

PLANET, ASTEROID, MINOR PLANET: A CASE STUDY IN ASTRONOMICAL NOMENCLATURE

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Abstract: Since 1801 the multitude of bodies that orbit between Mars and Jupiter have been called planets, small planets, minor planets, petites planètes, kleine Planeten, planetoids and asteroids. We investigate the popularities of these nomenclatures and chart the way in which, over the last 20 to 30 years, the use of Sir William Herschel's word 'asteroid' has become more widespread.

Key words: asteroids, minor planets

1 INTRODUCTION

Much has been made recently of the definition of the term 'planet' and specifically the question as to whether Pluto is 'in' or 'out' of the premier league. Many have questioned whether the Solar System has a host of spherical planets or a mere eight (four rocky mid-sized bodies, Mercury, Venus, Earth, Mars; and four gas giants, Jupiter, Saturn, Uranus and Neptune). In this short paper we principally investigate the terminology applied to the multitude of bodies that orbit the Sun between the orbits of Mars and Jupiter. In 1801 they started off as 'planets', but they were generally rather steadily demoted over the course of the following four decades. The demotion of Pluto took almost twice as long.

Let us start by questioning the status of Ceres. When Ceres was discovered serendipitously, at the beginning of January 1801, was it classed as a new planet? The short answer is not really. On 1 September 1801 its Palermo (Sicily) discoverer, Giuseppe Piazzi (Figure 1), was writing to William Herschel discussing the new "... étoile, qui par son mouvement ressemble beaucoup à une Planète." (see Lubbock, 1933: 269). It was only by the end of 1801 that the orbit of Ceres was known with any certainty and its position in the 'Bodian Gap' between Mars and Jupiter was established. Did Ceres immediately become ranked with the likes of Mercury, Venus, Earth, Mars, Jupiter, Saturn and Uranus? Again the answer is not really. It was too faint. In February 1802 Joseph Banks was commenting on its "... little disc of the size of the 1st or 2nd satellite of Jupiter ..." (ibid.). So there is no question of there actually being eight 'real' planets in 1801, and at the end of March 1802, with the discovery of Pallas, this number increasing to nine. Astronomers always seemed to be suspicious of the status of Ceres. It was regarded as being too faint, too small, of too little mass and having an orbit that was too eccentric and of too high an inclination to be worthy of joining the Sun's planetary team.

Were the 'Celestial Police', the illustrious group of astronomers led by Baron Franz von Zach in a hunt for the missing body between Mars and Jupiter (see Cun-

ningham, 1988: 7), disappointed at the insignificance of Ceres? Or was this new celestial body just what was expected, considering the fact that the ancients had not discovered it, and the orbits of Mars and Jupiter were not affected by any unexplained perturbations?

Maybe the demotion from planetary status occurred when it was realised that Ceres was not alone, and was merely one of a host of objects that inhabit the region between the orbits of Mars and Jupiter. The discovery of this multiplicity happened relatively quickly. Johann Elert Bode (1749–1826) had been very excited by the discovery of Ceres, but the second 'moving star' worried him. Writing to Herschel in May 1802 (Lubbock, 1933: 271) he noted that Pallas "... is a planet travelling with Ceres, in the same orbit, at the same distance round the sun. Such a thing is unheard of!"

Let us investigate the introduction of the two most popular terms used to describe these bodies, 'asteroid' and 'minor planet'.

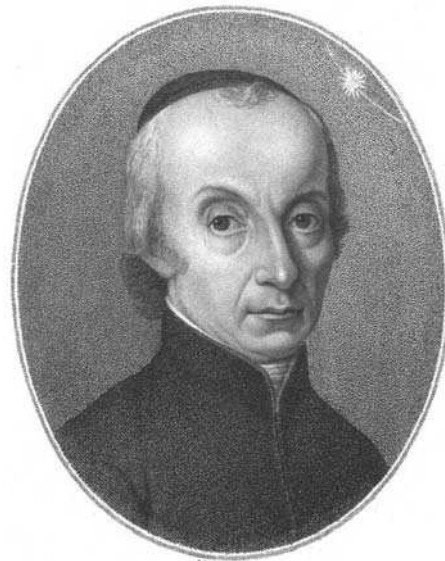


Figure 1: Sicilian astronomer, Giuseppe Piazzi, 1746–1826 (after en.Wikipedia.org/wiki/Giuseppe_Piazzi).

2 ASTEROID

The demotion of Ceres and Pallas started on 6 May 1802, the day on which William Herschel (Figure 2) read his paper “Observations on the two lately discovered bodies” to the Royal Society in London (see Herschel, 1802). Herschel had spent much of April observing Ceres and Pallas, using his 7-foot and 10-foot reflectors and his lucid disc micrometer. He estimated the size and the relative brightness of the two bodies and questioned whether they had detectable atmospheres or satellites. Herschel concluded that Ceres had a diameter of 162 miles, and Pallas a diameter of no more than 70 miles, values that are now known to be underestimated by factors of three or more. These diameter measurements were contained in a letter that Herschel wrote to Piazzi on 22 May 1802, a letter that ends:

Moreover, if we were to call [Ceres] a planet, it would not fill the intermediate space between Mars and Jupiter with the proper dignity required for that station. Whereas, in the rank of Asteroids it stands first, and on account of the novelty of the discovery reflects double honour on the present age as well as on Mr. Piazzi who discovered it. I hope you will see the above classification in its proper light, as so far from undervaluing your eminent discovery it places it, in my opinion, in a more exalted station. To be the first who made us acquainted with a new species of primary heavenly bodies is certainly more meritorious than merely to add what, if it were called planet, must stand in a very inferior situation of smallness. (see Cunningham, 2002: 252).



Figure 2: Sir William Herschel, 1738–1822 (after en.wikipedia.org/wiki/William_Herschel).

