | 749 |
| 9. | PANSTARRS C/2011 L4 | 1.5 | 504 |
| 10. | 1P/Halley 1982i | 1.9 | 85 |

| | | | |
|---|---|---|---|
| 11. | 17P/Holmes 17P-07 | 2.3 | 414 |
| 12. | IRAS-Araki-Alcock 1983d | 2.5 | 56 |
| 13.-T | Kohoutek 1973f | 3 | 10 |
| 13.-T | 153P/Ikeya-Zhang P/2002 C1 | 2.8 | 301 |
| 15. | NEAT C/2001 Q4 | 3.1 | 339 |
| 16. | Aarseth-Brewington 1989a1 | 3.2 | 133 |
| 17. | Levy 1990c | 3.5 | 141 |
| 18. | LINEAR C/2001 A2 | 3.6 | 290 |
| 19.-T | NEAT C/2002 V1 | 3.7 | 322 |
| 19.-T | Machholz C/2004 Q2 | 3.7 | 355 |

The above table reflects the fact that some brightness measurements for the brightest comets are very approximate, having been made in daylight (for Comets C/2006 P1 and C/2024 G3) and/or at low altitude during bright twilight, and also the fact that the magnitude parameters for some of my very earliest comets are educated “guesstimates” somewhat in hindsight.

## INTERVAL BETWEEN TALLY ADDITIONS

For the purposes of these calculations, I consider “date 0” to be the date I acquired my first telescope, i.e., January 17, 1970. I added my first comet 16 days later.

The average interval between additions to my tally is 26.4 +/- 35.9 days, and the median interval is 17.5 days.

There have been two occasions when I have added three comets to my tally during a single night:

1993 December 14 (evening)

| | |
|---|---|
| Comet 2P/Encke 2P-94 | no. 181 |
| Comet 76P/West-Kohoutek-Ikemura 1993o | no. 182 |
| Comet 31P/Schwassmann-Wachmann 2 31P-94 | no. 183 |

2001 August 7 (morning)

| | |
|---|---|
| Comet 48P/Johnson 48P-11 | no. 491 |
| Comet 78P/Gehrels 2 78P-12 | no. 492 |
| Comet 130P/McNaught-Hughes 130P-11 | no. 493 |

There have been 39 additional occasions when I have added two comets to my tally during a single night. One five of those occasions, I added one comet during the evening hours (i.e., before local midnight) and the other comet during the morning hours (i.e., after local midnight); on one of those occasions, the date change at midnight also corresponded to a change of the month. There have been two additional occasions when I added two comets on the same calendar date, one in the morning and one during the following evening; these accordingly correspond to two consecutive nights.

The longest interval between two consecutive tally additions is 366 days, between Comet Toba 1971a (no. 6) and Comet Bradfield 1972f (no. 7).

I have added 343 comets (45.1%) during the evening hours and 418 comets (54.9%) during the morning hours. I added one of the morning-added comets, Comet ATLAS C/2024 G3 (no. 761), during daytime, before local noon.

## CALENDAR MONTHS

The various totals for each calendar month, for comet discoveries, comets passing through perihelion, and comets added to my tally, are listed below. I have included rankings for the top three months and bottom three months in each category.

For the purposes here, I consider the recovery of a periodic comet as a "discovery." For "annual" comets, i.e., those that are observable (with suitably large telescopes and instrumentation) throughout their orbits, I have defined "recovery" as being the first-reported earliest observation following the comet's aphelion. (By this definition, my visual observations constitute the "recoveries" of (596) Scheila on its 2017 and 2022 "returns.")

The average value would be 63.4 events per month, for each category of event.

| MONTH | DISCOVERY | | PERIHELION | | ADD | |
|---|---|---|---|---|---|---|
| January | 73 | 2nd-T | 67 | | 64 | |
| February | 34 | 12th | 55 | 11th | 50 | 10th |
| March | 62 | | 67 | | 65 | |
| April | 50 | 11th | 71 | 2nd | 46 | 11th |
| May | 79 | 1st | 62 | | 66 | |
| June | 63 | | 35 | 12th | 42 | 12th |
| July | 67 | | 61 | | 66 | |
| August | 71 | | 58 | | 83 | 1st |
| September | 73 | 2nd-T | 69 | 3rd-T | 75 | 2nd-T |
| October | 63 | | 69 | 3rd-T | 62 | |
| November | 67 | | 57 | 10th | 75 | 2nd-T |
| December | 59 | 10th | 90 | 1st | 67 | |

I have observed 31 comets (4.1%) that were discovered, that passed through perihelion, and that I added to my tally all within the same calendar month. I have observed 73 comets (9.6%) that were discovered, that passed through perihelion, and that I added to my tally all within different calendar years.

