New Designations For Old

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Abstract. The motivation for the new system of comet designations is discussed, as are examples of its use.

Introduction

Over the past decade or so, it has steadily become apparent that changes were necessary in the system for designating and naming comets. Changes in the designation system were approved at the meetings of the International Astronomical Union in August 1994 and will become effective at the beginning of 1995. In order to appreciate the value of these changes, it is helpful to understand something of the history of the problem.

In ancient times, when comets were necessarily naked-eye phenomena that appeared at intervals of several years, it was reasonably straightforward to keep track of them simply by noting the years of their appearance. Occasionally a particular year would produce more than one comet, but that caused little additional complication. This impersonal tradition continued for the better part of a century following the first telescopic discovery of a comet in 1680.

It was Messier's attempt—unsuccessful, as it turned out—to be the first person to see the comet predicted by Halley to return in 1758 that led to comet hunting as a sport and to the concept of "comet discoverers". In the case of Halley's Comet, the "discoverer" was in fact the person who had established the comet's periodicity, and this same principle was applied to the comets named for Lexell and Encke. In general, however, the discoverer was defined as the first person actually to *see* each comet. The King of Denmark's inauguration in 1831 of a gold medal for the "first" discoverer of each comet provided an international incentive for identifying the person correctly, a process that could take a year or more, given the primitive communications of the time. As a result, comets came almost to be considered the personal property of their discoverers, as the *Monthly Notices of the Royal Astronomical Society*, for example, listed them as "Brorsen's third comet", "de Vico's sixth comet", and so on.

Astronomische Nachrichten

The Danish medal was awarded through 1846, a year that produced what was then a record seven cometary discoveries. In order to cope with this influx, the leading source for announcing the discoveries, the *Astronomische Nachrichten*, decided to designate the comets of a given year with Roman numerals to indicate the order in which they passed their perihelion points. Of course, one cannot rely on comets to show themselves to their discoverers in the same order they choose to pass perihelion, and it became customary to keep *altering* the designations as new comets were fitted into the perihelion sequence. Periodic comets were so recognized when they were observed to return, and they in particular came to be associated with the names of their observational discoverers.

The inconvenience of the unstable assignment of Roman numerals was eventually remedied by initially designating comets with lower-case letters indicating the order of discovery in each year. These designations were generally defined from the beginning of 1870, although two later entries were shown from 1869. Incidentally, both the letters and the Roman numerals generally *preceded*, rather than followed, the year. At the same time the name of the discoverer was frequently (but not consistently) placed in parentheses following the designation. There was almost invariably only one name per comet, except that the curious case of comet 1877c = 1877 III was usually listed as "1877 III (Swift, Borrelly, Block)"; it shows in the 1994 edition of the *Catalogue of Cometary Orbits* as "Swift-Borrelly-Block", one of only two single-apparition, triple-named comets prior to 1930.

The first cases of numerals appended specifically to the names of periodic comets were for those comets we now know as P/Tempel 1, P/Tempel 2, and P/Tempel-Swift, the first two actually being listed in the *A.N.* as "Erster Tempel'scher Comet"and "Zweiter Tempel'scher Comet", and the third then invariably as "Tempel$_3$-Swift". The idea was that the Leonid comet of 1866 should become the "Vierter Tempel'scher Comet" on its return in 1899, but it was not actually observed to return until 1965, by which time the convention for numbering comets had gone through several more variations.

Although other authorities continued to use them, the influential *A.N.* ceased using the letter designations after the end of 1881 and reverted to the changeable Roman numerals of the past—although often only the year and name were given. A few years later, the *A.N.* was consistently indicating the unavailability of Roman numerals with an ellipsis, e.g., "1885 ... (Barnard)". In quick succession there then appeared comets "1886 ... (Brooks 1)", "1886 ... (Brooks 2)", and "1886 ... (Brooks 3)", which later took the Roman numerals 1886 V, III, and IV, respectively. The comet thus known later as "1886 IV (Brooks 3)" is in fact the one currently called P/Brooks 1, while the current P/Brooks 2 is a comet not discovered until 1889, by which time Brooks had discovered two other comets. The first of these (1887 II) was introduced as comet "1887 ... (Brooks Jan. 22)" in a system that was used rather consistently with discoverers and discovery dates until the end of 1898. Rare cases of multiple discoveries were denoted with hyphens, e.g., "1886 IX (Barnard-Hartwig)".

For returning periodic comets, name and designation were inverted and parentheses removed, e.g., "Encke'scher 1891 III", while the first recovery of what we *now* call P/Brooks 2 was indicated as "Brooks (1889 V) 1896 ...", later becoming "Brooks (1889 V) 1896 VI".