Herschel (1802: 220) then posed the question “What are these new stars, are they planets, or are they comets?” He enjoyed classifying objects (planetary nebula was another Herschelian first), and to help him

answer the question he went on to define the term ‘planet’, noting that

This cannot be difficult, since we have seven patterns to adjust our definition by. I should, for instance, say of planets,

1. They are celestial bodies, of a very considerable size.
2. They move in not very excentric [sic] ellipses round the sun.
3. The planes of their orbits do not deviate many degrees from the plane of the earth’s orbit.
4. Their motion is direct.
5. They may have satellites, or rings.
6. They have an atmosphere of considerable extent, which however bears hardly any sensible proportion to their diameters.
7. Their orbits are at certain considerable distance from each other.

Herschel then concludes that Ceres and Pallas are not planets because they are too small, too far from the ecliptic, free of satellites, rather comet-like in appearance (as seen through his instruments) and have orbits that are too close together. He then goes on to define ‘comet’ (and remember this was in the days before the existence of the Jupiter family of comets had been established):

1. They are celestial bodies, generally of a very small size, though how far this may be limited, is yet unknown.
2. They move in very excentric ellipses, or apparently parabolic arcs, round the sun.
3. The planes of their motion admit to the greatest variety in their situation.
4. The direction of their motion also is totally undetermined.
5. They have atmospheres of very great extent, which shew themselves in various forms of tails, coma, haziness, &c.

Since Ceres and Pallas had insignificant observable comae, Herschel realised that they were not comets either. In the world’s first scientific paper on these bodies he wrote:

Since, therefore, neither the appellation of planets, nor that of comets, can with any propriety of language be given to these two stars, we ought to distinguish them by a new name, denoting a species of celestial bodies hitherto unknown to us ... they resemble small stars so much as hardly to be distinguished from them, even by very good telescopes. It is owing to this very circumstance, that they have been so long concealed from our view. From this, their asteroidal appearance, if I may use that expression, therefore, I shall take my name, and call them *Asteroids*; reserving to myself, however, the liberty of changing that name, if another, more expressive to their nature, should occur. These bodies will hold a middle rank, between the two species that were known before; so that planets, asteroids, and comets, will in future comprehend all the primary celestial bodies that either remain with, or only occasionally visit, our solar system. (Herschel, 1802: 228).

So William Herschel, the discoverer of Uranus, the Royal Astronomer (not to be confused with the Astronomer Royal, who at the time was Nevil Maskelyne), the most prominent astronomer working in England, coined the term *asteroid* and defined it:

Asteroids are celestial bodies, which move in orbits either of little or of considerable excentricity [sic] round the sun, the plane of which may be inclined to the ecliptic in any angle whatsoever. Their motion may be direct, or retrograde; and they may or may not have

considerable atmospheres, very small comas, disks, or nuclei. (Herschel, 1802: 229).

This premature definition is far from accurate. To lean on Greek to imply that something between the orbits of Mars and Jupiter is ‘like a little star’ is misleading to say the least. The invention of the new word did not pass without critical comment. Some liked it. For example, on 17 June 1802 Heinrich Wilhelm Olbers (Figure 3), the discoverer of Pallas, wrote to Herschel:

I agree with you, honoured Sir, in your sagacious suggestion that Ceres and Pallas differ from the true planets in several respects, and the name *asteroid* seems to me to fit these bodies very well.

Olbers’ friend and countryman, Karl Friedrich Gauss (1777–1855), disagreed, however. On 25 June 1802 he wrote to Olbers:

Mr Herschel also gave me information on his “Asteroids”. What surprises me is (1) that he doesn’t announce it as being a modest proposal, but rather says simply “I call them,” and (2) that his reason in Ceres’ case consists in that it now “is out of the zodiac”. That shows a very biased and, it seems to me, unphilosophical outlook. (Cunningham, 2006: 227).

Pierre Laplace (1749–1827) was also not so sure:

Quant au nom que vous donnés [sic] à ces astres, je ne vois pas encore de motif suffisant pour ne pas leur conserver le nom de planètes.

And on 4 July 1802 Piazzi wrote Herschel:

Et pour la dénomination, ne pourroit-on pas appeler les petites planètes, planetoides? Car je vous avoue, le nom d’Astéroïdes me paraît plus propre aux petites étoiles. (See Lubbock, 1933: 274).

The original Piazzi letter has a capital P for planetoides and this word is underlined (Michael Hoskin, private correspondence, 2006). Two days before, on 2 July 1802, Piazzi had written to his Milanese astronomical friend and collaborator Barnaba Oriani (1752–1832):

I hope you won’t be sorry if I transcribe a letter recently received from Herschel. What do you think? It looks to me (1) Whatever the name given to this new star doesn’t really matter. Are they moving stars? You can call them planetoids or cometoids, but not asteroids. (2) For me the only difference between comets and planets is their eccentricity and inclination. Consequently Ceres is a planet and Pallas a comet. (3) Ceres’ diameter ... has to be much larger than 162 miles. (4) If we call Ceres an asteroid so we must call Uranus an asteroid. (This English translation is given in Cunningham, 2002: 192).

In 1803, an unsigned review of Herschel’s 1802 *Philosophical Transactions of the Royal Society* article was published in a new Scottish quarterly journal titled *The Edinburgh Review*, which somewhat controversially concentrated on literary and political criticism. In *The Edinburgh Review* (1803: 428) we read:

... and first we must positively object to the unnecessary introduction of new terms into Philosophy. The science of Astronomy is, beyond any other branch of mixed mathematics, loaded with an obscure and difficult technology ... Knowing, as we do, the great power of words in misleading and perplexing our ideas, we cannot allow the unnecessary introduction of a new term to escape unnoticed. Where a new object has been discovered, we cheerfully admit the right of the discoverer to give it a new name; but we will not allow needless multiplication of terms or an unnecessary alteration in the old classification of things, to be either

justifiable or harmless, a substitute for real discovery, or a means of facilitating the progress of invention. It remains, therefore, to enquire, whether the circumstances of Ceres or of Pallas, distinguish them from the bodies formerly known?