The following are what I consider to be the “best” comet to have the event in question during each calendar month:

**DISCOVERY**

| MONTH | YEAR | COMET | No. |
|---|---|---|---|
| January | 1996 | Hyakutake C/1996 B2 | 212 |
| February | 2002 | 153P/Ikeya-Zhang P/2002 C1 | 301 |
| March | 2020 | NEOWISE C/2020 F3 | 676 |
| April | 2024 | ATLAS C/2024 G3 | 761 |
| May | 2007 | 17P/Holmes 17P-07 | 414 |
| June | 2018 | 46P/Wirtanen 46P-18 | 653 |
| July | 1995 | Hale-Bopp C/1995 O1 | 199 |
| August | 2006 | McNaught C/2006 P1 | 395 |
| September | 1975 | West 1975n | 20 |
| October | 1982 | 1P/Halley 1982i | 85 |
| November | 1989 | Aarseth-Brewington 1989a1 | 133 |
| December | 1969 | Bennett 1969i | 2 |

**PERIHELION**

| MONTH | YEAR | COMET | No. |
|---|---|---|---|
| January | 2007 | McNaught C/2006 P1 | 395 |
| February | 1976 | West 1975n | 20 |

| | | | |
|---|---|---|---|
| March | 1970 | Bennett 1969i | 2 |
| April | 1997 | Hale-Bopp C/1995 O1 | 199 |
| May | 1996 | Hyakutake C/1996 B2 | 212 |
| June | 2006 | 73P/Schwassmann-Wachmann 3 73P-06 | 385 |
| July | 2020 | NEOWISE C/2020 F3 | 676 |
| August | 1982 | Austin 1982g | 52 |
| September | 2024 | Tsuchinshan-ATLAS C/2023 A3 | 749 |
| October | 1990 | Levy 1990c | 141 |
| November | 1987 | Bradfield 1987s | 105 |
| December | 1973 | Kohoutek 1973f | 10 |

**ADD**

| MONTH | YEAR | COMET | No. |
|---|---|---|---|
| January | 2025 | ATLAS C/2024 G3 | 761 |
| February | 1976 | West 1975n | 20 |
| March | 1970 | Bennett 1969i | 2 |
| April | 2020 | NEOWISE C/2020 F3 | 676 |
| May | 1983 | IRAS-Araki-Alcock 1983d | 56 |
| June | 1995 | 6P/d'Arrest 6P-95 | 198 |
| July | 1995 | Hale-Bopp C/1995 O1 | 199 |
| August | 1985 | 1P/Halley 1982i | 85 |
| September | 2006 | McNaught C/2006 P1 | 395 |
| October | 2007 | 17P/Holmes 17P-07 | 414 |
| November | 1989 | Aarseth-Brewington 1989a1 | 133 |
| December | 2023 | Tsuchinshan-ATLAS C/2023 A3 | 749 |

## NAMES

A total of 258 individual names appear within the list of the 761 comets. Of these, 223 (86.4%) are of actual people, 23 (8.9%) are observatories or survey programs, 5 (1.9%) are spacecraft or space-based telescopes, and 7 (2.7%) are mythological, fictional, or allegorical characters. One comet has not received a name.

119 (46.1%) of the names (including "Hale") appear only once in the tally.

## TOP 20 COMMONLY OCCURRING NAMES

| Rank | Name | Entries | Separate Comets |
|---|---|---|---|
| 1. | LINEAR | 76 | 71 |
| 2. | PANSTARRS | 31 | 30 |
| 3. | Rob McNaught | 28 | 25 |
| 4. | ATLAS | 22 | 22 |
| 5.-T | Carolyn Shoemaker | 21 | 16 |
| 5.-T | Don Machholz | 21 | 12 |
| 7.-T | David Levy | 18 | 15 |
| 7.-T | NEAT | 18 | 12 |
| 9. | Malcolm Hartley | 17 | 9 |
| 10. | Paul Wild | 16 | 3 |
| 11.-T | SWAN | 14 | 14 |
| 11.-T | Johann Encke | 14 | 1 |
| 13.-T | William Bradfield | 13 | 13 |
| 13.-T | Arnold Schwassmann | 13 | 3 |
| 13.-T | Arno Wachmann | 13 | 3 |
| 16. | William Tempel | 11 | 4 |
| 17. | Horace Tuttle | 10 | 4 |
| 18.-T | NEOWISE | 9 | 9 |
| 18.-T | Lemmon | 9 | 9 |

| | | | |
|---|---|---|---|
| 18.-T | Catalina | 9 | 8 |
| 18.-T | Tom Gehrels | 9 | 2 |

The top name on this list, LINEAR, alone accounts for 10.0% of the entire tally and 13.3% of all the separate comets I have observed.