The *A.N.* reintroduced the letter designations at the beginning of 1899, this time with the letter following the year, but by 1902 names were not being indicated (except for returning periodic comets). Names then started reappearing, particularly for periodic comets, generally again parenthetically, but without parentheses for the multiple-apparition comets. A rather curious system of parentheses and commas would allow simply "1907 V", or occasionally "1907 V (1907e) (Mellish)" or, more rarely, "1907 V (1907e Mellish)" for an older non-periodic comet; "1906 IV (Kopff)" for a one-apparition periodic comet; and "1906 V, Finlay'scher" for a return of P/Finlay. If Roman numerals were not available, these were given as in "1909a (1909 ...) (Borrelly-Daniel)" and "1909c (1910 ...), Halley'scher".

IAU Circulars

In 1920 the IAU Central Bureau for Astronomical Telegrams was established in Brussels, and on its move to Copenhagen in October 1922, the present series of *IAU Circulars* was initiated. As in the *A.N.*, the early *IAU Circulars* generally recorded comets by designation, the names being parenthetical. One reason for this was that the responsibility for providing the designations, both for comets and minor planets, remained in Germany. Often the IAU Central Bureau had to announce a comet or unusual minor planet without having a designation for it. In such a case the publication on an *IAU Circular* would be simply under a heading like "Object Baade" or "Comet Wolf". When, around 1925, the IAU *did* take on the responsibility for the cometary letter designations, it therefore continued this practice, adding the *designation* parenthetically.

At its return in 1925, the *IAU Circulars* denoted Brooks' comet 1889 V as just "Periodic Comet Brooks", although Crommelin's comet catalogue of that year listed it as "Brooks (2)" (copied by some as "Brooks II"); the numeral was not widely applied until 1946, and the parentheses were later eliminated. Crommelin also made other changes, such as replacing "Periodic Comet Winnecke" by "Periodic Comet Pons-Winnecke".

As photographic discoveries of comets became common, often with a team of astronomers working together, comet names like "Schwassmann-Wachmann" began to appear, and in 1930 "Peltier-Schwassmann-Wachmann" (or sometimes "Schwassmann-Wachmann-Peltier") became the first genuine triple name. The three-name limit was first imposed with comet Jurlof-Achmarof-Hassel in 1939, and Bappu-Bok-Newkirk in 1949 was the first triple name involving astronomers at a single site.

The "P/" notation for periodic comets was introduced in the 1940s, and as the same few photographic observers tended to discover more than one periodic comet, numerals came to be added to the names of such comets as soon as it was shown that their computed revolution periods were less than 200 years. This was often done in retrospect, with no attention paid to cases where the earlier policy might have indicated—indeed, *did* indicate in some publications—different numerals (viz., the unnecessary and confusing P/Barnard 1, P/Barnard 2 and P/Barnard 3, the switch between P/Neujmin 1 and P/Neujmin 2, the decision to introduce the name P/Tempel-Tuttle rather than the intended P/Tempel 4, etc.). As more and more comets have been discovered, the same troublesome practices, never officially endorsed by the IAU (it seems), have continued. The one "success" of this maze of appended numerals is that, rather surprisingly, in the "finally adopted set" a complete sequence 1, ..., n is still extant for each case of duplication of the name of a periodic comet.

Complications in recent decades have been the occasional indecision as to whether an object is a comet or a minor planet, and the need to interpolate past comets into the system. Thus comet 1939b = 1939 IV P/Väisälä 1 was originally known under the asteroidal designation 1939 CB, while comet 1977t was later redesignated as asteroid 1977 YA. In any case, the breakdown of international communications during World War II caused the letter designations again sometimes to be dropped—and on other occasions the letter designations used in North America were different from those used in Europe. The 1966 publication of a discovery of P/van Houten on the plates of the Palomar-Leiden Survey caused this comet to be given a designation, 1961 X, that placed it at the *end* of the list of comets passing perihelion that year, even though this comet was actually at perihelion between 1961 IV and 1961 V. No letter designation was given to this comet, and indeed, when it comes to interpolating old comets the letter-designation system has remained inviolate—which means that comets whose existence has been confirmed on the non-simultaneous blue and red exposures of the Palomar Sky Survey, but that were not well-enough observed for orbit computations to be made, could not receive any designations at all!

And triple-barreled names proliferated. In recent years there has been some attempt to restrict comet names to two components (or even one), for "team" discoveries, sometimes with the use of a team name (Tsuchinshan, IRAS, Spacewatch) or "appellation" (as for the SOLWIND and SMM comets, where the names became parenthetical to the designations of these apparent Kreutz sungrazers, and numerals were added for convenience).