The reviewer thought that Ceres and Pallas, as described by Herschel, were too similar to known planets and comets to deserve a separate definition:

... we must enter our protest to the formation of a separate class, distinguished by a new and uncouth name. (ibid.).

To justify this statement the author notes that Herschel had suggested that comets cool as time progresses and slowly lose their atmospheres, thus reducing themselves to the state of planets in everything but their magnitudes and eccentricities.

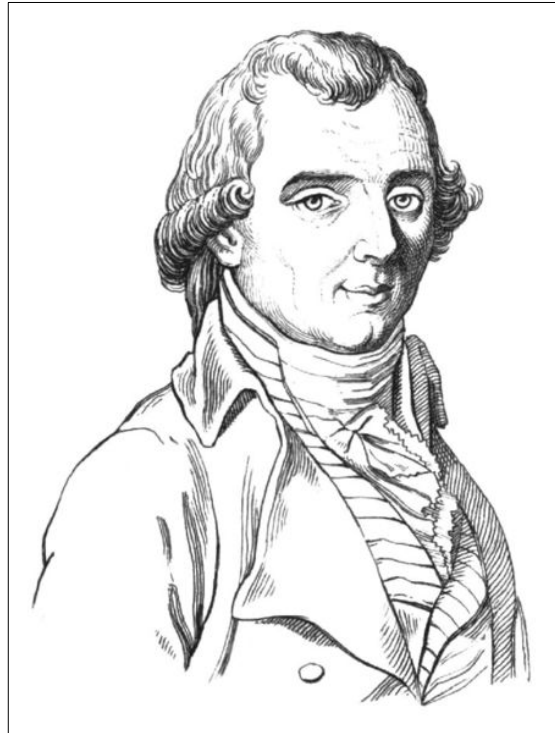


Figure 3: Heinrich Wilhelm Olbers, 1758–1840 (after en.wikipedia.org/wiki/Heinrich_Wilhelm_Matth%C3%A4us_Olbers).

The article goes on to criticise Herschel’s general writing style and scientific approach. Herschel is accused of “... great prolixity and tediousness of narration.” The author suggests that Herschel is prone to expressing “... loose, and often unphilosophical reflections ... [and] above all that idle fondness for inventing names, without any manner or occasion.” Furthermore,

Dr Herschel’s [sic] passion for coining words and idioms, has often struck us as a weakness wholly unworthy of him. The invention of a name, is but a poor achievement in him who has discovered whole worlds.

The Edinburgh Review author then completely ignores his (or her) own advice and suggests some new words to describe Ceres and Pallas:

Such being our opinion, it is of much less consequence to inquire, whether the new name of Asteroid is the most appropriate that could be imagined. To us, that

name presents the idea of some body resembling fixed stars; whereas the two new planets have no one circumstance in common with those distant bodies. If a new name must be found, why not call them by some appellation which shall, in some degree, be descriptive of, or at least consistent with, their properties? Why not, for instance, call them *Concentric Comets*, or *Planetary Comets*, or *Cometary Planets*? Or if a single term must be found, why may we not coin such a phrase as *Planetoid* or *Cometoid*?

We wonder if the writer of *The Edinburgh Review* article had independently generated the words ‘planetoid’ and ‘cometoid’ or had somehow been privy to the earlier Piazzi correspondence. The general rudeness of the article seems to us to rule out the possibility that it was a translation of a piece by Piazzi. The style of the article is typical of one of the co-founders of *The Edinburgh Review*, Henry Brougham (Figure 4),¹ who was never one to mince his words.

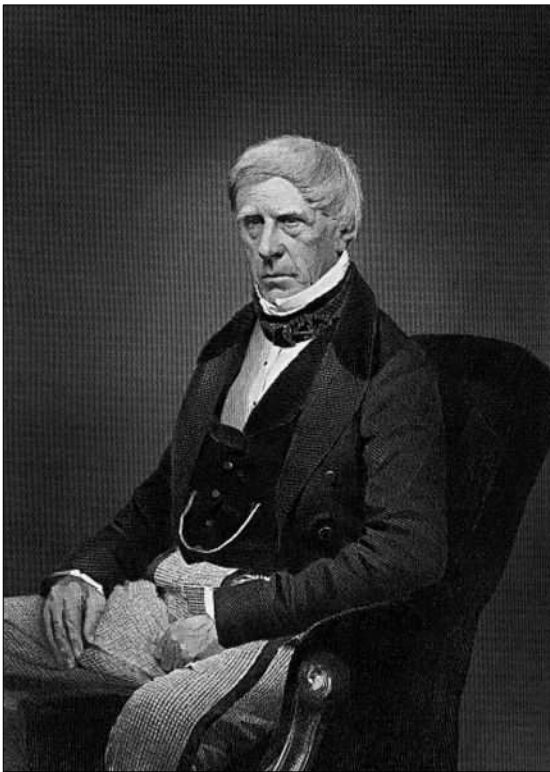


Figure 4: Henry Peter Brougham, 1778–1868 (after en.wikipedia.org/wiki/Henry_Peter_Brougham).

William Herschel seemed to have been rather fond of his new word ‘asteroid’, and he used it frequently. He, however, was not a man to insist that others followed his lead. In a paper he read to the Royal Society on 9 June 1803 he writes:

It is not in the least material whether we call them asteroids, as I have proposed; or planetoids, as an eminent astronomer in a letter to me, suggested; or whether we admit them at once into the class of our old seven large planets. (Herschel, 1803: 339).

So in early 1803 the word ‘planetoid’ was used by the writer of the article in *The Edinburgh Review* and also by Herschel’s correspondent, the ‘eminent astronomer’. Were these one and the same person? It seems more likely that the ‘eminent astronomer’ was Piazzi.