## APPROACHES TO EARTH

Of the 761 comets, 32 (4.2%) have approached to within 0.2 AU of Earth during their respective apparitions. Of these, 12 (1.6%) have approached to within 0.1 AU of Earth.

## TOP 25 CLOSEST EARTH-APPROACHING COMETS

| Rank | Comet | Delta_min (AU) | No. |
|---|---|---|---|
| 1. | (101955) Bennu 1999 RQ36 | 0.015 | 660 |
| 2. | 460P/PANSTARRS P/2016 BA14 | 0.024 | 595 |
| 3. | IRAS-Araki-Alcock 1983d | 0.031 | 56 |
| 4. | 252P/LINEAR 252P-16 | 0.036 | 592 |
| 5. | 209P/LINEAR 209P-14 | 0.055 | 543 |
| 6. | 45P/Honda-Mrkos-Pajdusakova 45P-11 | 0.060 | 490 |
| 7. | Sugano-Saigusa-Fujikawa 1983e | 0.063 | 58 |
| 8. | (3200) Phaethon (3200)-18 | 0.069 | 633 |
| 9. | (65803) Didymos (65803)-22 | 0.071 | 725 |
| 10. | 46P/Wirtanen 46P-18 | 0.077 | 653 |
| 11. | 73P/Schwassmann-Wachmann 3 73P-06 | 0.079* | 385 |
| 12. | 45P/Honda-Mrkos-Pajdusakova 45P-16 | 0.083 | 609 |
| 13. | Hyakutake C/1996 B2 | 0.102 | 212 |
| 14. | 300P/Catalina P/2005 JQ5 | 0.103 | 375 |
| 15. | Suzuki-Saigusa-Mori 1975k | 0.104 | 17 |
| 16. | 364P/PANSTARRS 364P-23 | 0.121 | 734 |
| 17. | 103P/Hartley 2 103P-10 | 0.121 | 477 |
| 18. | (3200) Phaethon (3200)-08 | 0.121 | 561 |

| | | | |
|---|---|---|---|
| 19. | 41P/Tuttle-Giacobini-Kresak 41P-17 | 0.142 | 613 |
| 20. | 169P/NEAT 169P-05 | 0.147 | 378 |
| 21. | 6P/d'Arrest 1976e | 0.151 | 23 |
| 22. | P/Haneda-Campos 1978j | 0.154 | 30 |
| 23. | 45P/Honda-Mrkos-Pajdusakova 45P-95 | 0.169 | 207 |
| 24. | 222P/LINEAR P/2009 MB9 | 0.173 | 461 |
| 25. | 26P/Grigg-Skjellerup 1977b | 0.182 | 24 |

*This value is for the primary component (component C). I also observed (as separate entities) components B, G, and R, which passed 0.067, 0.065, and 0.064 AU from Earth, respectively.

## TOP 10 LONGEST COMETARY TAILS

| Rank | Comet | Tail (degrees) | No. |
|---|---|---|---|
| 1. | Hyakutake C/1996 B2 | 70 | 212 |
| 2. | West 1975n | 26 | 20 |
| 3. | 1P/Halley 1982i | 25 | 85 |
| 4.-T | Hale-Bopp C/1995 O1 | 18 | 199 |
| 4.-T | Tsuchinshan-ATLAS C/2023 A3 | 18 | 749 |
| 6. | Kohoutek 1973f | 15 | 10 |
| 7. | NEOWISE C/2020 F3 | 12 | 676 |
| 8. | Bennett 1969i | >10 | 2 |
| 9. | Bradfield C/2004 F4 | 8.5 | 350 |
| 10.-T | SOHO C/1998 J1 | 8 | 242 |
| 10.-T | 153P/Ikeya-Zhang P/2002 C1 | 8 | 301 |

## COMETS VISITED BY SPACECRAFT

The following comets I have observed were encountered by spacecraft missions during the returns in which I observed them.

