Biela's Comet

by

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Introduced by Anne van Weerden

Introduction

In 1705 Edmond Halley concluded that the comet which is now named after him, was periodical. The second comet found to be periodical was, in 1818, Johann Franz Encke's comet, the third, in 1826, Wilhelm von Biela's comet. This comet appeared every six and a half years, and in 1832 the still very young Royal Astronomer of Ireland William Rowan Hamilton (1805-1865) wrote a short article about it. In this introduction Hamilton's life around that time will be described, just to show the article within the context of his life.

Every year in November and December Hamilton lectured on Astronomy, and apparently from 1831, of these lectures the Introductory Lectures became famous, which may have had to do with his having fallen in love with Ellen de Vere that summer. Some months earlier, in August 1831, the Astronomer Royal of England, George Biddell Airy (1801-1892), had visited Hamilton at Dunsink Observatory, and unknowingly, had caused Hamilton to almost lose his love for Science. Airy had considered the "Liverpool and Manchester Railway" as the "highest achievement of man," and Hamilton wrote to his pupil and friend Lord Adare, "When shall we see an incarnation of metaphysical in physical science! When shall the imagination descend, to fill with its glory the shrine prepared for it in the Universe, and the understanding minister there in lowly subjection to Reason!"

In the beginning of September 1831 Hamilton again met Ellen de Vere, whom he had learned to know two years earlier, when in August 1829 Wordsworth had been visiting the Observatory. They had dined with the Ellis family of Abbotstown and Ellen de Vere had also been present; she then was staying with her friend, one of the Ellis daughters. Meeting Ellen de Vere again, now at Adare where both were on a

visit, was a relief; "We almost instantly fell into a discussion upon [Coleridge's] Christabel, which she does not like so well as I do [...]. Yet I [...] felt interested in understanding why and how far I differed from one whose love for poetry is so sincere, and whose taste is so cultivated as Miss De Vere's."

Late in September 1831 Hamilton wrote to Adare, "My present return of respect and regard for astronomy – since the mathematical spirit was too strong and habitual in me to be subdued for more than a moment, arises [...] from finding [imagination] in astronomy too, I can sympathise with [a highly imaginative] mind like [Ellen de Vere's], and thus throw around the austere nakedness of the science the robe of a human interest [...], to me astronomy had come to be chiefly an exercise of intellect, and as such seemed superfluous, being so amply replaced by the reasonings of pure mathematics [...]. And though I have been speaking of astronomy as if it were merely a science, yet I am well aware that it is more, that it combines, in its perfection, feeling with thought, and pervades not the mind merely, but the soul of man." Only some weeks later, in November 1831, Hamilton gave the Introductory Lecture he became famous with; perhaps having been further invigorated by his experiences that summer.

Hamilton had given his 'Lectures on Astronomy' for the first time in 1830, and there must have been much talk already about the lectures. In 1831 Hamilton wrote to Lady Dunraven about the Introductory Lecture that he had had "a brilliant audience, poetry and science being present by their representatives," and about 1832 Graves wrote, "On the 8th of November Hamilton delivered the Introductory Lecture of his professorial course in the room over the vestibule of the College Dining Hall. It was filled to overflowing." The lectures "accordingly attracted crowded audiences, in which were to be seen not alone his class of Undergraduates but Fellows and Professors and literary men, with a sprinkling in addition of ladies, at that time a novelty in a College lecture-room. The subsequent lectures of the course were altogether different in style, being rigorously mathematical and demonstrative." [1]

The achievement Hamilton may have been most proud of was his success in showing the imaginative side of science to Wordsworth, who previously had venerated Science "when legitimately pursued for the purpose of elevating the mind to God," but not the "class of scientific persons [...] who themselves have no feelings of lofty enthusiasm." In February 1833 Wordsworth wrote to Hamilton, "Your Lecture [on Astronomy] I have read with much pleasure. It is philosophical and eloquent, and