The Oxford English Dictionary attributes the first recorded use of the word ‘planetoid’ to H. Brougham in *The Edinburgh Review*. At the time, Brougham was studying to be a lawyer. On page 428 in *The Edinburgh Review* the author of the article suggests that, when it came to discussing the astronomy of Ceres and Pallas, he is

... as well qualified to judge the truth of these, as if we had ourselves made or verified the observations upon which they are founded.

William Herschel’s grand-daughter, Lady Constance A. Lubbock, had no doubt that the “... very ill-natured criticism ...” came from Brougham (see Lubbock 1933: 282), and “Had Herschel adopted the better word *planetoids*, suggested by Piazzi, he might have saved himself from the aspersions cast upon him by some critics.” (Lubbock 1933: 276).

The Edinburgh Review article was subsequently mentioned by the Edinburgh amateur astronomer Hector Copland Macpherson (1888–1956):

In ‘the Edinburgh Review’ Brougham declared that Herschel had devised the word ‘asteroid’ so that the discoveries of Piazzi and Olbers might be kept on a lower level than his own discovery of Uranus. Many scientists would have been much offended at this contemptible insult, but Herschel merely remarked that he had incurred “the illiberal criticism of ‘The Edinburgh Review,’” and that the discovery of the Asteroids “added more to the ornament of our system than the discovery of another planet could have done.” (Macpherson, 1906: 20).

This rather surprising and contentious suggestion is completely unsupported by a detailed reading of the original article. The expression ‘kept on a lower level’ was not mentioned in 1803. The ending of the Macpherson quotation comes from the last line of Herschel (1805: 64). Here Herschel emphasised that “... the specific difference between planets and asteroids ...” becomes even more apparent due to the discovery of Juno, and

It will appear then, that when I used the name asteroid to denote the condition of Ceres and Pallas, the definition I then gave of this term will equally express the nature of Juno ... The propriety of therefore using the same appellation for the lately discovered celestial body (i.e. Juno) cannot be doubted. (ibid.).

Brougham was certainly a forceful critic: in recent private correspondence, Mary Brück used adjectives such as ‘arrogant’, ‘witty’, ‘clever’ and ‘highly opinionated’. His attack on Lord Byron prompted the poet to reply with the poem *English Bards and Scotch Reviewers*. Brougham also wrote a damaging and contemptuous review of Thomas Young’s suggestion, and demonstration, of the wave nature of light.

When the fourth asteroid was announced Herschel (1807: 260) rushed to the telescope to observe it and rejoiced in the “... valuable addition to our increasing catalogue of asteroids ...” He also hoped that

... the great success that has already attended the pursuit of the celebrated discoverers of Ceres, Pallas, Juno and Vesta, will induce us to hope that some further light may soon be thrown upon this new and most interesting branch of astronomy. (Herschel, 1807: 265).

How quickly was the word ‘asteroid’ taken up during the first decade of the nineteenth century? Well, some professional astronomers started to use it very quickly. Olbers wrote to Bode on 3 April 1807:

... with great delight, dearest friend, I hasten to tell you that I was lucky enough to find yet another planet (Vesta) belonging to the family of the asteroids, on 29th March. This time, however, the discovery was no mere chance ... According to my hypothesis concerning the asteroids ... I have, as you know, concluded that all asteroids, of which there are probably a large number, must pass through the north-western portion of the constellation Virgo and the western portion of the Whale. Regularly each month, therefore I check a particular section of these two constellations, having first thoroughly acquainted myself with the star content ... (see Roth, 1962: 28).

Note that Olbers uses the term ‘asteroids’ three times in this short quotation.

Moving to the more popular astronomical literature, we note that Squire (1820: 18) refers to Ceres, Pallas, Vesta and Juno as ‘small planets’ or ‘segments of planets’, but lists them under the heading ‘Asteroids’. Much is made of their glyphs. Jehoshaphat Aspin, the divisor of the popular constellation card collection, *Urania’s Mirror* (see Hingley, 1994), certainly uses the word ‘asteroid’ in the associated book, *A Familiar Treatise on Astronomy* (see Aspin 1825: 18) and defines it as follows:

ASTEROIDES. This appellation has been give to four planets recently discovered between the orbits of Mars and Jupiter ... They differ from all the other planets in their diminutive sizes, and in the form and positions of their orbits, which cross each other, and extend their planes beyond the limit of the zodiac. Hence Sir W. Herschel,^[2] not feeling himself warranted to refer them either to the class of planets or comets, denominated them *Asteroides*, or star-like

Aspin goes on to quote the *Edinburgh Encyclopaedia*, which concludes that the four bodies were once “... combined in a larger body.” This idea, that there was once a large planet between Mars and Jupiter and this had been broken up, was common place at the time.

Why Aspin thought it necessary to introduce the letter ‘e’ between the final ‘d’ and ‘s’ of the word asteroids is a mystery. Maybe he was influenced by happenings on the French side of the Channel. In Brussels, Quételet (1826: 204) discusses *Astéroïdes* and divides planetary bodies into three groups: Mercure, Vénus, Terre and Mars are “... planètes tellustriques ...”; Vesta, Junon, Cérés and Pallas “... désignées sous le nom d’Astéroïdes ou de Planètes télescopiques ...”; with Jupiter Saturne and Uranus being “... les Grandes Planètes” or “Planètes à cortèges.” The expression ‘planètes télescopiques’ was also used by Laplace (1836: 89).