| Comet | No. | Spacecraft |
|---|---|---|
| 21P/Giacobini-Zinner 1984e | 82 | International Cometary Explorer |
| 1P/Halley 1982i | 85 | Sakigake, Suisei, Vega 1, Vega 2, Giotto |
| 19P/Borrelly 19P-01 | 292 | Deep Space 1 |
| 81P/Wild 2 81P-03 | 332 | Stardust |
| 9P/Tempel 1 9P-05 | 367 | Deep Impact |
| 103P/Hartley 2 103P-10 | 477 | EPOXI (repurposed Deep Impact) |
| 67P/Churyumov-Gerasimenko 67P-15 | 577 | Rosetta |

The following comets I have observed were also encountered by spacecraft missions but not during the returns during which I observed them:

| Comet | Spacecraft | Return |
|---|---|---|
| 26P/Grigg-Skjellerup | Giotto | 1992 |
| 9P/Tempel 1 | Stardust | 2011 |
| (101955) Bennu | OSIRIS-REx | 2019, 2020, 2021 |

## RECORD OBSERVATIONS

Largest heliocentric distance:
Value: 13.049 AU
Comet: 174P/Echeclus P/2000 EC98 (no. 384)
Date: 2006 January 10

Smallest heliocentric distance:
Value: 0.119 AU
Comet: ATLAS C/2024 G3 (no. 761)
Date: 2025 January 14

Largest geocentric distance:
Value: 13.022 AU
Comet: 174P/Echeclus P/2000 EC98 (no. 384)
Date: 2006 January 10

Smallest geocentric distance:
Value: 0.019 AU
Comet: (101955) Bennu 1999 RQ36 (no. 660)
Date: 1999 September 19

Smallest elongation:
Value: 5.5 degrees
Comet: McNaught C/2006 P1 (no. 395)
Date: 2007 January 13

Farthest north:
Value: Declination +89d 56’
Comet: Boattini C/2008 J1 (no. 430)
Date: 2008 October 30

Farthest south:
Value: Declination -75d 06’
Comet: PANSTARRS C/2016 M1 (no. 629)
Date: 2019 February 1

My record for most comets observed in one night is 15, which took place on the night of March 21-22, 2009. My record for most comets observed in one year is 39, set in 2015. My record for most comet observations made in one year is 334, set in 2008.

**MISCELLANEOUS COMMENTS**

There have been four occasions when I observed two comets within the same telescopic field of view:

1994 June 9:
Comet McNaught Russell 1993v (no. 186)
Comet Takamizawa-Levy 1994f (no. 187)

1996 February 19:
Comet 65P/Gunn 65P-96 (no. 210)
Comet 22P/Kopff 1994s (no. 213)*
*added to my tally

2019 September 7
Comet ASASSN C/2018 N2 (no. 657)
Comet 260P/McNaught 260P-19 (no. 666)

2023 August 27
Comet 29P/Schwassmann-Wachmann 1 29P-19 (no. 498)
Comet Nishimura C/2023 P1 (no. 742)

There have been three occasions when I have observed two comets within the same binocular field of view:

1996 June 16
Comet Hale-Bopp C/1995 O1 (no. 199)
Comet 22P/Kopff 1994s (no. 213)

1996 June 24
Comet Hale-Bopp C/1995 O1 (no. 199)
Comet 22P/Kopff 1994s (no. 213)

2014 February 8
Comet Lovejoy C/2013 R1 (no. 532)
Comet LINEAR C/2012 X1 (no. 533)

There have been two occasions when I have observed two comets simultaneously with my naked eye:

2004 April 29
Comet LINEAR C/2002 T7 (no. 338)
Comet Bradfield C/2004 F4 (no. 350)

2007 December 30
Comet 17P/Holmes 17P-07 (no. 414)
Comet 8P/Tuttle 8P-08 (no. 415)

I have observed three comets telescopically during daylight hours, i.e., the sun's being above the horizon:

| | |
|---|---|
| Comet Hale-Bopp C/1995 O1 (no. 399): | 1997 March 4 |
| Comet McNaught C/2006 P1 (no. 395): | 2007 January 12 |
| | 2007 January 13 |
| | 2007 January 14 |
| Comet ATLAS C/2024 G3 (no. 761): | 2025 January 14 |

I obtained my daytime observation of Comet Hale-Bopp by following it for one minute past sunrise. I obtained my daytime observations of Comet McNaught and Comet ATLAS during broad daylight by utilizing altitude and azimuth offsets from the sun.

