Sir William Rowan Hamilton

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Illnesses and Astronomy

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Abstract

Despite having been astronomy professor at Trinity College Dublin and Royal Astronomer of Ireland, Sir William Rowan Hamilton did not make his great discoveries in astronomy but in mathematics, leading later biographers to conclude that he was not very suited for this position. In the 1880s Robert Perceval Graves published a three-volumed biography of Hamilton, from which it appears that with the help of an uncle Hamilton had become a very skilled practical astronomer. But also, that he regularly suffered from bronchitis. During the first years at Dunsink Observatory his health suffered so much from working in the open dome at night that he had to give up regular observing. All that time he had combined astronomy with mathematics, and even though mathematics now became absolutely predominant, Hamilton always remained enthusiastic about special events such as eclipses, comets and meteors, and even his 1853 *Lectures on quaternions* starts with astronomy. Perhaps surprising is that ignoring Hamilton's illnesses also gave rise to the idea that 'losing' Catherine Disney, his first great love, had an influence on his grades while studying at Trinity College Dublin, which it did not.

1 Introduction

Sir William Rowan Hamilton (1805-1865), astronomy professor at Trinity College Dublin and Royal Astronomer of Ireland, was one of the greatest mathematicians of his time. Because after the first years at Dunsink Observatory he gave most of his study time to mathematics, and made his greatest discoveries, Hamiltonian mechanics and quaternion algebra, in mathematics instead of astronomy, it has been claimed that he was not very suited for the position of Royal Astronomer; that he "did make some attempts at a practical use of the telescopes in Dunsink [Observatory], but [...] possessed no natural aptitude for such work."[1] Or, that when he became Royal Astronomer he "had almost no practical experience in astronomical observation."[2]

[1] [Ball 1895, 310]. Ball nevertheless did regard Hamilton as one of the Great Astronomers because of his contribution to 'physical astronomy' in the form of what Hamilton called the 'theory of the Dynamics of the Heavens', and because of the "elucidation of the difficult subject of Planetary Perturbations" [Ball 1895, 310-311]. NB: All webpages referred to in this article, except the ones in the large archival websites, have been saved in the WayBack Machine.

[2] Spearman, D. (2009), *Dictionary of Irish Biography*, Hamilton, Sir William Rowan. This statement may be correct as regards using the observatory instruments but not in general, as will be discussed hereafter.

I had not doubted these conclusions when in 2014 I started to write my *A Victorian Marriage*,[3] and I therefore did not pay much attention to it. But working on the biographical sketch of Catherine Disney (1800-1853)[4] I had to reread Hamilton's early years as described in the biography of Hamilton written by Robert Perceval Graves (1810-1893),[5] and I now saw that in earlier chapters there were more indications of illness and a weak health than I had realised. Graves clearly was well aware of the influence Hamilton's health had on the way he lived his life, but later biographers ignored it, therewith changing not only the view on Hamilton as an astronomer, but also the view on his private life, as will be shown hereafter.[6]

In what follows I will not give extensive references for details which in Graves' biography are given in correct chronological order, or conclusions elaborately discussed in my *AVM* and my biographical sketch about Catherine Disney; they all are arranged more or less chronologically, and easy to search through.

2 1805-1819. Early years, Dublin and Trim

William Rowan Hamilton was born in Dublin, 29 Dominick Street, now 36 Lower, at midnight on 3/4 August 1805. William's extraordinary intellect showed very early, and shortly after his first birthday his parents, Archibald Hamilton (1778-1819) and Sarah Hamilton née Hutton (1780-1817), decided to send him to Trim, to be educated by Archibald's only living brother James Hamilton (1776-1847).[7] "Uncle James" was a classicist and linguist, curate in Trim and schoolmaster of the Diocesan school. Together with his sister Jane Sydney Hamilton (1779-1814) he lived in the remains of Talbot's Castle, which also housed the school.[8] "Aunt Sydney" was proficient in Latin and Hebrew, and played an active role in young William's education.

It is not known when exactly William moved to Trim; what is known about these early years and his extremely rapid progress comes from family correspondence,[9] mostly letters written by Aunt Sydney to his mother Sarah. The first letter given by Graves most likely having been written on William's third birthday, he must have been brought to Trim somewhat earlier,[10] and he was apparently accompanied by his eldest sister Grace (1802-1846).

But next to education there may have been another reason to send William to Trim; from an early age he seems to have suffered from bronchitis. In October 1808 Aunt Sydney wrote to his mother Sarah, "Your son and heir is, thank God, very well; indeed he looks better these few days than ever I saw him." In 1822 Hamilton's entrance to Trinity College

[3] A Victorian Marriage : Sir William Rowan Hamilton.

[4] Catherine Disney : a biographical sketch.

[5] [Graves 1882-89]

[6] There were many aspects in the long train of gossip which distorted the view on Hamilton's life; next to ignoring the illnesses by later biographers, perhaps even more important was ignoring the influence of the two most important women in Hamilton's life, in this case also by Graves.

[7] [Graves 1882-89, I, 30]. For the family of Archibald Hamilton see The Hamiltons of Jervis Street.

[8] Talbot's Castle may have been the refectory of St. Mary's Abbey.

[9] [Graves 1882-89, I, 30-44]

[10] On 18 April 1808 William's paternal grandmother, Grace Hamilton neé McFerrand was buried in Dublin, in the cemetery of St. Mary's Church, the parish containing both Jervis Street where, at no. 30, she had lived with her husband and children, and Dominick Street where her son Archibald lived with his family. During her last years she had lived in Trim with her children James and Jane Sydney, and she may have died in Dominick Street, or in a Dublin hospital; perhaps in the hospital at Jervis Street, or Simpson's Hospital, then in Britain Street. If Aunt Sydney was involved in taking care of her dying mother, it is very well possible that William and Grace could only move to Trim after their grandmother's death; Uncle James had not married yet, and in those days men did not take part in caring for the daily worries around little children.

Dublin was postponed because of health problems,[11] and in his biography describing 1827, when Hamilton had become Royal Astronomer and lived at Dunsink Observatory, Graves remarks that the observatory, about eight kilometres from Dublin, was more suitable for Hamilton than Dublin due to both the undisturbed quietness and the "fresh air of a country life," even though his "delicacy of chest" would become a problem for his observing in the meridian room and the observatory's dome. Describing Hamilton's last year, 1865, Graves writes that he suffered from a combination of gout, bronchitis, and other ailments, and that in Hamilton's last weeks "bronchitis supervened, and, with other ailments, led on to the inevitable close."

Realising that Trim was a small rural town with much fresh air, and that the surroundings of Talbot's Castle, where the Hamiltons lived, provided many opportunities to play outside,[12] sending William to Trim to be educated seems like a perfect decision for an extremely intelligent boy with bronchitis, for which there was no medication yet. Sarah and Archibald had already lost two children then, William in 1801 and Archibald in 1804; being able to send young William to Trim may have been a relief for the worried parents.

The Hamiltons of Dublin and Trim Having come to live in Trim William was not in any way 'adopted'; the Hamiltons of Dublin and Trim were very close, and there were regular visits which lasted for days or even weeks. And although William also strongly bonded with the Hamiltons in Trim, from later letters it is obvious that he saw his parents and his sisters as his nuclear family.