Returning to the 1820s, two general texts, *Wonders of the Heavens* (Richard Phillips, London, 1822) and *First Steps to Astronomy* (Hatchard and Son, London, 1828), simply refer to Ceres, Pallas, Juno and Vesta as ‘planets’, as does Carey (1831: 34). The latter does, however, note that “... they are so very unlike the other primary planets ...”, and states that “Dr Herschel has given the name of Asteroids.” Dick (1840: 542) also refers to the four as ‘planets’. Tomlinson (1840: 186) talks of “... four little planets called *Asteroids*, because they have the *appearance of stars* ...”, while Nichol (1844: 22) has ‘small planets’, and Lardner (1856: 166) follows suit. In the same year, Reid (1856: 144), under the heading of *The Asteroids*, talks of “... thirty-eight small recently discovered planets,

situated between the orbits of Mars and Jupiter. They are sometimes called *telescopic*, as they are not visible to the naked eye ...”. Arago (1857, 4, 141) refers to them as ‘petites planètes’.

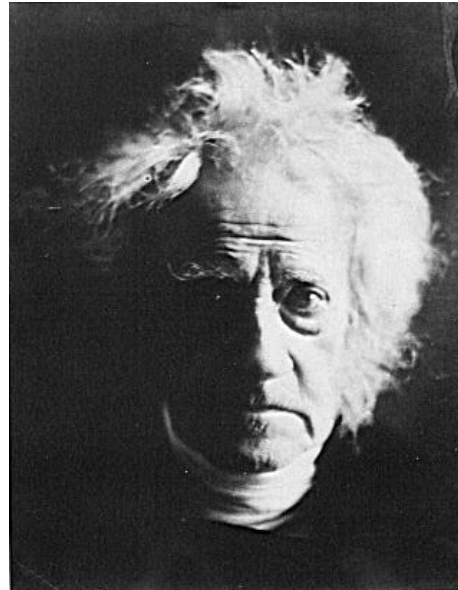


Figure 5: Sir John Herschel, 1792–1871 (after en.wikipedia.org/wiki/John_Herschel).

William Herschel’s son, John Frederick William Herschel (Figure 5), pointedly ignores his father’s invented word ‘asteroids’. In his contribution to the Reverend Dionysius Lardner’s *The Cabinet Cyclopaedia*, Herschel (1833: 243) writes only of planets:

Among the stars there are several, – and those among the brightest and most conspicuous, – which, when attentively watched from night to night, are found to change their relative situations among the rest; some rapidly, others much more slowly. These are called *planets*. Four of them, – Venus, Mars, Jupiter, and Saturn, – are remarkably large and brilliant; another, Mercury, is also visible to the naked eye as a large star, but for a reason which will presently appear, is seldom conspicuous; a fifth Uranus, is barely discernable without a telescope; and four others, – Ceres, Pallas, Vesta and Juno, – are never visible to the naked eye. Beside these ten, others yet undiscovered may exist; and it is extremely probable that such is the case, – the multitude of telescopic stars being so great that only a small fraction of their number has been sufficiently noticed to ascertain whether they retain the same places or not, and the five last-mentioned planets having only been discovered within half a century from the present time.

Ten planets! John Herschel completely ignores the one he is observing from—planet Earth. Our home planet only gets a mention when (on page 416) Herschel produces a ‘Synoptic Table of the Elements of the Solar System’ and under ‘Planet’s name’, lists, in order of mean distance from the Sun, Mercury, Venus, Earth, Mars, Vesta, Juno, Ceres, Pallas, Jupiter, Saturn and Uranus.

To appreciate fully the above discussion, it is important to remember that after Vesta was found in 1807 all the initial excitement quickly waned, as there were no similar discoveries for some considerable time. The 38-year ‘fallow period’ was finally broken with the

discovery (on 8 December 1845) of Astraea by Karl Hencke (see Hughes, 1997). More significantly still, some nine months later, in September 1846, the discovery of the distant Neptune, from the recognition of its gravitational effect on Uranus, made it very clear that *here* was a new body truly worthy of being called a planet. And with the discovery in 1847 of Hebe, Iris and Flora, interest in the rapidly-growing number of small bodies in the Mars-Jupiter region was clearly being reignited. Indeed in the first edition of his famous text *Outlines of Astronomy*, John Herschel (1849) deigned to use the word ‘asteroids’ (if a little reluctantly), as he added Neptune to his tabulation of planets and removed the small Mars-Jupiter bodies that were present in his 1833 tabulation.

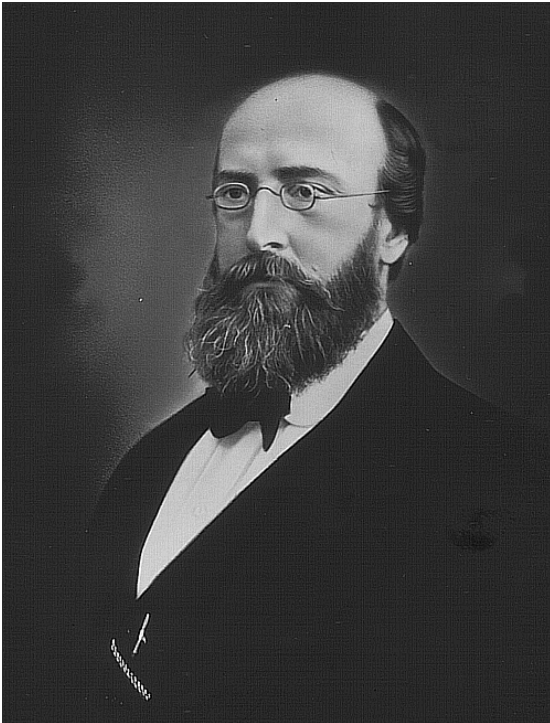


Figure 6: Benjamin Apthorp Gould, 1824–1896 (courtesy of the Argentine National Observatory).