[1] Despite enjoying the presence of ladies at his Introductory Lectures, as a very Victorian mathematician Hamilton believed that pure mathematics was not for women. Still, in any case in 1834 ladies were also present at the subsequent, more mathematical lectures; in December Hamilton wrote to uncle James, "As to the lectures, they continue to be well attended, and the ladies were constant to the last, except one extra day upon eclipses, which I had warned them would be particularly dry and mathematical." The "presence of such different classes of auditors" made teaching difficult, because Hamilton apparently did try to make also the subsequent lectures attractive for the larger audience. When thereafter the Provost tried to prevent non-students, and perhaps especially ladies, to attend these more mathematical lectures Hamilton did not object, happy that he could again teach as mathematically rigorous as he thought necessary. But uncle James was not at all happy with it, and wrote to Hamilton, "it seems of your last campaign one great boast and achievement has been routing the fairer part of your audience from the field, and that in Halls founded by the Virgin Queen. Does not her shade exagitate your pillow "with nightly fears"?" The course in Astronomy was given twice a week during the whole of Michaelmas term, until in 1841 the schedule changed and the students already had followed courses in mechanics and optics, making the astronomy lectures more mathematical.

instructive, and makes me regret, as I have had a thousand occasions of doing, that I did not apply to Mathematics in my youth. It is now, and has long been, too late to make up for the deficiency." To which Graves commented, "The letter [...] from Mr. Wordsworth tells the impression made by the Lecture upon one not too easily to be pleased in regard either to the style or substance of literary work. The passage is interesting in connexion with the fact that Hamilton had previously won over Wordsworth to a higher appreciation of Science than he had previously arrived at, by proving to him that in the region of discovery it called for the exercise of the imaginative faculty. It strikes one with surprise to hear Wordsworth lamenting that he had not in his youth studied mathematics." [2]

In the weeks after his renewed acquaintance with Ellen de Vere, in September 1831, Hamilton fell ever deeper in love with her, and he will have been happy that that was possible after his years of mourning for the loss of his first love, Catherine Disney. Life must have looked wonderful; next to being in love, after a summer full of discussions about a professorship in mathematics, the Board of Trinity College decided that he could stay at his beloved Observatory and devote himself principally to mathematics, and they doubled his salary. That same autumn Hamilton became a member of the British Association for the Advancement of Science, which was founded earlier that year. For the rest of his life, with hardly any exception, he visited the annual meetings which were held in different cities in England and Ireland, and lasted a week.

But in December 1831 Ellen de Vere rejected him. Hamilton's world collapsed, and he became very melancholic for many months, until in the summer of 1832 he made a most remarkable discovery. He realised that he was living a passion-wasted life, and discovered a way to change that. After two months feeling much healthier 'of body and mind,' in October he discovered conical refraction, for which he would be knighted, [3] and early in November he fell in love with Helen Bayly.

Hamilton rewrote his annual lectures every year; before writing an Introductory Lecture for May 1843 he noted in a memorandum, "Principles which have been intellectually fixed in my own mind must give some corresponding fixity to my teaching; sentences, passages may be repeated, old trains of thought followed out again, but I am far from going through a cold habitual process; I feel an always new desire to use the always new opportunity of being of what use I can to a new class of fellow-members of this University." This explains the following scene which took place in November 1832, when Hamilton just had fallen in love with Helen Bayly.

One of Helen Bayly's sisters, Penelope Rathborne, was a neighbour to the Observatory, and Hamilton had learned to know Helen Bayly because she regularly visited her sister. On the 22nd November 1832 Hamilton was happy and very much in love, and he had been writing love poems about Helen Bayly. He then wrote in a letter to Penelope Rathborne, "Lord Adare, of all people in the world, popped in on me today while I was quietly sitting among my books and papers, and I begged of him to remember what he had seen, and to give me a good *karachthur*, which he promised to do, and was surprised that he had not found me either absent or writing sonnets – for I had sent some of my late sonnets to Lady Dunraven, as she had seen all my former

[2] In 1833 Graves had moved to England, where he became curate of Undermillbeck; Wordsworth then lived only some kilometres away, in Rydal Mount, between Ambleside and Grasmere, close to Rydal Water.

[3] Hamilton was knighted in 1835, at the Dublin meeting of the British Association.

ones. Had he come a few hours earlier indeed – but as it was, he will report that I am a most industrious Professor. I believe, however, he thinks I am growing less accurate than usual, for in talking of the comet, I caught myself calling it, not Biela's, but Bayly's. I hope I shall be more careful when I come to speak of it in my lectures." [4]

The last week of November and December were difficult for Hamilton; Helen Bayly had left Dublin to visit her mother who was ill, now both were ill, and illnesses were often right out dangerous in those late Regency times. Moreover, Helen was still considering Hamilton's proposal and had not yet given her consent. During those weeks Hamilton wrote the following short, popular article about the Biela's comet, but from the first part of the publication in *The Dublin Penny Journal*, written in December 1832, it can be seen that despite his woes he did not lose his love for astronomy any more. It is not known when he wrote the second part; *The Dublin Penny Journal* was published every week, and the second part may have been written at either the same time, or early in January. Shortly after Christmas Helen agreed to marry him, and if Hamilton thus wrote the second part in January, he wrote it while being very happy.