Around those years both families were changing fast; in 1809, the year his little sister Eliza turned two, another brother Archibald was born; he died early. Also two more sisters were born, Sydney in 1810, and Sarah in 1812. In February 1814 Uncle James married Elizabeth Boyle (1791/1792-1848), and in October that same year Aunt Sydney died.[13] Bessy, the eldest daughter of Uncle James and Aunt Elizabeth, was born late in 1814 or in 1815, the year also William's youngest sister Archianna was born. Around 1816 Uncle James and Aunt Elizabeth had a son who died very young, William's cousins Gracey and Mary were born in 1817 or 1818, and 1819 or 1820, respectively.[14] His mother Sarah and his little sister Sarah both died in 1817,[15] and his father in 1819,[16] shortly after having married Anne Barlow, perhaps née Pollock (.. -1823). Thereafter the siblings were taken care of by relatives.

After his father's burial William first stayed in Dublin with Arthur Hamilton (1776-1840), a barrister and cousin of his father and Uncle James. He apparently also visited other Dublin relatives,[17] and just before Christmas he returned to Trim, where he "suffered from a short illness." It seems that thereafter Grace lived regularly in Trim, while Eliza, Sydney and Archianna lived in Ballinderry, with their uncle John Willey (1781-1847) and aunt Susan Willey née Hutton (.. -1858), a sister of their mother Sarah. Also "Cousin Arthur" played an important role; he seems to have become a father figure to the Hamilton siblings, who regularly met each other in his house at 7, later 10, South Cumberland-street.

[11] See section 3, p. 4.

[12] Still today there is much opportunity to play in the open air, and the Hamiltons even swam in the river Boyne [Graves 1882-89, I, 47].

[13] Because Graves mentions her having been cared for by William's parents [Graves 1882-89, I, 27], Aunt Sydney must be the Miss Hamilton of Dominick Street who was buried on 28 October 1814. Like her mother Grace, she was buried at St. Mary's cemetery in Dublin. The difference in addresses in the burial records, "Trim" and "Dominick Street," might indicate that grandmother Grace indeed died in a Dublin hospital.

[14] For the children of the Hamiltons of Trim see The family of uncle James Hamilton of Trim.

[15] William's sister was buried on 4 January 1817, his mother died on Saturday night 10 May 1817 after an illness of only a few hours; she was buried on 13 May. They were also buried at St. Mary's cemetery. The burial records of the other early deceased children of the Hamiltons from Dublin were not found.

[16] Archibald Hamilton was buried at St. Mary's on 12 Dec 1819.

[17] [Graves 1882-89, I, 76]. "Aunt Collins" lived in Aungier street.

3 1820-1822. Astronomy and illness

The first letter given in Graves' biography in which observing is mentioned is from October 1819 when William, then fourteen years old, wrote to Grace, who apparently was with her sisters in Ballinderry, that he had "viewed the moons of Jupiter with his large telescope, and imagined to distinguish the Ring of Saturn."[18] Describing 1820 Graves mentions William's growing enthusiasm for astronomy; he observed conjunctions and occultations of the planets and their moons, "but the occurrence of two lunar eclipses, one on the 29th March, and the other on the 22nd September, and of an intervening Solar Eclipse on the 7th September, all visible at Trim, became of absorbing interest to him."[19]

William started to read astronomy,[20] and his Uncle Willey, an accomplished amateur astronomer, taught him to draw for instance maps of paths of the moon's shadow during solar eclipses. William was impressed by Uncle Willey's plans, tables and maps, which were, as he wrote, "most ingeniously, accurately, carefully, neatly, skilfully, obligingly, and beautifully executed." Apparently from 1820 Uncle Willey regularly came to Trim, and together they prepared for special events. William also studied spherical trigonometry because Uncle James wanted that, whenever Uncle Willey came, William would be able "to profit by his acquirements in practical astronomy," having studied the theory already.[21]

Perhaps not all letters describing William's observations were known to or given by Graves, but there are quite a few examples. For instance, in October and early December 1820 William tried to observe occultations of Jupiter and Venus by the Moon,[22] and in 1821 having bought an Ephemeris, he precalculated the occultation of a star by the moon on 17 June; his prediction having been 4.5 minutes early it was, for his time and circumstances, quite accurate.[23] On 14 July 1821 he wrote to Cousin Arthur, "You know you told me the last evening we were in Dublin together, that you had hopes of being able to procure me the loan of a telescope, if I had no cold on my next visit." Apparently, Cousin Arthur was worried about the effects observing had on his nephew's health.

William made calculations for the progress of a partial eclipse of the moon on 6 February 1822; he rose around three o'clock and saw the eclipse which agreed with his calculations. His aunt Mary Hutton (.. -1837) gave him a *Nautical Almanack* for 1822, and he observed Jupiter's satellites which "correspond[ed] very well with the configuration" given in the almanac. And in March he made "a great many calculations" for the partial eclipse of the Moon in August 1822. He later mentioned that his "favourite amusement" then "was calculating and observing occultations of stars by the moon; eclipses too."[24]

In April 1822 William contracted whooping cough which in adults is usually not acutely severe, yet the coughing fits cost much energy. Also in April his little cousin Kate died; William wrote to Cousin Arthur that she was buried on 18 April, "by the side of her little brother and mine."[25] Whooping cough can last for months and it is likely that in William's

[18] The earth had crossed the plane of the ring in March, making the ring virtually invisible, and because of a near crossing in November the ring was becoming very thin again.

[19] [Graves 1882-89, I, 81]. The solar eclipse was partial, see *EclipseWise.com*.

[20] In 1820 William read Joanne Keill's 1718 *Introductio ad Veram Astronomiam*, and in 1821 John Brinkley's 1813 *Elements of Astronomy* [Graves 1882-89, I, 82, 112].

[21] [Graves 1882-89, I, 82, 89, 101, 289]

[22] William wrote that the occultation of Jupiter on 18 October was "obscured by vapours," and using the planetarium program *Stellarium* it can be seen that the predicted (probably not by William) occultation of Venus on 2 December did not occur.

[23] [Graves 1882-89, I, 89, 112, 91]. Again using *Stellarium* it appeared to be an occultation of τ-Sagittarii.

[24] [Graves 1882-89, I, 99, 101, 112]

[25] William's three brothers had all died young; it is not known which of the three he was alluding to. Assuming that Kate was buried in Trim because William attended the funeral, this little brother may have died during a visit to Trim; people could die after an illness of only a few hours, see footnote 15.

case it was enhanced by his bronchitis; Graves writes, "His uncle's objections, on account of loss of time, to his accepting an invitation from his cousin [Arthur] to change the air by a visit to him having been overruled by the Doctor,[26] Hamilton went up to Dublin early in May. The change was required, for he had been for some time forbidden to read, coughed much, and had to struggle with great difficulty of breathing."[27]

Going to Dublin proved "beneficial to his health;" William resumed his studies; he read '*Differential Calculus*' by Garnier[28] and wrote a short paper about chronology in Virgil's *Aeneid* which again included astronomical calculations. He also read the *Mécanique Céleste* of Laplace, and finding a "flaw in the reasoning by which Laplace demonstrates the parallelogram of forces," or rather, providing a more general proof,[29] started a chain of events which would lead, most likely in December 1822, to his first visit to Dr. Brinkley, Royal Astronomer of Ireland, who lived at Dunsink Observatory.[30] William brought with him two new mathematical papers,[31] by which Brinkley was impressed.