The year 1849 also saw the publication of the first volume of *The Astronomical Journal*. Edited in Boston by Benjamin Apthorp Gould (Figure 7), the *A.J.* quickly commandeered the word ‘asteroid’ (see, for example, Alexander, 1851), and although some papers were published under headings such as ‘Observations of Hygea’ (Ferguson, 1851), by the second volume the *A.J.* was routinely indexing items both under ‘Asteroid’ and under headings like ‘Hygea (10th Asteroid)’. In that second volume, Gould (1852) conveniently listed the glyphs for 13 of the first 15 asteroids, noting that these glyphs were being replaced by new symbols that consisted of the numbers (1 to 15) enclosed in a circle (this nomenclature being suggested by Johann Rudolf Wolf (1816–1893) of Zürich Observatory). Eventually, when the numbers got too large, the circles were dispensed with. The old glyphs were in fact designed for the first 17 asteroids, as well as sporadically up to No. 37 (see Schmadel, 1992).

By the time John Herschel published the second edition of his *Outlines of Astronomy* in 1853, the word

‘asteroid’ only appears in the index. Instead, Herschel (1853: 243) writes of “... eight telescopic planets, — Ceres, Pallas, Juno, Vesta, Astraea, Hebe, Iris and Flora (which may therefore be termed *ultra-zodiacal*) ...”, while in the tabulation on page 543 he lists no fewer than 22 planets in order of semi-major axis (i.e. the eight ‘conventional’ planets, Mercury-Neptune, and the first fourteen minor planets).

During the latter half of the nineteenth century the number of known asteroids was increasing nearly exponentially. Arago (1857) listed the orbital parameters of 42, when Chambers wrote his *Descriptive Astronomy* (1867: 92) the number had grown to 89, and by 1890 the total stood at 287 (see Ball, 1893: 197).

3 MINOR PLANET

The term ‘minor planet’ seems first to have been introduced in *The Nautical Almanac and Astronomical Ephemeris* in 1835. In 1830 the Lords Commissioners of the Admiralty (who were responsible for the publication of *The Nautical Almanac*) asked the Astronomical Society (which became the Royal Astronomical Society in March 1831) to suggest possible ways in which the *Almanac* could be improved (see Dreyer & Turner, 1923: 56). The outcome was the conversion of the *Almanac* from a work that was only really useful for nautical astronomy to one that was useful for both nautical and practical astronomy. The size of the *Almanac* increased from just over 200 pages (1833 and before) to just over 500 pages (1834 and after). Tables concerning Ceres, Pallas, Juno and Vesta first appeared in 1834. These listed, at four day intervals, such coordinates as heliocentric longitude and latitude, geocentric right ascension and declination, length of radius vector, logarithm of distance from Earth and mean time of transit. (The interval was reduced to one day around opposition.)

In the context of the present paper, Lieutenant W.S. Stratford, R.N. (the Superintendent responsible for producing the *Almanac*) referred to Ceres, Pallas, Juno and Vesta as planets in the 1834 edition. When, in May 1835, he was writing the preface for the 1837 edition, they were referred to as ‘minor Planets’ (see page vii), and in December 1835, when writing the preface for the 1838 edition of the *Nautical Almanac* they were elevated to ‘Minor Planets’ (see page vii).

Despite the involvement of its parent organization in the improvements in *The Nautical Almanac*, the *Monthly Notices of the Royal Astronomical Society* did not immediately use the term ‘minor planets’, and it certainly did not use the nomenclature ‘asteroids’. As new discoveries were made in the late 1840s, the *Monthly Notices* continued to refer to them as ‘planets’, or sometimes as ‘small planets’. It finally took the plunge with ‘Minor Planets’ in February 1853, in *Monthly Notices* Volume 13 (for November 1852 to June 1853). This volume starts on page 1 with the announcement of the discovery, by J.R. Hind (on the evening of 15 December 1852 at Mr Bishop’s Observatory, Regent’s Park, London) of ‘another small planet’, Thalia. The journal follows this announcement by listing of the orbital parameters of Lutetia and Massilia. (The spelling of the latter, named after the French city of Marseilles, originally oscillated between the Latin ‘Massilia’ and the Greek ‘Massalia’.) Minor

planets were much in the news in 1853, eight having been discovered in the previous year. On page 93 in Volume 13 of *Monthly Notices* the announcement was made that, at the 11 February 1853 Annual General Meeting of the Society, Mr J.R. Hind had been awarded the Gold Medal "... for his astronomical discoveries, and in particular for the discovery of eight small planets." The report of the AGM ended with a table titled 'Catalogue of the Minor Planets at present known, in order of discovery', which listed the 'reference numbers', names, discovery dates and discoverers of the 23 such bodies then known. In all of this discussion there was the implication that the eight larger bodies, Mercury to Neptune, were the 'Major Planets' or, in popular parlance, simply the 'Planets'. The editors of the *Monthly Notices* were, however, not strict, for Lardner (1853) used the terms 'planetoids' and 'small planets'.

Although the *Astronomische Nachrichten* had briefly flirted with 'Asteroiden' in 1852 (see the index to Volume 34), the heading 'Planeten, Kleine' appeared in the index in 1855, principally due to the influence of Friedrich Wilhelm August Argelander (1799–1875; see, for example, Argelander, 1855). Interestingly, in Volume 39 under the heading 'Planeten, neue', there were entries such as 'Euphrosyne (31)', showing that the complete circles surrounding the numbers were already by then deteriorating into parentheses. Shortly afterwards the parenthetical numbers preceded the names in a custom that still continues, although some writers nowadays omit the parentheses.

Did the expression 'minor planet' catch on quickly? The literature indicates that its reception was mixed. In further editions of *Outlines of Astronomy*, John Herschel (1871, 11th edition, pages 333, 352, 727, 731) got bolder with his use of the term 'asteroids', and it also was used by Plummer (1873: 118). Meanwhile, Yale University's Professor Elias Loomis (1868: 224) 'sat on the fence', writing:

On account of the close resemblance in appearance between these small planets and the fixed stars, Herschel proposed to designate them by the name *Asteroid* – a term which has been very extensively adopted. Some astronomers employ the term *Planetoid*; but the term *minor planet* is more descriptive, and is now in common use among astronomers.