New designation system

So the main requirements of a new designation system are that comets recognized from the past could be easily and logically worked into the system, and that it would not matter if one could not immediately decide whether something were a comet or an asteroid. Furthermore, since letter designations have in recent times only very rarely been given to comets for which orbits can not be computed, there is essentially a 1:1 correspondence between the letter and Roman numeral designations, a redundancy that is surely unnecessary, given that the comets also usually have names. Finally, with the recognition of well over 100 multiple-apparition comets whose returns can generally be rather accurately predicted using modern computers (particularly when allowance is made for the nongravitational forces that affect the motions of

most comets in a rather systematic way), it seems unnecessary to acknowledge and designate a "recovery" *every* time one is observed to return to perihelion; in any case, when large telescopes are used, more and more periodic comets are observable all the way around their orbits.

The new system being introduced in 1995 accords to each discovery a designation consisting of the year of discovery, an upper-case letter to indicate the halfmonth during that year, and a numeral to indicate the order of discovery in that halfmonth. The halfmonth descriptors are identical with those used for minor planets, the difference being that for minor planets the sequence in a given halfmonth involves another letter, as well as a possible numeral (and for comets the numeral is not a subscript). Late announcements of discoveries made during earlier halfmonths can easily be accommodated. If a comet turns out to be a minor planet, or vice versa, the initial designations would be maintained. The prefix "P/" can still be applied to denote a periodic comet, and this is replaced by a "C/" to denote a comet that is *not* periodic. If a comet is designated but no orbit can be computed, the prefix would be "X/". If an object given a comet designation turns out to be an asteroid, it would receive the prefix "A/". If returns of a periodic comet are—for whatever reason—unpredictable, the "P/" can be replaced by "D/".

"Established" periodic comets are to receive permanent numbers in front of the "P/", in much the way that minor planets receive permanent numbers. This establishment will normally occur when a periodic comet is observed to make its next return to perihelion, at which time the recovery is acknowledged and a new designation supplied. Soon afterwards a sequential number is officially assigned to the comet, and future recoveries will then be recorded as such only if a comet is lost for a substantial interval of time, or if the revolution period is in excess of, say, 50–60 years. These numbers can also be given to cases where periodicity is established by linking observations at different apparitions of a comet, or where a comet is observed through aphelion. Although mixing of cometary and asteroidal designations is not a problem, it has been thought desirable to give periodic comet numbers as an *alternative* when an object deemed to be a comet has previously received a permanent asteroid number. Thus (2060) Chiron can *also* be denoted as 95P/Chiron and (4015) Wilson-Harrington as 107P/Wilson-Harrington. Some of the numbered comets, like 3P/Biela and 5P/Brorsen, are now lost and evidently defunct, so they are instead denoted 3D/Biela and 5D/Brorsen. For the unnumbered periodic comets it is anticipated that the "P/" will be converted to a "D/" even more frequently, e.g., for all cases where the period is longer than 50–60 years or when several returns have been missed since discovery.

Although no changes are currently being made in the system used for *naming* comets (i.e., comets will still generally be named for their discoverers), some additional formality will be introduced, causing the names proposed for comets to be approved by a committee, a procedure that is usually expected to produce only minimal delays, with a name generally being available by the time the first orbit is computed. The names will again be parenthetical to the designations, because it is the names that can logically be omitted. It is possible that the naming system will be modified in the future in the interests of fairness and simplicity. For example, there could be increased use of team names when several people are involved in making a discovery, and comet names might be restricted to a maximum of two components, rather than three. Furthermore, since the numbers preceding the "P/" uniquely define the established periodic comets, one might consider dropping any numerals that *follow* the names. On the other hand some astronomers want to distinguish with appended numerals *all* comets, periodic or otherwise, having the same name—surely a step backward reminiscent of the system used in the *M.N.* in the 1840s!

Comets of 1994

New-style designations can and should be applied to pre-1995 comets, whenever possible. As an example, the old and new designations for the comets of 1994 are as follows:

1994a becomes P/1994 A1 (Kushida)
1994c becomes C/1994 E1 (Mueller)
1994d becomes C/1994 E2 (Shoemaker-Levy)
1994f becomes C/1994 G1 (Takamizawa-Levy)
1994h becomes P/1985 Q1 = 1994 J1 (Maury)
1994i becomes C/1994 J2 (Takamizawa)
1994k becomes P/1994 J3 (Shoemaker 4)
1994m becomes C/1994 N1 (Nakamura-Nishimura-Machholz)
1994n becomes P/1994 N2 (McNaught-Hartley)
1994o becomes P/1994 P1 (Machholz 2)
1994r becomes C/1994 T1 (Machholz)
1994u becomes P/1994 X1 (McNaught-Russell)

