

Michael F. Atiyah

(1929–2019)

Mathematician who transformed the fields he brought together.

Elite mathematical research transformed in the second half of the twentieth century. Capitalizing on new opportunities for international collaboration, superstar theorists sought ambitious syntheses across intellectual domains at new heights of abstraction. At the vanguard of jet-age mathematics was Michael Francis Atiyah, who died on 11 January. Winner of the Fields Medal and the Abel Prize, and a president of the Royal Society in London, Atiyah breathed life into research sites and partnerships with an unchecked zeal for the social life of theorizing. His conversations reshaped the fields from which he drew.

Specializing in algebraic geometry and topology, the study of shapes and their transformations, Atiyah made his greatest contributions through dialogue with leading researchers who had complementary expertise. Two of his early collaborations resulted in K-theory and index theory, exemplars of his generation's new breed of interdisciplinarity. Subsequent collaborations straddled the theoretical extremities of mathematics and physics, relating intricate symmetries to the fundamental properties of matter. Later, presiding over learned societies and institutions, he promoted the same values of cooperation and internationalism that defined his research.

Born in London in 1929 to a British artist mother and a Lebanese father who worked in the British colonial civil service, Atiyah was raised between Sudan and England before excelling at boarding school in Cairo. He emerged as a formidable young mathematician at the Manchester Grammar School and — after a brief period of national service — Trinity College at the University of Cambridge, UK. He stayed there for his doctorate under W. V. D. Hodge, a geometer active in international mathematical organizations. Hodge exposed Atiyah to a cosmopolitan panorama of emerging theories and supported his career-defining application for a Commonwealth fund fellowship for postdoctoral research at the Institute for Advanced Study (IAS) in Princeton, New Jersey.

Newly wed to mathematician Lily Brown, who gave up her position at Bedford College London to join him in Princeton, Atiyah spent 1955–56 in the exhilarating company of many of the world's most accomplished young mathematicians. A contemporary recalled him being “everywhere, bursting with ideas”. He bounced between seminars and teas that lasted for hours. As he



reported to his funders, “the innumerable conversations, carried on at all times of day” were the highlight of his fellowship. New IAS friends included Friedrich Hirzebruch, Raoul Bott and Isadore Singer, who would later become partners in his highest-profile collaborations.

In a system that rewarded networking and international collaboration, Atiyah shone brightly. Next came a lectureship at Cambridge, then a readership at the University of Oxford in 1961 that led to the Savilian Professorship of Geometry, also at Oxford, in 1963. With Hirzebruch and Bott, Atiyah developed striking algebraic methods to describe and interrelate complex contortions of multidimensional shapes.

His meteoric ascent was recognized by a Fields Medal in 1966, the first year the award was designated for the most outstanding mathematicians under 40 — as it has been ever since. By then, Atiyah had already announced his most famous result, the Atiyah–Singer Index Theorem, for which he and Singer would share the second-ever Abel Prize in 2004. Over decades of collaboration, the two continued to probe the links between the mathematics of static shapes, Atiyah's speciality, and that of dynamic flows, Singer's.

From 1969 to 1972, Atiyah was a professor at the IAS until family considerations drew him back to Oxford in the early 1970s as a Royal Society research professor. Atiyah mentored many advanced students and early-career researchers, formally and informally. Interlocutors learnt to brace themselves for energetic exchanges that

ranged over vast conceptual expanses in a dazzling and demanding experience of theory in motion.

Atiyah's return to Oxford coincided with new interactions with theoretical physicists, with whom he linked index theory to emerging perspectives in quantum physics. A prolific researcher, networker and advocate, he forged multifarious ties between the frontiers of mathematics and physics. His efforts also helped to reshape the mathematics and physics professions. Later generations of scholars could attain recognition as elite mathematicians for work on quantum physics, and they could claim elite contributions to physics from the recesses of mathematical theory.

Around this time Atiyah also began taking on more formal positions in national and international organizations, including presidencies of the London Mathematical Society and the Mathematical Association in Leicester, UK. In 1990, he became Master of Trinity College and the inaugural director of the Isaac Newton Institute for Mathematical Sciences in Cambridge.

From 1990 to 1995, he was president of the Royal Society in London, where he relished the historic social rituals, pursued international ties and pugnaciously advocated for British science funding. His farewell address championed internationalism and denounced the military–industrial complex and nuclear arms, on which he blamed half a century of relative British decline. He continued this stance as president of the nuclear-arms-opposing Pugwash Conferences on Science and World Affairs after his retirement from Cambridge in 1997.

Based thereafter in Edinburgh, UK, his wife's home town, Atiyah remained an active researcher, scientific ambassador and omnivorous intellectual provocateur. From 2005 to 2008, he took a turn as president of the Royal Society of Edinburgh.

Throughout his career, Atiyah employed freewheeling conversation as a powerful instrument for crafting mathematical alliances. By leadership and example, he helped to define an era in which the world of mathematics became dramatically more interconnected. ■

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