The mixed reception is underlined by the fact that the word *asteroid* is "... very extensively adopted ...", while *minor planet* is "... in common use." Chambers (1867: 91) embraced 'minor planets', and added a footnote:

The old name of *asteroids*, proposed by Sir William Herschel, has nearly fallen into disuse. Nothing could be more inappropriate than such a designation; *planetoids* would have been better. However, *minor planets* is preferable to either.

In Chambers' later much extended Fourth Edition of his *A Handbook of Descriptive and Practical Astronomy*, the first part of the second sentence in the footnote has been softened slightly, and now reads: "Such a designation was not very appropriate." (Chambers, 1889, 1: 164). Newcomb (1878: 333), from the U.S. Naval Observatory, ignores the word 'asteroid' and refers to 'the small planets'. Flammarion (1881: 499) uses the expression 'les petites planètes'. In his *The Story of the Heavens*, Ball (1893:

193), sticks with 'minor planets'. The great astronomical populariser Richard Proctor (1892: 552) disagreed with Chambers and the previous three authors. His chapter on the subject is titled 'The Zone of the Asteroids', and he writes, as a footnote:

This name, asteroids, is far better than 'minor planets' for these small bodies ... It would have been convenient, but for this misuse of the term, to call the four outer planets the major, and the four inner the minor planets'. [Note that Loomis (1868) refers to the planets as 'superior' and 'inferior'.]

In publishing the Gresham Lectures that he gave between 1881 and 1882, Ledger (1882) agreed with Chambers. His eleventh lecture is entitled 'The Minor Planets', and he writes:

But we ought perhaps to explain, before we make any further remarks with regard to these little bodies, why it is that we adopt for them the appellation *Minor Planets*, in preference to any other. We do so, because the orbits in which they travel round the Sun are not only governed by the same laws, but in many respects are similar to those of the larger planets. At any rate, we may confidently say, that in no one respect, except in the minuteness of their discs, can they be justly described as star-like. The name of Asteroid, which has this meaning, and which was originally assigned to them, is therefore about as unjustifiable a title as could well be selected. (Ledger, 1882: 266).

The doyenne of astronomical history, Agnes Clerke (1885: 100), nods in the direction of Herschel's 'asteroids', but seemingly prefers to discuss the 'little family of the minor planets'. Princeton's Professor Charles Young (1895: 339), refers to 'asteroids or minor planets', and continues to use both terms in his textbook. While still writing of minor planets, Chambers (1912: 111) notes that

One remarkable fact about these planets is that their orbits are in many cases much more inclined to the Ecliptic than any of the orbits of the older planets. Hence the term 'ultra-zodiacal planets' was once suggested."

This term, 'ultra-zodiacal planets', was used by John Herschel between 1833 and 1870. It is particularly relevant that William Herschel's son resisted the use of the word 'asteroid' for so long.

In the updated version of their famous text-book, Russell, Dugan and Stewart (1926: 347), the term 'asteroid' predominates. Maybe there is much to be said for using one word instead of two! Spencer Jones (1924: 243), in section 142 of his text-book, writes:

The Minor Planets. – The minor planets or asteroids, as they were named by Sir William Herschel, are a numerous group of very small planets circulating in the space between Mars and Jupiter ...

The term 'asteroids' is then used in the following pages of description. Maybe Spencer Jones favours it because of the illustrious nature of the originator? In *The Splendour of the Heavens*, Crommelin (1923) titles his chapter 'The Asteroids or Minor Planets', but then uses the word 'asteroid' throughout what follows.

The word 'asteroid' often found its way into literature. Our favourite quote is from Sherlock Holmes:

Is he not the celebrated author of *The Dynamics of an Asteroid*, a book which ascends to such rarefied heights of pure mathematics that it is said that there was no man in the scientific press capable of criticising it? (Doyle, 1966: 409).

4 RECENT USAGE

Cecilia Payne-Gaposchkin (1954: 232) discusses the asteroids in the same section as other ‘lesser bodies of the solar system’, and notes that “... they are sometimes called minor planets or planetoids, but we shall adhere to the general practice of calling them asteroids.” Around the same time, Abetti (1954: 171) rather oversteps the mark by writing “... the misnomer ‘asteroids’, although sometimes still used, is being replaced by the designation ‘minor planets’ or ‘planetoids’.”

An early monograph on the subject is by the German astronomer Günter D. Roth (1962). The title is *The System of Minor Planets*, but this appellation probably owes much to the fact that the original German version of the book used to term ‘kleine Planeten.’

Most of the modern major American and European astronomical textbooks, including Motz and Duveen (1977), Karttunen et al. (1987), Unsöld and Baschek (1991), Zeilik et al. (1992), Carroll and Ostlie (1996) and de Pater and Lissauer (2001), embrace the word ‘asteroid’.

The early 1970s saw a ‘sea-change’ in asteroidal studies (see, for example Gehrels, 1984). The progress of the Space Age exploration of the Solar System was such that missions were being planned to the major planets. Obviously these spacecraft had to fly through the ‘asteroid belt’ so opportunities were presented for imaging some of the inhabitants. Also cosmogonists realised that asteroids provide an important key to the planetary building process and to the composition of the original solar nebula. At last we were past the time when Gehrels (1979: 7) could write

By the 1950’s the malaise in asteroid studies had come to the point where it was improper at the major observatories to work on these “minor” bodies that were called “the vermin of the sky.” Even the old-timers wondered how many more useless asteroids should be discovered.

Apparently the expression ‘the vermin of the sky’ was a conversational epithet much loved of Austrian astronomer Professor Edmund Weiss (1837–1917), Director of the Vienna Observatory from 1878, who used often to object to the way in which asteroidal trails spoilt the photographic plates that he had exposed in order to reveal the details of nearby nebulae (e.g. see Seares, 1930: 10). As an example of how asteroidal experts became disillusioned, Metcalf (1912: 201) wrote:

Formerly the discovery of a new member of the solar system was applauded as a contribution to knowledge. Lately it has been considered almost a crime.