The Comet.

pp. 207+208 No. 26. December 22, 1832

The little comet which at present excites so much the interest of astronomers and of the public, was first seen by Montaigne, at Limoges, in March 1772. It was soon afterwards observed by Messier, and on the 3d of April in the same year, a small telescopic star was seen by him shining through it, and was mistaken for a nucleus, or bright and solid body of the comet, such as many are found to possess; a more attentive examination, however, confirmed the suspicion suggested by its first appearance, that it had neither nucleus nor tail. In its appearance it resembled perfectly those faint nebulae, or little clouds of light, which are seen in great numbers among the stars by the help of telescopes, in every part of the sky, and could only be distinguished from a nebula by observing that it shifted its place among the stars, and passed from constellation to constellation. In 1806, a little comet was observed, which passed the perihelion of its orbit, that is the point nearest to the sun, on the 2d of January in that year; it was not, however, at that time recognised to be the same comet which had been seen in 1772, nor was this identity perceived until the comet was re-discovered in

[4] That evening they kissed for the first time; on the 24th Hamilton wrote to Helen Bayly, "I began to fear that you wished to part forever, and were studying to soften the rejection. The cloud was upon me for a short time indeed, [...] I seemed to see a new array of coming hours of pain, a new succession of secret struggles with grief, the breaking up of a new seal which had imprisoned a new fountain of anguish. ... And soon you rewarded me for all ... by your tacit confession the next evening, when we were again alone together. Then, for the first time, I touched the lips of any but my nearest relatives, and was filled with an unquiet joy and a trouble sweet, and you too were deeply disturbed, and I kissed away the tear from your cheek, and in the moment that we were together I seemed to enjoy a happiness more exquisite but more untranquil than any I before had known."

1826. On the evening of the 27th of February in that year, it was perceived by Biela, whose name it now bears, at Josephstadh, in Bohemia, as a small round nebulosity, which on the following evening had advanced about a degree towards the east, and had a little increased in size and brightness. Biela continued to observe it for some time. Gambart, at Marseilles, discovered it independently, on the 9th of March following, and from his observations, he concluded that it passed its perihelion on the 18th of the same month. The comet was observed soon afterwards, at Gottingen, by Harding, and at Altona, by Clansen; it disappeared about the beginning of the following May. The calculations of Gambart and of Clanson established the identity of the comet, thus discovered by Beila in 1826, with that of 1772, and with that of 1806, and shewed that this little body revolves about the sun in an ellipse or oval curve, the sun being out of the centre of the oval by about three quarters of the half length of the oval; that is, as it is technically expressed, the linear eccentricity being about three quarters of the mean distance. The time of revolution was found to be about six years and three quarters; so that, although through its faintness it happened not to be perceived, it must have passed its perihelion five times in the interval from 1772 to 1806, and twice in the interval from 1806 to 1826. It was also an inference from the time of revolution thus found, that the comet would pass its perihelion again towards the end of 1832; and a more accurate calculation since made by Baron Damoiseau, in which the attractions of the planets, especially of Jupiter, were allowed for, conducted to the expectation that this perihelion passage would take place on the 27th of November, 1832. Whether this prediction has been verified to the very letter, it is difficult as yet to say, for the faintness of the comet has scarcely suffered it to be seen; it has, however, been perceived in the excellent telescopes of Herschel, and in a part of the sky but little differing from that expected.

H.

(To be continued.)

The Comet.

(Continued from page 128.)

pp. 223+224 No. 28. January 5, 1833

In our former number, we stated that the perihelion passage of the comet was predicted to take place on the 27th of November, 1832. It was also predicted that it would pass near the orbit of the earth. These predictions, which there is no reason to think inaccurate, excited however a very disproportionate interest in the minds of persons unacquainted with astronomy, who thought that nobody would take all this trouble about an almost invisible thing, and that the expected and talked-of comet must be some enormous and terrible visitant. Accordingly, a few months ago, the

newspapers abounded with accounts of persons, who, without any incumbrance of telescopes, (and for ought we know in the day time) had seen this monstrous comet: there were even detailed descriptions of *comet hurricanes*, which regularly set in, every night at the very time of the comet's passing the meridian. In reality, however, the comet is so extremely faint an object that we have not received any authentic account of its being seen at all, except by Sir John Herschel. He, indeed, inheriting the immense reflectors, and not degenerating from the fame of his illustrious father, was able to detect this little wanderer in a place not much differing from that which theory had assigned: and the sublime delight was experienced, which attends the fulfilment of scientific prediction, the realization of scientific idea.

