

Synge, John Lighton

by Petros S. Florides

Synge, John Lighton (1897–1995), mathematician and theoretical physicist, was born 23 March 1897 in Dublin, youngest among one daughter and three sons of Edward Synge (1859–1939), then land agent in Kingscourt, Co. Cavan, and his wife Ellen Frances (1861–1935), daughter of the distinguished Irish engineer James Price (qv). The Price family can be traced back to Sir William Stuart of Scotland who settled in Ireland in the early seventeenth century. In the male line, Synge's family can be traced back to the sixteenth century to Thomas Millington, 'corruptly called Singe of Bridgnorth' in Shropshire (K. C. Synge, 1937). According to tradition, the changing of the name from Millington originated with Henry VIII, who commanded a favourite choirboy to 'Singe, Millington, singe'. The present form, Synge, was well established by 1600 and it is pronounced to rhyme with 'sing'.

Synge's family were members of the Church of Ireland, and an incredible number of his distant ancestors attained high office in the church. Preeminent among them were his direct ancestor Edward Synge (qv) (1659–1741), archbishop of Tuam, and Hugh Hamilton (qv) (1729–1805), grandfather of Isabella Hamilton, Synge's great-grandmother. Hugh Hamilton – no relation to the mathematician Sir William Rowan Hamilton (qv) – 'was the most intellectual Irish bishop of the eighteenth century' (Synge, 1957), and wrote extensively, and with great distinction, on mathematics, physics and chemistry, and theology. Remarkably, Hamilton's academic career is almost identical to J. L. Synge's more than 150 years later. Interestingly, the family of Isabella's mother, Juliana Tisdall, can be traced back to the time of Henry VIII, to the McCrossans of the sept of Leix (Co. Laois) called O'Moore (or O'More), thus establishing a Gaelic strain in Synge's ancestry. Of J. L. Synge's more immediate relatives the most distinguished are, undoubtedly, his uncle John Millington Synge (qv), the playwright and dramatist, and his daughter, Cathleen Synge Morawetz (b. 1923), an eminent applied mathematician and the first woman to hold the directorship of the famous Courant Institute of New York.

In stark contrast to so many of his illustrious ancestors Synge was an atheist, stating in his characteristic style: 'I am a protestant to the marrow of my bones, holding the essence of protestantism to consist, not in the recitation of this creed or that, but in the assertion of the right of the individual to hold his own views on all matters and express them as he thinks fit, with the prudential reservation that one does not preach vegetarianism (at least not too violently) in the lion's den' (Synge, 1957).

In 1903 the Synge family moved to Dublin, where J. L. Synge attended St Andrew's College (1911–15) and entered TCD in 1915; he won a foundation scholarship in mathematics at the end of his first year, probably an unprecedented achievement. In TCD he met Elizabeth Eleanor Mabel Allen, a history student who shared his

religious and political beliefs; they married in 1918 in a registry office ('certainly not in a church', as he put it). He graduated in 1919 with a double senior moderatorship in mathematics and experimental physics and a large gold medal.

In January 1920 he was appointed lecturer in mathematics in TCD, and in the late summer of the same year left for Canada to join the University of Toronto as assistant professor of mathematics. It was soon after his arrival at Toronto that Synge became interested in Einstein's theory of relativity. His approach to the theory was the elegant geometrical and visual approach which Herman Minkowski initiated in 1908; this geometrical approach was to become the most distinct characteristic of Synge's subsequent work in theoretical physics.

In 1925 Synge returned to Dublin to a fellowship and the Erasmus Smith chair of natural philosophy in TCD. Of his many contributions to differential geometry, dynamics, and relativity in the following five years, the most important paper was 'On the geometry of dynamics' (1926). In it, Synge regarded the configuration space of a dynamical system as a Riemannian manifold and used the method of tensor calculus throughout. A by-product of this work was the derivation of the all-important equation of the geodesic deviation. A major undertaking of Synge's during this time was the editing, with Professor A. W. Conway (qv), FRS, of UCD, of the first volume of the mathematical papers of Sir W. R. Hamilton; it was published by the RIA in 1931.

