THE CHINESE UNIVERSITY OF HONG KONG
FIFTY-SECOND CONGREGATION
Conferment of the Degree of Doctor of Science, *honoris causa*
A Citation

Sir Michael Atiyah, OM, FRS

Born in London to an English mother and Lebanese father, thus perhaps inheriting a certain English pragmatism along with the mathematical traditions of the "middle east" cultures, Michael Francis Atiyah progressed from schoolboy mathematics in Egypt and then in that famous hothouse for young talent, Manchester Grammar School in England, to a first degree at Trinity College, Cambridge in 1952, a Ph.D. three years later, and, after four decades of mathematical thinking, almost thirty honorary degrees in recognition of his status as one of the great mathematicians of our century.

He has therefore progressed from the basics of addition, subtraction, multiplication and division—deliberately confused with ambition, distraction, uglification and derision, by an Oxford mathematician, Lewis Carroll — to scale the highest peaks of the higher mathematics. He has, in fact, progressed into what must be, for most of us, the mysterious realm of mathematical, particularly geometrical, operations that, being by no means transparent, can only be made plain to an audience of other mathematicians. That audience is one made up of people of many different countries, speaking a host of different languages, who are able to grasp the complexities of this universal language of science. Mathematics, called by Carl Friedrich Gauss "the queen of the sciences", knows no barriers of race, nationality, culture, or politics. Nor does it recognize frontiers between science and the arts, for it is both science and art. Paradoxically, therefore, it is at once democratic and exclusive, for only those may use this language who have brains, concentration, and imagination enough to follow its cunning intricacies, unanticipated simplicities, its symmetries and sublime asymmetries. For Sir Michael, the beauty of mathematics is an elegance achieved by understanding the complexities of reality and expressing them in simpler, more orderly forms.

Sir Michael's progress as a mathematician might be called a "geometrical progression" of prizes and honours, the First Smith's Prize being awarded to him the year he became twenty-five and also a Research Fellow at Trinity College, where he is now Master. In 1955 he was awarded a Commonwealth Fund Fellowship and became a member of Princeton's Institute for Advanced Study for the first time, one of several occasions. Between 1958 and 1961 he was a Fellow of Pembroke College, Cambridge, then defected to that other university, Oxford, achieving the rank of Reader and Professorial Fellow of St. Catherine's at the early age of thirty-two. When just thirty-three, he was made a Fellow of that most prestigious of learned scientific bodies, the Royal Society.

The Nobel prize committee making no award for mathematics, the highest honour in the field is the Fields Medal. This Atiyah won in 1966, while in his late thirties. The Royal Medal followed in 1968 and in 1988 the Copley Medal of the Royal Society, of which he became a Research Professor in the early 1970s and President from 1990 to 1995.

A characteristic of mathematics is that many of its brightest stars turn out to be meteors, reaching a zenith while very young, only to vanish into outer darkness. A measure of Sir Michael's genius is that his

mathematical ideas led to a new synthesis of seemingly disparate areas of enquiry and thence to hosts of applications, so that his methods could dominate the field for many fecund years.

To think of reality as composed of dimensionless dots or particles is to see it as resembling an incredibly detailed and minute "pointilliste" painting. Sir Michael, however, saw it more as a Jackson Pollock canvas, a web of strings of paint, in a mighty maze, though not without a plan. This view is more easily accounted for by "topology", the study of objects that bend and stretch, in the so-called "rubber sheet geometry". In particular, this has been fashioned into a bridge over the divide between mathematics and physics. Topology also offers ways of stringing or threading together seemingly disparate areas of mathematical thinking. By linking topology to algebraic geometry, a new "topological invariant" appeared, providing a base for a novel kind of mathematics, K-theory. This in turn was the basis of his collaboration with Isadore Singer that resulted in the "index theorem" which won Atiyah the Fields Medal. Working it all out was a ten year task. The index theorem proved useful in theoretical physics, for when it was found that right-handed and left-handed particles behave differently, the theorem furnished a method of measuring these asymmetries. The applications of topology to quantum mechanics have also been a fruitful development in Atiyah's work. Thus, in his middle years, he was still engaged in some of his most influential work in mathematics. Sir Christopher Zeeman has explained that Atiyah has connected so much in so many different areas that he has remained pre-eminent in world mathematics for thirty years.

Mathematical research requires neither expensive laboratories nor costly apparatus; nor does it involve painstaking examination of corrupt and corruptible text, or burrowing like a mole into the learned warrens of great libraries. The mathematician must understand the brief history of previous mathematical innovation and then sit with a pad and pencil and think afresh. It requires intense concentration, laser sharp, to kindle the almost spontaneous combustion of thought itself, burning with that which Walter Pater considered desirable in life itself: "a hard, gem-like flame". This flame of mathematical thinking lights up the seemingly impenetrable walls of the labyrinth that is the unknown, what has not yet been thought. The product of Atiyah's thinking can be found in numerous papers, and in such works as *K-Theory* (1966), *Collected Works* (5 vols., 1988), *Geometry and Dynamics of Magnetic Monopoles* (1988) and *The Geometry and Physics of Knots* (1990).

Claude LeBrun has called Atiyah "one of the great mathematical teachers of our time." Over the years he has generously made himself available to us as an external expert, giving valuable advice to our Department of Mathematics and conducting seminars on campus in 1992 and 1995.

Here then is a counsellor of the highest value, a great mathematician, and a college administrator of great personal warmth and humanity. He was knighted in 1983 and awarded the Order of Merit in 1992. Made Commander of Lebanon's Order of the Cedars in 1994, he is also an Honorary Professor of the Chinese Academy of Science.

It is my delightful duty, Mr. Chancellor, to present Sir Michael Atiyah, who entered a dark labyrinth and emerged into the light, holding a thread, to receive the degree of Doctor of Science, *honoris causa*.