In a letter to Cousin Arthur, written in October 1822, William made the telling remark, "my telescope lies untouched in a corner of my desk, and my coughs forget to trouble me." Not only does it indicate his growing interest in pure mathematics at the cost of his astronomy, it can also be seen as another foreboding of the health problems during his early years at Dunsink, due to observing regularly. Yet in January 1823 he again prepared for an eclipse of the Moon, and it hardly needs to be evinced that, the enthusiastic genius he was, his calculations were again quite accurate.[32]

4 1822-1823. Illness and TCD

It had apparently been planned that William would enter Trinity College Dublin (TCD) in October or November 1822. In July he was again in Dublin at Cousin Arthur's house, and on 18 July he wrote to Eliza that Charles Boyton would be his tutor; he was a son of a family friend, and had become a Fellow on 13 July 1821.[33] A large entrance exam had been held on 1 July 1822, and the next main exam dates were 14 October and 4 November.[34]

[26] Allowing William to go to Dublin seems to contradict the idea of the city's bad air, yet from the context it can be seen that the benefit will have come from changing surroundings or even, having been forbidden to read, being away from his uncle's pressures for a while. These pressures will generally not have been a problem for William, but they may have been under these circumstances.

[27] Going to Dublin 'early in May' and 'for some time' having been forbidden to read indicates that William contracted whooping cough before Kate's death. Whooping cough being highly contagious and most common in little children, they may have caught the illness together, leading to Kate's death.

[28] Garnier, J.-G., (1813), *Géométrie Analytique, ou, Application de l'algèbre a la géometrie.*

[29] [Graves 1882-89, I, 103, 661-662]. Graves calls finding the 'flaw' a "great masterpiece" but that is an exaggeration, see Hamilton and the flaw in Laplace.

[30] Together with two apprentices of his father, on 8 July 1819 William had also visited the observatory. Brinkley had not been at home but the instruments had been shown by the assistant; that must have been Charles Duncan Thompson (ca 1794-1876) who was astronomy assistant from 1817 until the early 1870s, therefore also during the entire time Hamilton was Royal Astronomer, 1827 until 1865.

[31] [Graves 1882-89, I, 124]. William found the 'flaw' in Laplace in May 1822, but Graves does not give an exact month for William's first visit to Brinkley. Yet one of the papers, 'On Contacts between Algebraic Curves and Surfaces,' was written in December 1822, which means that there were in any case seven months between finding the 'flaw' and visiting Brinkley late in December 1822, or perhaps early in 1823.

[32] Checking his predictions with *Stellarium*, his calculations again appeared to be in good agreement.

[33] [Graves 1882-89, I, 81, 91, 108]. Charles Boyton (ca 1800-1844).

[34] TCD Admissions Records, 1769-1825. Around those years exams attended by many candidates were held on the first Mondays of July (except when the feast day the Visitation of the B.V. Mary, 2 July, was on a Monday) and November, and in October mostly the first Mondays, but also the second or the third. Next to these large sessions there were many small ones, mostly on Mondays but not always, sometimes attended by only one candidate. That also these exams were admission sessions in their own right can be deduced from the 'meridie' given to the best answerers of these exams.

It had meant that William and Eliza would see each other more often because while attending college William would live in Dublin with Cousin Arthur, and Eliza was, apparently since September 1822, enrolled in the school of the Misses Bithia (.. -1835) and Frances (.. -1825) Hincks in North Great George's-street in Dublin.[35]

But William's whooping-cough appears to have been enhanced, or extended, by his bronchitis, and in October he still had not yet fully recovered. Graves writes, "The following letter [to Eliza, written on 9 October 1822,] announces the postponement till the summer of the next year of his entrance into College. This decision was arrived at after much discussion between his uncle and his Cousin Arthur, the determining motive being the state of his health, which during the spring and the summer had caused much uneasiness."

William wrote, "We shall probably not meet until Christmas, as I am not to enter College till next July, which is a disappointment to us both. ... The Sunday before last I received what is justly styled in our Liturgy "the most comfortable Sacrament of the Body and Blood of Christ." I had been prevented by my cough from attending at several returns of that holy ordinance, and even from joining at all in public worship. I am convinced that the precept is wise which enjoins us not to forsake the assembling of ourselves together."

In January 1823 William confirmed to Eliza that he would enter TCD in July, and wrote that although he would be very busy preparing himself, he had to tell her about "the eclipse of the moon, last Sunday evening. I had made calculations of all the circumstances six months ago, and I showed them to uncle as soon as dinner was over. He wrote a note to ask Mr. Butler and his brother to come to observe, and drink tea; they came, but not till all was nearly over. When the time of emersion approached, for the moon was totally eclipsed, I went out to the garden: the stars and planets were glowing, but their queen was absent. I sought her, but her place was nowhere to be found. Shortly afterwards, I saw through my telescope the first Satellite of Jupiter and knew that the emersion of the moon must have taken place. For it is a remarkable coincidence that Jupiter's moon emerged from a total eclipse only three minutes and a-half before ours did. At the same time Saturn was on the meridian,[36] and in some parts of the world the moon was seen to cover a small star while itself totally eclipsed. So I think an astrologer would say something wonderful was portended. I went out and saw that the moon had just begun to emerge. What then must have been the feelings of one who worshipped the host of heaven, and knew not that their motions were reduced to calculation! For myself, as I gazed, my delight was blended with awe. That instant, I observed a falling star, and the circumstance struck me. I observed a similar one during the last eclipse of the moon, and told Cousin Arthur that the heavens seemed to sympathise in commotion with the astonished earth. [. . .] The shadow of the earth went rapidly off the moon, moving apparently in a north-west direction, as I had calculated, such as this /. The whole course of emerging from total darkness to perfect light did not occupy an hour. It was interesting to observe the gradual increase of the moonlight on the scenery. At last the shadow went off entirely, to wander through space until the 23rd of July, when it will again cause a total eclipse."

[35] The Misses Hincks were related by marriage to the Huttons, see Hamilton's introduction to Coleridge. Both Grace, Eliza and Sydney attended their school [Graves 1882-89, I, 173] yet is not known when exactly; for Grace and Sydney there are only indications for 1825. In Eliza's case it can be inferred that both in May and in July 1822 she was in Ballinderry [Graves 1882-89, I, 100-101, 108], and it is certain that she attended the school in May 1823. She was fifteen then, and apparently lived in or near the school with the Misses Hincks, also regularly visiting other relatives such as the Huttons at 'Kilmore House near Clontarf' [Graves 1882-89, I, 99, 141, 173]. But a letter written on 23 September 1822 [Graves 1882-89, I, 114] and the letter written in October 1822, given hereafter, indicate that she then already was in Dublin, which means that she most likely enrolled in September 1822. Archianna only was seven then; her having been so much younger may have meant that more than her sisters she saw the Willey family of Ballinderry as her own, which in turn may be one of the reasons she is mentioned less often in Graves' biography.