It is this periodical return and consequent fitness for frequent comparison with theory, that invests with so great an interest, in the minds of astronomers, a body which, from its smallness and faintness, would otherwise be utterly insignificant. Revolving about the sun in less than seven years, it seems to belong to our own system, to our own solar family. We can compare its motions with those of our own sister planets, and trace in the one, as in the other, the influence of the sun's attraction, and the fulfilment of the laws of Kepler: an influence and a fulfilment which can indeed be also traced in the orbits of all other comets, for example in that of the great comet of 1811, but only through very small portions of those enormous orbits, the rest being invisible by distance. Only a very few, out of the many comets that have been seen, are known as yet to revolve in moderate periods about the sun: and the comet of Biela was hailed with interest and delight, as an accession to this little band. Astronomers expect that near the end of 1835 another of these periodic comets will return to its perihelion, the celebrated comet of Halley, which was last seen about the time of the accession of George the Third, and which, at intervals of about three quarters of a century, had several times before attracted the notice of Europe.

The periodicity of Biela's comet has been assigned as a reason for its interesting astronomers *notwithstanding* its smallness. But there is a view, in which its *very smallness* gives to it an interest that it would not otherwise possess. To explain this other source of interest, we must be allowed to make some remarks on another little periodic comet, the comet of Encke's, which passed its perihelion last May, though from its faintness and southern position it was not seen this year in Europe, and was only detected at the observatory of the Cape of Good Hope, by Mr. Henderson, who has the charge of that establishment. This comet, also, though never easily visible, had been long watched by astronomers with interest from the rapidity of its revolution about the sun. But this interest as of late been greatly increased, by the detection, in its motion, of a little irregularity, which has been successfully accounted for on the supposition of a resisting ether diffused through the planetary spaces, while it does not seem to admit of any other explanation. No effect, indeed, of such resistance, has been yet detected in the motions of the planets: but this objection to an ether is not formidable, much less decisive. For there is abundant evidence that the planets are bodies far more dense and massy than any ordinary comets, and especially than those little comets now in question; and we know that a feather is greatly resisted by an atmosphere through which a stone makes its way without any sensible hindrance. And as, in order to observe the effects of the resistance of our atmosphere, we do not use the densest but the rarest moveables, a feather not a stone, so astronomers are glad when they find themselves furnished in the heavens with a new celestial feather,

if we may call it so, wherewith to prove the existence and watch the effects of that fine ether, through which the old cannon balls of planets held on so free a way. Thus then the very smallness of Biela's (as of Encke's) comet, is favourable to the inquiries of astronomers on an important question. But if this smallness were not combined with periodical return, the comet would disappear for ever, before it could be long enough observed to give any decisive testimony on this question of a resisting ether, and then it would be only one of a crowd, to which every few years are adding, and which have little other interest than the possibility that a remote posterity may one day detect, in the celestial phenomena of their age, some unexpected connexions with our then ancient records.

We have not spoken of the near approach of the orbit of Biela's comet to the orbit of the earth, although this has often been popularly put forward as a ground of alarming interest. There is indeed a very near approach of the two oval orbits to each other at their nearest points, an approach within about twenty thousand miles, according to the elements of Baron Damoiseau; so that the comet, moving in its own oval path, came, about the end of last October, according to calculations founded on those elements, to be only twenty thousand miles from the nearest point of the oval path of the earth: and, therefore, if the earth had happened to be at the same time in that nearest point, the comet would have been much nearer than the moon, and would only have been removed from the earth's surface by about two diameters of the earth. But the earth did not come up to that nearest point till about the end of November; and this difference of a month in time had so great an influence on the mutual distance of the two bodies, that the comet in its late approach came no nearer than within about fifty millions of miles, and is now receding from us. It is little likely that the earth and comet will ever happen to arrive together at the nearest points of their respective paths; still less that the changes which the attractions of the planets are perpetually making will ever so alter the comet's oval as to make the two paths exactly intersect, or approach so near as to render a collision possible: but even a collision with a body so light and cloudlike as the comet, would not be attended with those disastrous effects which some have amused themselves with imagining, and we need not be much concerned on *this* head for the fate of our great great great great grand children.

H.