I have never succeeded in observing a comet during a total solar eclipse. I have observed numerous comets during total (and deep partial) lunar eclipses – the first occasion being Comet Bowell 1980b (no. 46) during the eclipse on 1982 July 5-6 – and on three occasions I have added comets to my tally during total lunar eclipses:

| | |
|---|---|
| 2003 November 8 | Comet Tabur C/2003 T3 (no. 344) |
| 2015 September 27 | Comet 10P/Tempel 2 10P-15 (no. 584) |
| 2022 May 15 | Comet PANSTARRS C/2021 O3 (no. 717) |

I have observed comets from 10 states within the U.S. (four of which I have lived within during the times in question), plus the District of Columbia:

Arizona
California (resident)
Colorado
Maryland (resident)
New Mexico (resident)
Oklahoma
Tennessee
Texas (resident)
Utah
Washington

I have observed comets from six countries outside the U.S.:

Australia
Indonesia
Iran
Mexico
New Zealand
Zimbabwe

I have observed comets from locations in international waters:

Caribbean Sea
Pacific Ocean

I have made unsuccessful visual attempts for an additional 281 comets that are not on my tally. (Some of these are returns of periodic comets that I have successfully observed on other returns.)

When I had my CCD imaging system operational during the early- to mid-2000s I imaged 13 comets which I did not observe visually. (I unsuccessfully attempted all of them.) I did successfully visually observe one of them (201P/LONEOS) on a subsequent return (in 2015, no. 563).

Since 2017, and up to this writing, I have remotely imaged 81 comets via the Las Cumbres Observatory network that I have not observed visually. It is conceivable that in the future I might visually observe a handful of those I have recently imaged.

I have visually observed 30 “asteroids” (25 of these being separate objects, the other 5 being additional returns of four of those objects) that I consider as reasonable candidates for being “extinct” or “dormant” comets that conceivably could show cometary activity in the future (or be found to have done so in the past) and thus eligible to be added to my tally retroactively. (In theory, this statement could apply to any asteroid I have observed). One of these objects, (139359) 2001 ME1, is a recently-identified “dark comet” that exhibits non-gravitational accelerations suggestive of cometary outgassing. Another object, (65407) 2002 RP120, is a “Damocloid,” i.e., an inactive object in a Halley-type or long-period orbit.

When I had my CCD imaging system operational during the early- to mid-2000s I imaged one of these objects – 2000 DG8, a “Damocloid” – that I did not observe visually (although I did attempt it, unsuccessfully).

As of this writing I have remotely imaged 12 of these objects via the Las Cumbres Observatory network that I did not observe visually. Two of these are objects that I have visually observed during previous returns.

## “BEST” COMETS

The following list is my semi-objective, semi-subjective determination of what I consider to be the “best” comets I have ever observed. The rankings include factors like brightness, tail length, ease of visibility, and placement in the sky, as well as a subjective “feel” of the comet’s overall spectacle and its personal effect on me.

## TOP 25 “BEST” COMETS

| Rank | Comet | No. |
|---|---|---|
| 1. | West 1975n | 20 |
| 2. | Hale-Bopp C/1995 O1 | 199 |
| 3. | Hyakutake C/1996 B2 | 212 |
| 4. | Bennett 1969i | 2 |
| 5. | Tsuchinshan-ATLAS C/2023 A3 | 749 |
| 6. | NEOWISE C/2020 F3 | 676 |
| 7. | McNaught C/2006 P1 | 395 |
| 8. | ATLAS C/2024 G3 | 761 |
| 9. | 1P/Halley 1982i | 85 |
| 10. | 153P/Ikeya-Zhang P/2002 C1 | 301 |
| 11. | Kohoutek 1973f | 10 |
| 12. | IRAS-Araki-Alcock 1983d | 56 |
| 13. | 17P/Holmes 17P-07 | 414 |
| 14. | Levy 1990c | 141 |
| 15. | NEAT C/2001 Q4 | 339 |
| 16. | LINEAR C/2001 A2 | 290 |
| 17. | Machholz C/2004 Q2 | 355 |
| 18. | 46P/Wirtanen 46P-18 | 653 |
| 19. | PANSTARRS C/2011 L4 | 504 |
| 20. | Lovejoy C/2014 Q2 | 556 |
| 21. | Bradfield 1974b | 11 |

| | | |
|---|---|---|
| 22. | Aarseth-Brewington 1989a1 | 133 |
| 23. | Lulin C/2007 N3 | 432 |
| 24. | Kobayashi-Berger-Milon 1975h | 16 |
| 25. | Bradfield C/2004 F4 | 350 |

The “best” (i.e., most spectacular and awe-inspiring) comet observation I have made is of Comet West 1975n (no. 20) from the parking lot of White Sands National Monument (now White Sands National Park), New Mexico, on the morning of March 3, 1976.

16 Springs Canyon, New Mexico, USA
February 23, 2025