[36] That means that Saturn was exactly in the south.

In February he wrote to Cousin Arthur, "I observed, four weeks ago, that while part of the moon was still under the eclipse the centre was less visible than the circumference. Since that time I have found an adequate cause of the phenomenon in the rarity of the lunar atmosphere. In the sun, on the contrary, which has a dense atmosphere, it is ascertained that the centre is brighter than the circumference. [...] Another thing that struck me was the near coincidence in point of time between the eclipse of our moon and that of the first Satellite of Jupiter. By an investigation founded on the successive propagation of light, I ascertained that there were places (not in this earth) at which the emersion of Jupiter's moon and the middle of the eclipse of ours would have appeared to synchronise, and also that these places are all contained in a hyperboloid of revolution, Jupiter being in one focus, the earth in the other, and the axis equal to the space that light traverses in the difference of the times of the phenomena: about ninety millions of miles. The result is remarkable."

The latter observation is one of the examples signifying that William was becoming a mathematician, which had started in 1822. In August 1821 Uncle James had given him Bartholomew Lloyd's 1819 *Analytic Geometry*,[37] about which William wrote in 1822 to Cousin Arthur, "Ill-omened gift! it was the commencement of my present course of mathematical reading, which has in so great a degree withdrawn my attention, I may say my affection, from the Classics." That year he wrote his first original mathematical papers, yet he also worked hard on the classics. He would indeed always be able to change subjects even though it was not always easy; in January 1823 he remarked that to be able to study the classics he had to give up his "favourite mathematical studies, [...] lest they should interfere too much with my classical – and that not merely by the time they require, but by occupying my thoughts even at moments when they are not before my eyes."

In April 1823 William mentioned in a letter to Eliza that he had "a cold, as usual." Having visited Dunsink Observatory, in May he wrote to Cousin Arthur that he had forgotten to tell him "one thing about the Pole star. When I saw it through the telescope, to my great surprise I observed it move from west to east, and cried out "It is going wrong!" Doctor Brinkley was amused, and explained that the telescope inverted objects. He also remarked that the Pole star moves with about thirty times less velocity than one in the Equator."

On the last day of May William mentioned to have made a curious discovery in Optics, and Graves suggested that he was referring to his 'Characteristic Function',[38] which would lead to what is now called Hamiltonian mechanics. Graves continued, "On the 7th of July, 1823, preceded by rumours, not unfounded, of the intellectual prowess of 'Hamilton the Prodigy,' he made his appearance in the courts of Trinity College, and underwent the Entrance Examination. As was expected, he came out first of one hundred candidates,[39] and on the next day obtained a premium[40] for his answering at an examination in Hebrew."

[37] Lloyd, B. (1819), *Analytic Geometry*.

[38] In 1822 Hamilton had written "an Essay which contains the germ of his investigations respecting Systems of Rays, which were begun in the following year" [Graves 1882-89, I, 110]. On 13 December 1824 his paper 'On Caustics, part I', was read at the meeting of the Royal Irish Academy, it was communicated by Brinkley, who then was president of the RIA [Graves 1882-89, I, 177]. The paper was referred to a committee, which on 13 June 1825 reported that it was so abstract and general that it was necessary to explain how the formulae and conclusions were obtained [Graves 1882-89, I, 186]. The paper then evolved into Hamilton's first paper on the Theory of Systems of Rays, which was published in the Transactions in 1828. It is noted there that the paper was read 3 December 1824 (that should have been 13 December; the meetings were on Mondays), acknowledging that it was in fact the same paper, and in a footnote Hamilton comments that he had extended it during the periods of delay of printing the volume. Hamilton wrote the footnote in June 1827, apparently while staying with the departing Brinkley at the observatory; he had been appointed Royal Astronomer on 16 June 1827, passed his final exams on 19 and 20 June, and received his BA on 10 July.

[39] Remarkably, this was the only entrance exam around that time with exactly a hundred candidates. Hamilton will have been happy with it, he liked such number coincidences [Graves 1882-89, II, 256].

[40] Obtaining a premium meant to have been 'the best answerer.'

College apparently did not start immediately after Entrance, but after the summer holidays. In July William again visited Brinkley at the observatory, mentioned the upcoming eclipse of the moon in a letter to Eliza, and on the day of the eclipse, 23 July 1823, he wrote a poem, 'Ode to the Moon under total eclipse'. He made excursions, for instance to the Dargle river, and in September he finally started his "life as a Student."

5 1823-1825. College and Catherine Disney

Even though it was very difficult for Hamilton, his grades were hardly influenced by 'losing' Catherine Disney, as has been claimed. These claims in turn overshadowed the fact that in the Winter of 1825-1826 Hamilton was really very ill.

Graves writes, "the first year of Hamilton's college career justified all the expectations entertained by his friends, and foreshowed the intellectual altitude he was destined to attain. It was one of unprecedented success. At the first, or Hilary, examination[41] he gained both premiums, and about the same time was awarded a Chancellor's Prize for his Poem on the subject of 'The Ionian Islands'. At each of the three subsequent examinations he obtained both certificates [for Science and the Classics];[42] but at the examination in Trinity Term [during the last days of June 1824] a still higher honour was conferred upon him by the examiner in Classics, Dr. Elrington,[43] awarding the judgment of optime to his answering in Homer. [...] The honour on this occasion was entirely unexpected by Hamilton."

Notwithstanding his enormous intellect Hamilton had to work hard; on 8 October 1823 he wrote to Eliza, apparently alluding to the premium for Hebrew he had won the day after the Entrance examinations, "One thing only have I to regret in the direction of my studies, that they should be diverted or rather, rudely forced by the College Course from their natural bent and favourite channel. That bent, you know, is Science – Science in its most exalted heights, in its most secret recesses. It has so captivated me – so seized on, I may say, my affections – that my attention to Classical studies is an effort, and an irksome one. And I own that before I entered College, I did not hope that in them I would rise above mediocrity. My success surprised me; but it has also given me a spur, by holding out a prospect that even in the less agreeable part of my business I may hope still to succeed."

Graves continues, "It was also at the commencement of this summer that he received a second Chancellor's Prize for his poem 'Eustace de St. Pierre', the subject being the well-known incident in the Siege of Calais. These two prize poems [are] written in different styles, but both more spirited and impulsive than is ordinarily the case with compositions of the same class."

In August 1824, just before starting his second year at college, Hamilton met Catherine Disney in Summerhill House near Trim.[44] He was visiting the family with Uncle James, and he immediately fell deeply in love with her. Still in August he visited Edgeworthstown where he met Maria Edgeworth, and in September he was preparing for examinations. He also worked on his 'curious discovery;' that paper was communicated in December.[45]

[41] Before Bartholomew Lloyd's Provostship, which started in 1831, there were four terms: Hilary, Easter, Trinity and Michaelmas; the exams were held in January, April, June, and October [Graves 1882-89, I, 194, 181, 186, 190]. Hamilton's first exam was apparently four or five months after having started College.

[42] Premiums were given to a student only once a year, if he became the best answerer again he received a certificate. That was apparently due to the fact that the premium was accompanied by "books to a certain value to be obtained from the University Bookseller."

