William Rowan Hamilton

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Sir William Rowan Hamilton (midnight, 3–4 August 1805 – 2 September 1865) was an Irish physicist, astronomer, and mathematician, who made important contributions to classical mechanics, optics, and algebra. His studies of mechanical and optical systems led him to discover new mathematical concepts and techniques. His best known contribution to mathematical physics is the reformulation of Newtonian mechanics, now called Hamiltonian mechanics. This work has proven central to the modern study of classical field theories such as electromagnetism, and to the development of quantum mechanics. In pure mathematics, he is best known as the inventor of quaternions.

Hamilton is said to have shown immense talent at a very early age. Astronomer Bishop Dr. John Brinkley remarked of the 18-year-old Hamilton, 'This young man, I do not say *will be*, but *is*, the first mathematician of his age.'

Life

William Rowan Hamilton's scientific career included the study of geometrical optics, classical mechanics, adaptation of dynamic methods in optical systems, applying quaternion and vector methods to problems in mechanics and in geometry, development of theories of conjugate algebraic couple functions (in which complex numbers are constructed as ordered pairs of real numbers), solvability of polynomial equations and general quintic polynomial solvable by radicals, the analysis on Fluctuating Functions (and the ideas from Fourier analysis), linear operators on quaternions and proving a result for linear operators on the space of quaternions (which is a special case of the general theorem which today is known as the *Cayley–Hamilton theorem*). Hamilton also invented "*icosian calculus*", which he used to investigate closed edge paths on a dodecahedron that visit each vertex exactly once.

William Hamilton

William Rowan Hamilton (1805–1865)

Born	4 August 1805 Dublin, Ireland
Died	2 September 1865 (aged 60) Dublin, Ireland
Residence	Ireland
Nationality	Irish
Fields	Physics, astronomy, and mathematics
Institutions	Trinity College, Dublin
Alma mater	Trinity College, Dublin
Academic advisors	John Brinkley
Known for	Hamilton's principle, Hamiltonian mechanics, Hamiltonians, Hamilton–Jacobi equation, Quaternions, Biquaternions, Hamiltonian path, Icosian calculus, Nabla symbol, Versor, Coining the word 'tensor', Hamiltonian vector field, Icosian game Universal algebra, Hodograph, Hamiltonian group, Cayley–Hamilton theorem
Influences	John T. Graves
Influenced	Zerah Colburn Peter Guthrie Tait
Notable awards	Royal Medal (1835)

Mathematical Studies

Hamilton's mathematical studies seem to have been undertaken and carried to their full development without any assistance whatsoever, and the result is that his writings do not belong to any particular "*school*". Not only was Hamilton an expert as an arithmetic calculator, but he seems to have occasionally had fun in working out the result of some calculation to an enormous number of decimal places. At the age of eight Hamilton engaged Zerah Colburn, the American "*calculating boy*", who was then being exhibited as a curiosity in Dublin. Two years later, aged ten, Hamilton stumbled across a Latin copy of Euclid, which he eagerly devoured; and at twelve he studied Newton's *Arithmetica Universalis*. This was his introduction to modern analysis. Hamilton soon began to read the *Principia*, and at sixteen Hamilton had mastered a great part of it, as well as some more modern works on analytical geometry and the differential calculus.

Around this time Hamilton was also preparing to enter Trinity College, Dublin, and therefore had to devote some time to classics. In mid-1822 he began a systematic study of Laplace's *Mécanique Céleste*.

From that time Hamilton appears to have devoted himself almost wholly to mathematics, though he always kept himself well acquainted with the progress of science both in Britain and abroad. Hamilton found an important defect in one of Laplace's demonstrations, and he was induced by a friend to write out his remarks, so that they could be shown to Dr. John Brinkley, then the first Royal Astronomer of Ireland, and an accomplished mathematician. Brinkley seems to have immediately perceived Hamilton's talents, and to have encouraged him in the kindest way.

Hamilton's career at College was perhaps unexampled. Amongst a number of extraordinary competitors, he was first in every subject and at every examination. He achieved the rare distinction of obtaining anoptime both for Greek and for physics. Hamilton might have attained many more such honours (he was expected to win both the gold medals at the degree examination), if his career as a student had not been cut short by an unprecedented event. This was Hamilton's appointment to the Andrews Professorship of Astronomy in the University of Dublin, vacated by Dr. Brinkley in 1827. The chair was not exactly offered to him, as has been sometimes asserted, but the electors, having met and talked over the subject, authorised Hamilton's personal friend (also an elector) to urge Hamilton to become a candidate, a step which Hamilton's modesty had prevented him from taking. Thus, when barely 22, Hamilton was established at the Dunsink Observatory, near Dublin.

Hamilton was not especially suited for the post, because although he had a profound acquaintance with theoretical astronomy, he had paid little attention to the regular work of the practical astronomer. Hamilton's time was better employed in original investigations than it would have been spent in observations made even with the best of instruments. Hamilton was intended by the university authorities who elected him to the professorship of astronomy to spend his time as he best could for the advancement of science, without being tied down to any particular branch. If Hamilton had devoted himself to practical astronomy, the University of Dublin would assuredly have furnished him with instruments and an adequate staff of assistants.

He was twice awarded the Cunningham Medal of the Royal Irish Academy.[5] The first award, in 1834, was for his work on conical refraction, for which he also received the Royal Medal of the Royal Society the following year.[6] He was to win it again in 1848.

In 1835, being secretary to the meeting of the British Association which was held that year in Dublin, he was knighted by the lord-lieutenant. Other honours rapidly succeeded, among which his election in 1837 to the president's chair in the Royal Irish Academy, and the rare distinction of being made a corresponding member of the Saint Petersburg Academy of Sciences. Later, in 1864, the newly established United States National Academy of Sciences elected its first Foreign Associates, and decided to put Hamilton's name on top of their list.[7]