As it happened, five of the 11 new comets of the year turned out to be of short period, but this would not be initially known. Immediately after discovery, the comets would be simply "1994 A1", "1994 E1", etc., the "P/" or "C/" (or "D/" or "X/"), as well as the parenthetical name, being added later. It should be noted that 1994 J1 was a periodic comet making its first observed return, its discovery designation in 1985 also being recorded. As a separate step, this comet would then become "115P/1985 Q1 = 1994 J1 (Maury)", after which one or both (as appropriate) of the equated designations could be omitted, giving "115P/Maury" or even simply "115P". The form "115P/Maury" is the only one in which the name would *not* be parenthetical and is similar to what is done at present—although it must be noted that the "115" is *mandatory*—and allowance of "115P" (without the "/") suggests that the form "115P (Maury)" would also be acceptable. The other comets given letter designations (but not new-style designations) in 1994 are returning periodic comets that would already be known by their numbers and names (as given on *MPC* 24252 and on pp. 43-44 of

this issue of the *ICQ*). Comet P/1994 P1 (Machholz 2) and one of those established periodic comets, 51P/Harrington, were observed to split. These designations apply to the combined comets. The secondary components, for example, are to be referred to as P/1994 P1-B or P/1994 P1-B (Machholz 2), and 51P/Harrington-B or 51P-B, or conceivably 51P-B (Harrington), the rule being to apply the "-B" (or other letter) to the end of the unparenthesised part of the designation.

Why abandon current letter designations?

There is clearly widespread support for abandoning the Roman numeral designations. On the other hand, several people have wondered why the letter-designation system was not simply accepted as the new standard. While this course was certainly considered, it was felt that the letter designations had not been used in the past in a sufficiently uniform manner, and that the proposed changes in designation *policy* (termination of recognition of routine recoveries, need to interpolate old comets, etc.) were sufficiently far-reaching to warrant the use of a completely different system. Confusion between faint comets and asteroids is clearly going to become more of a problem in the future, so it seems reasonable that the systems for designating these classes of object should be similar. Some people have gone so far as to suggest that a *single*, uniform system should be used for *both* comets and asteroids. This course was not adopted because there is clearly some considerable difference between a bright long-period comet and a faint main-belt asteroid, and in any case, the comet designations are supplied by the CBAT and the asteroid designations by the Minor Planet Center.

It is hoped that readers will agree that the practice of designating and naming comets has become so convoluted and inconsistent that the proposed changes were indeed necessary. While the *A.N.* tried and in large measure succeeded to systematize procedures during the latter part of the nineteenth century, it is clear that the IAU has not until now shown the leadership it should in dealing with the different techniques for observing comets that have come along during the twentieth century and are likely to be used in the twenty-first. The new system differs quite drastically from the old, and it may take some time to get used to this. Computer files and programs will be have to be modified. The system is the outcome of a lot of discussion during the past three years, and it is no accident that in some aspects it represents a reversion back to what was done in the *A.N.* While the designation system has been set, some problems remain in connection with the way names are assigned to comets, and these may not be resolved before the next IAU General Assembly in 1997.

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Thoughts on Comet Hunting

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Abstract. The author examines his successful project for discovering new comets, giving an overview of his results — nine comets he discovered that carry his name.

The Beginning

It was just 20 years ago — December 1974 — that I decided to pursue a systematic search for comets. This decision came at a pivotal time in my life. I had just finished serving three years in the military, had moved back home, and wanted a project that would encourage me to spend more time viewing the heavens. Over the previous decade, I had spent considerable time viewing all the planets and a half-dozen comets, had found every Messier object in one year (1969-70), and had photographed the skies. I have always enjoyed the view of the night sky through the telescope. The projects that I considered were variable stars, asteroid studies, and comet hunting.

Comet hunting seemed most appealing to me. I also knew that very few Americans were searching for comets, because most visual discoveries were being made from foreign lands. According to James Muirden (*The Amateur Astronomer's Handbook*), the average comet hunter took 300 hours to find a new comet. This was confirmed to me when I read an interview with William Bradfield appearing in the magazine *Eclipse*, in which Bradfield said that his first discovery took 260 hours and his second an additional 306 hours. My early philosophy thus developed: I would attempt systematic comet hunting for as long as I found it enjoyable. If I did not find it enjoyable, I could quit my comet-hunting program and move on to something else, my only "loss" being the time spent looking through the telescope. Finally, I wanted my comet-hunting program — as extensive as it might become — to be only a part of my life, not to consume it. I did not want to exclude other activities or people from my life just because I wanted to hunt comets.

The remainder of December 1974 was spent setting up my comet-hunting program and practicing under the night sky. I divided my sweepable sky into four sections — excluding dense, Milky-Way and galaxy-laden areas. (This lasted less than a year, when I then opened up the whole sky for sweeping.) The instrument that I used was an 11-cm $f/5$ reflector at 20×, sitting on a mount taken from my 15-cm Criterion Dynascope. Within a year, I transferred the 11-cm reflector to an equatorial (unguided) pipe mount.