[43] Charles Richard Elrington (1787-1850). On 3 July Hamilton wrote to Aunt Mary about the optime, mentioning that he had not yet recovered from his lack of sleep between the two examination days.

[44] Summerhill was a hundred-roomed mansion in Co Meath. Catherine's father Thomas Disney was agent to Lord Langford, and his family apparently but perhaps temporarily lived at Summerhill.

[45] See footnote 38.

Having visited the Disneys regularly, and having fallen even deeper in love, in February 1825 he wrote a Valentine poem for Catherine.[46] But in the second half of that month he "had to suffer [a disappointment] which fell with crushing weight upon his heart and spirits. He learned quite unexpectedly from the lips of her mother that the lovely object of his passionate admiration was claimed as bride by an elder suitor, and that her marriage would shortly take place."[47] It clearly was a devastating shock, yet in March Hamilton won a premium for the Catechetical Examinations, having been lent several books by for instance Edward and James Disney, two of Catherine's brothers. He received the premium "as well for regularity of attendance as for goodness of answering."

Just before Easter, which in 1825 fell on 3 April, Hamilton was "occupied in scientific pursuits and projects," leading Uncle James to express "some misgiving [...] as to whether he was doing justice to his Classical preparation," and indeed, in the Easter Examination Hamilton did receive lower grades than usual. This has been taken as a sign that Hamilton was in distress over having lost Catherine[48] yet that conclusion is too easy; he doubtlessly had a very difficult time, but there was more to what had happened.[49]

Graves explains, "What occurred at the Examination [...] was, that while [Hamilton's] success in Science was what it always had been, Mr. Kennedy, as his Examiner in Classics,[50] gave the secondary judgment of bene to his answering in both Greek and Latin authors,[51] appending to his theme the usual valde bene; but Mr. Kennedy was not content with this amount of depression of Hamilton's established character as a Classical scholar; he went so far as to stop, as it was called, the Classical Certificate in the division; thus intimating that neither Hamilton nor his competitors for the honour had reached the standard of positive merit required. He also withheld the Classical Premium from the division. This decision of the Examiner was loudly exclaimed against at the time. Mr. Kennedy's character protected him from all dishonouring imputations; but his Examination was freely charged with unreasonableness, and it was moreover averred that, persuaded as he was that no Examiner in College was qualified to give an optime in Greek but himself, the remembrance of this honour having been conferred on Hamilton by another, and in a subject, the Iliad of Homer, which he had made his own by publishing an edition of the work, had brought him down upon the distinguished Undergraduate, animated by a personal feeling which caused actual, though it might be unconscious, unfairness. However, we have seen that Hamilton's preparation in Classics had not been careful, and he wisely took his disappointment without a murmur as an admonition for his future guidance."

And in a footnote Graves adds, "By reference to the Examination books in Trinity College, I have verified the fact of the stoppage both of Certificate and Premium; and it is certainly remarkable that not only Hamilton, but several other students in this division, who both before and after this Examination uniformly obtained valdes in Classics, suffered on this occasion the same depression of their judgments as he did: I may name [William Robert] Halliday [(1808-1878)], who subsequently obtained the Classical Medal in his class, and Bartholomew [Clifford] Lloyd [(1808-1872)], brother of the late Provost."[52]

[46] In the biographical sketch of Catherine Disney a suggestion is made about a connection between Hamilton's Valentine poem and the family's decision to hasten the apparently agreed marriage.

[47] [Graves 1882-89, II, 610]. Catherine married on the 5th of May 1825.

[48] See for instance Hamilton's page at the MacTutor website.

[49] Having given more attention to Science than to the Classics may have been caused by his "disappointment;" it may have been easier for him to become engulfed in Science and forget everything else, than in the Classics, see p. 8.

[50] James Kennedy Baillie had also been the examiner in the Catechetical Examinations.

[51] The degrees descended from "valde bene through bene, satis, mediocriter to vix medi, with its accompanying caution. Valde bene was the judgment bestowed upon thoroughly good answering" [Graves 1882-89, I, 154].

[52] Humphrey Lloyd died in 1881; Graves published the first volume of the biography in 1882.

6 1825-1826. Catherine Disney, exams, and illness

Graves' biography is sometimes hard to follow because it mostly is chronological but not always. Although this Examination happened in April 1825, Graves gives the disappointment about the grades and the disappointment of hearing about Catherine's marriage in one sentence, and in reversed order. Thereafter he gives the poem 'The Enthusiast', which was written in January 1826, in which Hamilton described how happy he had been with his Science and with loving Catherine, and how losing her had left him "darkly changed." Graves then adds in a footnote that in December 1853 Hamilton wrote to his friend Augustus De Morgan, "The Enthusiast' was composed on a sick bed, during almost the only time of serious illness that I can remember, and one brought on chiefly by brooding on that youthful grief, notwithstanding great and successful efforts to maintain a high (indeed at that time brilliant) reputation in my own University. The gloom described at the close is therefore not a fair description, or anticipation, of my subsequent life."

After having given this 1826 poem, Graves gives the poem 'A Farewell' which was written in May 1825, shortly after Catherine's wedding; in this poem Hamilton wrote that he had not felt able to attend the wedding, but that he wished her a very happy life. Graves comments, "It was well for Hamilton that the calls upon him for intellectual exertion were imperative, allowing of no remission, of no brooding over sorrow. He sedulously prepared himself at Trim for the June Examination [1825], in which his old success attended him, valde in omnibus, and the two Certificates in Science and Classics."[53]

But only when having arrived at the end of the year 1825, therefore thirteen pages after having mentioned the illness in connection to the 1826 poem and thus leaving the suggestion that it had rather been a depression than an illness, Graves writes that Hamilton's illness had been serious. "Concerning the end of the year 1825, little information is supplied by the correspondence in my hands. It is certain that he went in at the October Examination [1825], and obtained both Certificates, though with a bene for theme; and from letters in the early part of the succeeding year, and from the fact that he did not present himself at the January Examination [1826], it appears that in the first half of the winter he must have been seriously out of health. Indeed in one of the 'Stanley Papers'[54] he refers to his indisposition as a 'long and painful illness.' It is not to be wondered at that the strain upon heart and mind which he had undergone should have told upon him."

In this last sentence again putting emphasis on the connection between losing Catherine and the illness, Graves may have intended to show Hamilton's distress without saying it too explicit. But although he had mentioned that Hamilton had not been able to 'brood over sorrow' too long because of the "calls upon him for intellectual exertion," by writing the biography as he did, allowing for such concealments and achronologicality, and combining Hamilton's lower grades, the 1826 poem and the illness, he left much room for speculation about many months of melancholy, having caused Hamilton's health to deteriorate.

Yet even if Hamilton had been brooding and therewith had weakened his health, only after the addition that it had been a 'long and painful illness' it can be seen that it was not just a depression of some sort; in those days many people often became very ill and many people died young, even while being happy. Moreover, in that same year, 1825, Hamilton met Arabella Lawrence, to whom he wrote a very open letter about his love for poetry and his fascination with and passion for science; he was not just brooding or melancholic for months on end.

[53] It can be inferred that Hamilton then decided to do what he would do for the next six years: work hard and try to "maintain his philosophic calm." For how he discovered how to handle such feelings see p. 12.