It is like the birth of a child in an already too large family; to keep track of it and bring it up properly is too much of a strain on the family exchequer.

The Twelfth Colloquium of the International Astronomical Union was held in Tucson (Arizona) in March 1971 under the title *Physical Studies of Minor Planets* (see Gehrels, 1971). One hundred and forty people (including the second author of the present paper) attended this meeting, the first on asteroids (the term used overwhelmingly in the papers presented) in the history of the subject. Eight years later a second conference was held, which attracted 144 people. This time the title was simply *Asteroids* (see Gehrels, 1979).

Subsequent conferences have had their proceedings published under the titles of *Asteroids II* and *Asteroids III*.

5 THE INTERNATIONAL ASTRONOMICAL UNION

Ever since its founding in 1919, the International Astronomical Union has routinely shunned ‘asteroids’ and ‘asteroides’, and in its two official languages used ‘minor planets’ and ‘petites planètes’, most notably in the title of Commission 20, which deals with their positional observations, orbits and ephemerides. In 1947 the IAU’s ‘Minor Planet Center’ (MPC) was established, this choice of name perhaps seeming a little surprising since the Center was located in the U.S.A. where the early use in the *A.J.* had tended to make the term ‘asteroid’ more popular than in Europe. But the MPC had evolved after World War II from the German Astronomisches Rechen-Institut (ARI) that previously attended to the ‘Kleine Planeten’.

Since 1991 the ARI has published five editions of the *Dictionary of Minor Planet Names*, together with a recent appendix (see Schmadel, 2006).

Soon after its discovery in 1930, the object initially labelled ‘Object Lowell Observatory’ or ‘The Trans-Neptunian Planet’ came to be known widely as Pluto, ‘the ninth (major) planet’. Right from the start, several astronomers around the world were opposed to this appellation, and their numbers increased as later research showed not only that Pluto was considerably less massive and much smaller than had been initially assumed, but that—rather like Ceres—it was not alone, but was a member of a belt of even smaller, but in many respects similar, bodies. As in the early nineteenth century, the early twenty-first century saw further arguments about what constitutes a planet, this time by committees established by the IAU.

The recognition in 2005 of a more distant object that was somewhat larger than Pluto brought matters to a head, and much of the 26th General Assembly of the IAU (which was held in Prague, in August 2006) was devoted to a consideration of the ‘Pluto problem’. At the General Assembly’s final session it was decided, by a substantial majority of the more than 400 members attending, that there are just eight planets in our Solar System—those known a century and a half ago—bodies both moving in orbits that dominate their semi-major axis regions and being (more or less) spherical, because they are in hydrostatic equilibrium.

A new category of ‘dwarf planets’ was defined, this category also consisting of objects large enough to be in hydrostatic equilibrium but *not* moving in orbits dominating their regions (or “... clearing out their neighbourhood ...”, as the actual resolution put it). This new category would initially consist of Ceres, Pluto and the larger more distant object, previously known as 2003 UB₃₁₃, which received the number and name 136199 Eris a couple of weeks later. Actually, Pluto—now 134340 Pluto—was defined to be the prototype of the trans-Neptunian variety of ‘dwarf planet’, in the expectation that more members would be added when (and, indeed, if) it became possible to establish which objects were in hydrostatic equilibrium. It was not clear whether more of the traditional main-belt asteroids would also be deemed ‘dwarf planets’, but if so, Ceres would presumably become the prototype for these bodies.

As for the remainder—that is, asteroids (as the resolution actually stated), comets, meteoroids (yet another ‘kettle of fish’!), trans-Neptunian objects, etc.—they were to be known collectively as ‘small solar-system bodies’. Earlier versions of the resolution recommended that the term ‘minor planet’ be discontinued, although the term was not even mentioned in the final version, so the MPC is presumably still permitted to exist. After all, since the vast majority of the hundreds of thousands known are not in hydrostatic equilibrium, they cannot really be considered any type of ‘planet’. But, then, it was also firmly decided by democratic vote that a ‘dwarf planet’ is not a ‘planet’ either!

So we really need a different term for ‘dwarf planet’, preferably a single word. One possible term, brought up informally at the IAU meetings, is ‘planetino’. Popular though the single word ‘asteroid’ may have become in recent decades, it seems to us that this is now the ideal time to resurrect Piazzi’s original 1802 proposal of ‘planetoid’.

The three elements of the 2006 IAU resolution would therefore refer to eight ‘planets’, three (with more to come) ‘planetinos’ and a quite overwhelming number of ‘planetoids’ (not to mention comets, etc.). Although the Prague resolution to designate the trans-Neptunian ‘planetinos’ (if we may be so bold ...) as ‘plutonians’ was rejected by a very small majority, it does make sense to divide the ‘planetinos’ into ‘plutonians’ and (why not?) ‘cereans’. (After all, a possible alternative, sometimes mentioned in the backrooms of the Prague Congress Centre, would be ‘plums’ and ‘cereals’!)

6 NOTES

- Henry Brougham was born in Edinburgh on 19 September 1778. He turned out to be a gifted scholar, and at the age of 14 became a student at Edinburgh University where he studied science and mathematics (in fact all students at Edinburgh did mathematics and moral philosophy in their first year). He even presented a paper on “Experiments and Observations of the Inflection, Reflection and Colours of Light” to the *Royal Society* whilst still a student. In 1800 Brougham changed courses, transferring to the Faculty of Law. Apart from founding *The Edinburgh Review* in October 1802 with Francis Jeffrey and Sydney Smith, he also wrote 35 articles for this publication in the first two years. In 1803 or 1804 Brougham moved to London to further his law career. He then went on to become a Member of Parliament (in 1816), and was elevated to the House of Lords in 1830, becoming Lord Chancellor in Earl Grey’s Whig Government.
- Herschel was knighted in 1816.

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