In 1930 Synge was invited to head the newly established department of applied mathematics of the University of Toronto. Apart from a number of short visits to Brown University in Maryland and to Princeton University, and a brief appointment as a ballistics mathematician in the US Army Air Force during the war, he was to remain in Toronto till 1943. In 1933 he applied the theory of elasticity to investigate the problem of 'traumatic occlusion' connected with the physiological periodontal membrane; the result was a major paper 'On the tightness of the teeth, considered as a problem concerning the equilibrium of a thin incompressible elastic medium', a supreme example of mathematical modelling. A theorem, known now as Synge's theorem, on even-dimensional Riemannian manifolds, published in 1936, is acclaimed as 'one of the most beautiful results in global differential geometry of the twentieth century' (Frankel, 2004). Another important and influential paper on 'Relativistic hydrodynamics', published in 1937, became a classic; it was reproduced in the *Journal of General Relativity and Gravitation*, xxxiv, no. 12 (2002), as one of the 'golden oldies' of relativity.

He moved to Ohio State University in 1943 to head the mathematics department for the following three years; the method of the 'Hypercircle', a precursor of today's 'finite elements method' in numerical analysis, was developed, with W. Prager, during this time. In 1946 Synge accepted an invitation to build up and head the mathematics department of the Carnegie Institute of Technology (latterly the Carnegie-Mellon University) in Pittsburgh.

Synge left America in 1948 to return permanently to his native Dublin as a senior professor in the school of theoretical physics of the Dublin Institute for Advanced Studies (DIAS); he officially retired in 1972 but continued his research, mainly on relativity, for another twenty years or so. What must be one of Synge's most remarkable achievements during these years is his paper on the 'Gravitational field of a particle' (1950); in it he was able, for the first time, to penetrate and explore in detail the region inside the Schwarzschild radius (what we call today a black hole). Synge's reputation as a relativist attracted research scholars, collaborators, and eminent visitors from all over the world, making the DIAS one of the great centres in relativity theory.

Synge made outstanding contributions to widely varied fields: classical mechanics and geometrical optics, gas dynamics, hydrodynamics, elasticity, electrical network and antenna theory, mathematical methods, and, above all, differential geometry and Einstein's relativity theory. He published eleven books, including the extraordinary semi-popular book *Kandelman's Krim*, and over 200 papers, the last one at the age of 92; it was, appropriately enough, on geometry. The complete list of his published work can be found in *General relativity* (Ó Raifeartaigh, 1972). Every book and every paper is a remarkable work of art, characterised by his striking clarity of expression and the sheer beauty of his prose, and, of course, by Synge's geometric spirit. He was also a superb lecturer.

The almost universal geometrical approach to the theory of relativity in the last forty years or so is due primarily to Synge's influence, especially to his two epoch-making books on the special and general theories of relativity, which were published in the late 1950s. It is on record, for example, that the outstanding relativist Sir Roger Penrose was drawn into the field of relativity after reading Synge's books. In 1972 Synge himself said: 'If you were to ask me what I have contributed to the theory of relativity, I believe that I could claim to have emphasised its geometrical aspect' (Synge, 1972).

Synge was the recipient of many honours throughout his long life. Member (1926) and president (1961–4) of the RIA, fellow of the Royal Societies of London (1943) and of Canada (1932), and honorary fellow of TCD, he was awarded honorary doctorates from the University of St Andrews (1966), QUB (1969), and the NUI (1970), the Tory medal of the Royal Society of Canada (1943), and the Boyle medal of the RDS (1972). The Royal Society of Canada and the University of Toronto founded mathematics prizes in Synge's name, and in 1992 TCD, his alma mater, founded the J. L. Synge public lecture and the J. L. Synge prize in mathematics, given in alternate years.

Synge died 30 March 1995, exactly one week after his ninety-eighth birthday. His mind was lively and vivid to the very end of his life, reading avidly and thinking about mathematical problems. He was a kind and generous man who helped and inspired several generations of students. In old age he suggested that a significant part of

his epitaph might read: 'He encouraged younger men'. Alas, there is no tomb for an epitaph, Synge having bequeathed his body to the medical school of TCD. But his students, and those who were fortunate to come in contact with him, will always remember him with gratitude, admiration, and the deepest respect.

K. C. Synge, *The family of Synge or Sing* (1937); J. L. Synge, *Kandelman's Krim: a realistic fantasy* (1957); id., *Geometry and physics* (Boyle Memorial Lecture, 1972); L. Ó Raifeartaigh (ed.), *General relativity: papers in honour of J. L. Synge on his 75th birthday* (1972); P. S. Florides, 'Professor John Lighton Synge, FRS (obituary)', *Irish Mathematical Society Bulletin*, xxxvii (1996); id., 'John Lighton Synge', A. Whitaker and M. McCarthy (ed.), *Irish physicists* (2002); Th. Frankel, *The geometry of physics: an introduction* (2nd ed., 2004); personal knowledge