[54] The 'Stanley Papers' were apparently written by Hamilton, Grace, Eliza and Sydney, Catherine (most likely until February 1825), her sister Anne, and the five Disney brothers who then attended College. The papers were meant to "furnish material for regular discussions," which were held in Dublin.

In April 1826 Hamilton received his second optime;[55] "As the former optime [1824] was conferred upon his answering in Greek, this was gained by his mastery in Mathematical Physics, as exhibited in an examination conducted by Mr. Boyton, a scholar of high reputation in this department, and therefore justified in thus signalising the answering of a student. It gave to Hamilton the unique distinction of having obtained two such judgments, a distinction rendered the more remarkable by the fact that one was in Classics, the other in Science. He now became a celebrity in the intellectual circle of Dublin; and invitations, embarrassing from their number, poured in upon him, but he had strength of character sufficient to keep him from yielding to seductions of this kind, and he remained throughout his Collegiate course the steadily industrious student which he had been before. Not that he did not enjoy society and companionship: he was cheerful and sympathetic, and perfectly free alike from affectation and from conceit."

On the 7th of June 1826 Hamilton wrote a poem which shows that having lost Catherine was still very difficult; it sounds as if he tried to soothe himself. But it also shows that he did not have the slightest notion that Catherine's marriage had been forced upon her,

> Peace be around thee, wherever thou goest;
> Happiness still o'er thy bright path hover!
> Nor aught of gloom or of sorrow come
> The sunshine of thy young days to cover!
> All gladness go with thee, all bliss that springs
> From a mind at ease, in pure thoughts dwelling;
> And rich be thy home with undying joys
> From wedded Love's holy fountain welling!
>
> And yet, oh yet! not quite forgotten
> Be *he* to whom thou wert a light so long;
> A thought that was twined with his fondest musings,
> His early dream, his fount of song!
> Who, though once to thy heart, to thy love, he aspired,
> Now asks but a passing thought from thee;
> Remember me as a brother *only*:
> But yet, as a brother, *remember* me!
>
> But may peace be around thee, wherever thou goest!
> May happiness still o'er thy bright path hover!
> Nor aught of gloom or of sorrow come
> The sunshine of thy young days to cover!
> May thy home be rich with the still-new joys
> From wedded Love's holy fountain welling,
> And thy heart be a shrine for the bliss that springs
> From a tranquil mind, in pure thoughts dwelling!

6.1 1825-1826 in chronological order

Graves' giving up chronologicality left much room for speculation about a cause for Hamilton's alleged lower grades. To see why this is too simplistic, or simply not true, the events are given again, but now in chronological order.

[55] Optimes were very rare indeed; between 1775 and 1780 Thomas Elrington had received an optime, the next one was given to John Henry North between 1803 and 1809, and Hamilton received them in 1824 and 1826. At a dinner in 1826 John North said about Hamilton, "I used to be very proud of my one optime, but here is a gentleman that has thrown me into the shade with his two optimes" [Graves 1882-89, I, 221].

On 14 February 1825 Hamilton wrote the Valentine poem; before the end of the month he heard that Catherine was going to marry in May. In March he won a premium at the Catechetical Examinations, in April he received his usual high grades for Science and for his theme in Classics, but a bene for Greek and Latin authors. In May 1825 he wrote the farewell poem, in June he again received certificates in both Science and the Classics. In October he obtained both certificates, but a bene for theme. In the Winter of 1825-1826 he was ill, he did not attend the January Examinations of 1826, and wrote the poem 'The Enthusiast' on his sickbed. In April he received, next to both premiums, his second optime, and on 7 June he wrote the poem in which he wished Catherine a peaceful and happy life.

Clearly, Hamilton's lower grades, two benes instead of valde benes, were not so directly related to losing Catherine as they seemed to be, to which it should be added that 'lower grades' only meant not the highest grades; also benes were of course very good grades. Placing the events in chronological order also shows that the emphasis on the connection between the illness and losing Catherine diverted the attention away from the fact that Hamilton did not have such a stable health as he seems to have had when the biography is read superficially; next to his obviously chronic bronchitis, several times he was seriously ill.

6.2 The Enthusiast remark, a psychological discovery, and illness

Concluding this period in Hamilton's life, his 1853 remark about the 1826 poem 'The Enthusiast' has to be discussed; Graves' opinions, and his choice to give the poem and the footnote in the description of 1825, have contributed greatly to the view on Hamilton as a brooding man, who in his whole life only really loved Catherine Disney.

In December 1831 Hamilton was rejected by Ellen de Vere, the second woman he had fallen in love with. Even though he was again able to work hard on his mathematics, this time he was far more clearly and openly melancholic, until in the summer of 1832 he discovered how to handle his feelings of "gloom and languor." He wrote to his new friend Aubrey de Vere, one of Ellen's brothers, that "a great revolution" in his feelings had taken place. Through the 'revival of the power of hope,' as he called it, his increased health 'of body and mind' led to his discovery of conical refraction for which he would be knighted, and to his falling in love with Helen Bayly, with whom he would marry in 1833.

Hamilton made his remark about 'The Enthusiast' on 14 December 1853, only some weeks after Catherine's death and therefore shortly after having heard for the first time that she had also loved him but had been coerced into her marriage; it was again very difficult for him, yet this time he was able to handle himself. Then regarding the remark that his 1826 illness had been "brought on chiefly by brooding on that youthful grief" in the light of his 1832 discovery, a discovery he more than once referred to in later years and which he now made use of, it can be seen that rather than some stated truth, the remark was a contemplation about how unable he had been in his younger years to handle such feelings.

Graves seems to have befriended Hamilton personally in 1829,[56] and he did not recognise the importance of Hamilton's discovery. This may have been due to a lack of psychological insight, or to his having left for England in 1833; they only saw each other occasionally, and Graves returned to Dublin in 1864, when Hamilton was quite ill already. Graves thus may have kept the image of his friend as he had known him in their younger years; as having been prone to melancholy and brooding over sorrow.

There is yet another aspect to the connection Hamilton made between illnesses and happiness, in 1832 feeling that his health had been restored after his psychological discovery, and in 1853 assuming that in 1826 he had fallen ill because of his brooding over sorrow.

[56] Hamilton had befriended John Graves (1806-1870), Robert's elder brother. Graves does mention visits to Cousin Arthur's house when he was younger; they therefore knew each other already before 1829.

In his time viruses, bacteria, and many other causes of illness were unknown. Many women died in childbirth, and people could fall ill and die in only a few hours; calomel and laudanum were common medicines and blood letting by leeches was a standard treatment. With death so omnipresent it is easy to imagine that people hoped their psychological strength would protect them. Knowing about health what we know now, also as regards his opinions about illnesses it is important to judge Hamilton within the context of his time.

7 1827-1865. Illnesses and astronomy in later years

In April 1827 Hamilton presented an 'Account' to the Royal Irish Academy in which he "in popular language set forth the substance of his Essay on a 'Theory of Systems of Rays.'" Already being "a celebrity in the intellectual circle of Dublin" because of his two optimes, knowing how good he was in practical astronomy, that he was working on a theory about optics, and that he had become a regular visitor at the observatory, there was nothing very unexpected to his having been nominated, even if only twenty-one years old, as astronomy professor at Trinity College, and Royal Astronomer of Ireland. He was unanimously elected to the professorship in June, and in October 1827 he moved into Dunsink Observatory.

From then on he yearly lectured on Astronomy, yet he did not take it lightly; he rewrote his lectures every year. From these lectures it is obvious that astronomy remained awe inspiring for him, and he was very able to convey his enthusiasm to others. Apparently from 1830 until 1841, when the schedule at TCD changed and his Lectures were given at a time the students were already advanced in optics, his Introductory Addresses attracted many members of the public.[57] And he also was serious about becoming an active practical astronomer; for instance in December 1827 Hamilton wrote to Wordsworth that he had been up all night, observing.

Yet Graves thus starts describing 1828, "The commencement of Hamilton's practice as an Observer rather seriously affected his health. He suffered from constant cold in head and chest, and was much of his time confined to the house. He, notwithstanding, persevered in the occupations of the meridian-room, at this time rendered more trying by roof-shutters out of gear. This perseverance is proved by an active correspondence which began in the early part of 1828, between him and Dr. Robinson [of Armagh Observatory] exchanging observations of moon-culminating stars, with a view to determine the difference of longitude between Dunsink and Armagh. He was also employed in preparing for the printer the conclusion of his Essay on Systems of Rays by expanding some of the discussions. At length intermission of study, and to this end change of scene, became evidently necessary; and as his friends both at Armagh and Edgeworthstown had been competing for him as a guest, he acted successively upon their invitations. At Armagh he could scarcely have escaped more observing than he was fit for; and therefore, though feeling that the second half of his visit to his brother-Professor was an outstanding debt, he gave precedence to Edgeworthstown."

Early in April 1828 having returned to the Observatory, Hamilton felt "restored in health and spirit." In May 1828 he wrote to Robinson, "I have been star-gazing a good deal, I scarcely dare to say observing, but I find my interest in practical astronomy [Graves inserts: returning] gradually on me, and I am sure that as soon as I can hope to be of any use to Science by my observations, I shall not [Graves inserts: grudge] any labour or shrink from any exertion. My Essay has been quite finished for some time, at least the First Part of it, so far as depended on my own revisions. ... Airy [of Greenwich Observatory] says in his last

[57] Hamilton's famous series of Introductory Lectures on Astronomy 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."

letter, which he dates from the Observatory of Cambridge [...], that he will perhaps think it necessary for his astronomical education to revisit my Observatory, a remark which I may with much greater truth [Graves inserts: apply] to my deferred visit to Armagh."

In October 1828 Hamilton wrote to Robinson, "I have been busy observing and calculating, which I am beginning to take a great interest in. I am sorry to hear that your children have the whooping-cough; but it is better for Tommy to have it now than when he is about to enter College, as was the case with me." But Hamilton's health was again not good; in December 1828 Robinson wrote, "I am glad to hear so good an account of your Lectures [on Astronomy], and regret that I could not hear one of them for the pleasure of seeing my expectations so perfectly fulfilled. Good-bye, and go to bed and rise early, for I hear you are not as well as everyone who knows you will wish you to be. The intemperance of study is as fatal as any other, or even more so, for it cuts off only the noblest of our race."

Hamilton indeed still observed regularly; in May 1829 he wrote to his aunt Mary Hutton, "A line to tell you that, having had a good deal of observation for some time past, I always muffle myself up, and have found your dressing-gown very comfortable. I cannot say so much for the beautiful fur cap, which, as well as my hat and college cap, I find badly suited for hard work. In their stead I wear a night-cap, and over it a Welsh wig, which make me a comical figure." And by 1831 Hamilton was so used to the telescope that he wrote to Grace, "While wandering on our steamer on Lough Derg, [...] I cast my eye on the nearest vessel of the chain which we were towing after us, and read its number as 189. In truth it was 681; but my eyes, accustomed to inverting telescopes, made this my optical blunder."

But that year also was the year Hamilton gave up; becoming ill from observing so often would obviously destroy almost anyone's motivation. In May 1831 he wrote to Robinson, "My tastes, as you know, are decidedly mathematical rather than physical, and I dislike observing; which circumstance makes me rather unfit for holding an Observatory as a contemporary and compatriot of you." Robinson answered that the German astronomer Encke hated observing, and that Hamilton's assistant Thompson could do the largest part of the observations; that would indeed become the common practice at Dunsink Observatory.

Nevertheless, in 1838 Hamilton was involved in a project with Robinson to determine "the longitude of the Observatories of Armagh and Dublin, respectively, by the method of Chronometers," and later by "rocket-signals." And throughout his life Hamilton remained to be enthusiastic about astronomical events such as comets and eclipses;[58] he visited Lord Rosse and his large telescopes at Birr Castle, he described the grinding process of the mirrors to his wife, held open days for the public at the observatory, and spent much time explaining astronomy to amateurs. He gave evening lectures at people's homes, and aided, for instance, Mary Ward (1827-1869) when she wrote a book about objects visible with a good but small telescope.[59]

7.1 Theoretical astronomy

In Hamilton's time it was widely recognised that, even though after the first years at Dunsink Observatory he did not regularly observe any more, he always remained closely involved in astronomy. In 1842 it was written in the *Athenæum* about the annual meeting of the British Association that "peculiar interest was excited by the presence of the three great astronomers, Bessel, Herschel, and Hamilton, who were seen seated together on the platform."

In 1846 Hamilton was working on his astronomy lectures, which "in this term had for its chief subject the perturbation of the planetary orbits, in connexion with the recent

[58] For the experiments see the Transactions of the Royal Irish Academy, vol. 19, pp. 110-146. For impressions about his enthusiasm see Astronomy in 1848, and On an 1850 report of a fireball.

[59] The Hon. Mrs. Ward, 1859, Telescope teachings.

discovery of the ultra-Uranian planet, which had not yet definitively received the name of Neptune. It is to the direction thus given to his thoughts that we probably owe an astronomico-mathematical discovery of remarkable elegance which signalised for Hamilton the last month of this year. It was communicated by him to the Royal Irish Academy on the 14th December, 1846, and was 'a new mode of geometrically conceiving, and of expressing in symbolical language, the Newtonian law of attraction, and the mathematical problem of determining the orbits and perturbations of bodies which are governed in their motions by that law." Hamilton called his discovery the 'hodograph'.[60]

In July 1847 Hamilton wrote to Graves, "The Oxford Meeting has been an eminently successful one, decidedly taking rank among the greatest and best of the Meetings of the British Association. The astronomical character has been very prominent, perhaps more so than on any former occasion. It has several times happened to me to sit between Struve and Le Verrier (both of whom, somewhat to my surprise, and certainly beyond my deserts, assigned to me a high place among British astronomers in their speeches at the concluding meeting). And when I rose to give an account of the application of the Calculus of Quaternions to the Theory of the Moon,[61] on the Thursday of last week, and saw before me not only those two eminent foreign astronomers, but also Herschel, and Airy, and Adams, and Challis, besides Peacock and Whewell, and others scarcely less distinguished, I could not refrain from acknowledging it to be an alarming, and almost an awful thing, to speak on any subject of physical astronomy in the presence of such an audience."

And in 1849 he wrote in an unsent letter that, as opposed to 'abstract science,' "in practical astronomy [...] – though I never grudge the loss of a night's sleep, when anything interesting is to be done or seen – I could not hope, by the devotion of my whole remaining life, to rival (for example) my friend Struve, of Russia, who in the strongest terms represented to me, at Oxford, during the Meeting of the British Association in 1847, that, though I held the title of Royal Astronomer of Ireland, my astronomical brethren on the continent would decidedly prefer my never looking through a telescope to my giving up or less ardently pursuing mathematics. "You are," he was pleased to say, "our teacher."

Apparently to his surprise Hamilton's work was acknowledged in France; in March 1856 he wrote to Robinson, "Within the last few days I have received from Paris a quarto of about 200 pages, almost entirely devoted to the development and application of my results in physical astronomy – the first part relating to my abstract results in dynamics, and the second being headed, *Thèse d'astronomie. Application de la Méthode de M. Hamilton au Calcul des Perturbations de Jupiter* – by Saturn, Uranus, Neptune and Mars, the Earth, &c. – with long inequalities of all sorts extended to the years of our Lord, 2300, and 2800 – all by Prof. or Monsieur Houel, of Alençon[62] but submitted to Cauchy, Duhamel, and Delaunay, and (as it seems) approved by them. How comfortable to see my abstract results translated into hundredths of seconds sexagesimal! and how odd a feeling it gives to read, in the astronomical department, every now and then, of "l'ellipse de M. Hamilton"! or better still, here and there, without the "M," "l'ellipse de Hamilton"! – for it is the truth, though perhaps scarcely two or three persons in these countries have noticed it, that I assigned, twenty years ago, elliptic orbits for all the planets, essentially distinct in theory, though very little differing in practice, from those so beautifully imagined by Lagrange, and having certain centrobasic and symmetric advantages."

[60] [Graves 1882-89, II, 542]. Hamilton's communication. The hodograph, meaning 'a way to write or describe', can be defined as "the path traced out by the extremity of a vector which continually represents, in direction and magnitude, the velocity of a moving body." Actually being a direct application of his quaternions, it is now used in physics, astronomy, solid and fluid mechanics, and meteorology.

[61] In June he had communicated it to the Royal Irish Academy.

[62] Thèse de Mécanique, Thèse d'Astronomie, by Jules Hoüel, 1855.

Hamilton indeed felt that he had contributed very much to astronomy. In June 1856 he wrote to Augustus De Morgan: "A few years ago you recommended me to get *Grant's History of Physical Astronomy*. I have only recently acted on the suggestion, stimulated, perhaps, by receiving an account of the well-deserved honour paid to the author by the Council of the Astronomical Society. The book is very valuable, and very creditable to its composer. But your humble servant may be pardoned if he finds himself somewhat amused at the title, "History of Physical Astronomy, from the Earliest Ages to the middle of the Nineteenth Century," when he fails to observe any notice of the discoveries of Sir W.R. Hamilton in the theory of the Dynamics of the Heavens.[63] Jacobi thought them of importance enough to deserve an elaborate commentary at his own hands, and of course I admit, though perhaps it is rather lately that I have really felt, how very richly he adorned the subject, by taking it up where I had left it."[64]

In 1856 Hamilton suffered from his first attack of gout, and through the years it became worse. But it was not just gout; starting on the description of 1865, Hamilton's last year, Graves writes that on 2 January "Hamilton begins thus a letter to his younger son: – 'It is a solemn thing, but I do not find it a painful one, to enter on a new year. I wish you many happy returns. It was my hope to have gone to Castleknock [to church] yesterday, but my cough was by no means so far gone as to make that safe.' These words may serve to indicate [...] the shaken state of his bodily health, which from henceforth had to contend with a fatal combination of gout and bronchitis."

8 Mainly a mathematician, yet also Royal Astronomer

Although Hamilton greatly preferred mathematics over astronomy, it is totally unknown what would have happened if he had not suffered from bronchitis. He did admit that he disliked observing but that was after years of falling ill after observing; there are indications for far more aptitude for astronomy than Hamilton is given credit for. One of the problems of Graves' biography is that he left out what he did not judge to be important enough for his readers. Many details are only given by Graves if they also serve other purposes, such as throwing light on someone he admired, or showing what a "simple, zealous great man" Hamilton was, while excusing himself for giving "too domestic" facts.[65] Excepting the descriptions of his youth, the many small indications for Hamilton's aptitude for practical astronomy therefore have to be searched for.

Generally overlooked details are that Hamilton had good technical skills, and a thorough knowledge of the night sky. In November 1820 he wrote in his journal, "borrowed Mr. Bell's instruments and made a quadrant. The idea last night occurred to me of making a more accurate one for sines than Martin's; I did so, and returned the instrument[s]."[66]

In April 1834 he wrote to a friend, "Since [my paper] went off, I have turned astronomer for the present; & finding myself unable to induce [the clockmaker] Sharp to keep his promises, & left in the lurch by him, I made a foray yesterday, & carried off bodily the telescope and circles from his house – he being at Mr. Cooper's, & having promised to leave them here before he went. We, that is myself & Thompson & the Carpenter, Plumber & Carman, had great amusement for a good while taking down and putting up everything.

[63] Ball comments, "The intimacy between the two correspondents will account for the tone of this letter" [Ball 1895, 310].

[64] See for instance Jacobi's 'Vorlesungen über Dynamik'.

[65] [Graves 1882-89, II, 286; I, 29]

[66] This 'Martin' may have been Benjamin Martin (1704-1782), a then very well-known instrument maker, which would show that William did not fear to try to improve whatever he encountered. The quadrant was used to determine the angle between the horizon and celestial bodies.

Altho' Sharp had locked up the microscopes ... I contrived such expedients for reading off, that in the course of 5 or 6 hours work last night I found I could very easily identify & point to a star. For example, I found at once ε Lyrae: but the night was far from good, & I did not see the annular nebula. Looking for the cluster mentioned by Herschel, I found another near it, which I had not noticed in his catalogue: but on reading off, I identified it with another mentioned by him. You would be amused if you saw my contrivances. The telescope is wonderfully improved in definition & colour, but whether from any change in it, or from the fault of the eye-glasses or of the night, its light seems greatly diminished."[67]

In 1846 having visited Greenwich Observatory but Airy having being absent he wrote, "I also amused myself [...] and idled the younger Mr. Breen, by my taking a transit of Polaris over a side-wire in the day-time, without an eye-glass. I estimated the error of my observation at five seconds: Mr. Breen concluded it to have been less than three." And in 1853 Hamilton wrote about his assistant Thompson, "The vast majority of [the] forty and odd thousand observations [recorded at Dunsink Observatory] has been made by my assistant, Mr. Charles Thompson [...]. I must add that I have spent with him a great many nights of observing in the dome."

Had I realised earlier how much his health had suffered from observing, and how good he was in practical astronomy, I would not have said about Hamilton, as I did, that he was "not an enthusiastic practical astronomer." Nor claim, as others do, that "it turned out that Hamilton had made a poor choice [by accepting the post of Royal Astronomer] as he lost interest in astronomy and spent all time on mathematics."

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