

Register

# Friedrich Hirzebruch

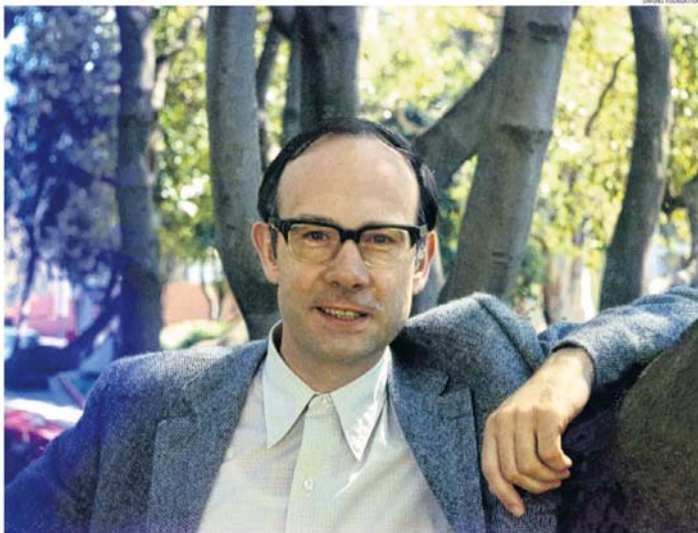
Outstanding German mathematician who worked assiduously to make his homeland an international centre for the subject

From his passion in the pursuit of mathematics as a youth during the turmoil at the end of the Second World War, Friedrich Hirzebruch rose to become the pre-eminent German mathematician of the second half of the 20th century. Through his efforts and vision, and his own fundamental contributions to pure mathematics, Bonn became an international centre of mathematical research, a status which it retains today.

Friedrich Ernst Peter Hirzebruch (universally known as Fritz) was born in 1927 in Hamm, Westphalia. His father was the director of the local gymnasium, and also a mathematician, so the subject always formed a significant part of his upbringing. He was 11 when war broke out. Hamm, with its marshalling yards, was a prime target of the Allies and a bombing raid on December 5, 1944 destroyed his house but, as the family moved around, also delayed his draft call. By the age of 15 he was, however, seconded to an anti-aircraft battery, where his education continued, and staring at the heavens gave him an opportunity to test practically his spherical trigonometry. In the final months of the war he was called up to an artillery unit and ended up in a prison camp (where he wrote theorems on

**He was determined to re-create in Bonn the atmosphere of Princeton**

his lavatory paper ration) but, being under 18, he was released in July 1945. He then came to Bonn, and after becoming a mathematician. Most German cities were destroyed and universities barely functioned. His local university, Münster, had a single lecture room for the whole Faculty of Science, which could be used by mathematicians once every three weeks. Nevertheless, through perseverance and the help of professors who recognised his talents, Hirzebruch graduated and in 1949 went to Switzerland to study with Heinz Hopf, who had left Germany when the Nazis came to power. There he learnt about algebraic topology and algebraic geometry, subjects which were to dominate his subsequent research.



Hirzebruch: he set up an annual meeting for the world's mathematicians in Bonn which continues to thrive to this day

The chance to develop this more fully came in the years 1952-54 at the Institute for Advanced Study in Princeton where he met D.C. Spencer, Armand Borel and Kunihiko Kodaira. There, and through correspondence with Jean-Pierre Serre and René Thom, he learnt of the radical new methods being developed which linked together the modern approaches to topology and analysis with the classical field of algebraic geometry. His first success was the signature theorem, which he followed up with a version of the Riemann-Roch theorem, a vast generalisation of a classical result from the 19th century. He returned to Princeton two years later where he met future collaborators Michael Atiyah and Raoul Bott.

The new techniques in algebraic

geometry, developed mainly in France, used the framework developed for topology to extend systematically classical results about curves and surfaces to higher dimensions. These involved, for example, counting the number of independent functions of a particular type on an algebraic variety.

Hirzebruch's innovation was to organise these through the use of certain universal polynomials whose coefficients were rational numbers (rather special numbers like the Bernoulli numbers, known for 300 years). When inserting the topological invariants of the variety into the polynomial, these gave whole numbers representing the count. Further developments yielded similar integrality results beyond algebraic geometry and

formed the origins of the later Atiyah-Singer index theorem.

Hirzebruch was always interested in the links between number theory and topology, and in his lectures his precise style always ended with a flourish as an unexpected connection was revealed.

With his international reputation established, he was appointed a professor at the University of Bonn aged just 27. There he determined to create an atmosphere which reflected his experience in Princeton. Fifty years earlier Germany had been the world centre of mathematics, but Nazi policies had led to the dispersal of many of the most important figures. He wanted to restore the reputation of mathematics in his homeland by inviting the most exciting workers in the

field to Germany. To this end he set up the annual Arbeitstagung in Bonn. This was a meeting which became an international forum for the latest results in mathematics. Regular speakers were the mathematicians he had met in Princeton but also Europeans such as the visionary Alexandre Grothendieck from France, Nicolaas Kuiper from Holland and Jacques Tits from Belgium.

Hirzebruch devised a seemingly informal and democratic way of determining the programme of talks, but this was carefully stage-managed so that the most important subjects got a hearing. A boat trip on the Rhine was a key activity which provided the genesis of many mathematical results. Despite traditions such as the first talk being given by Michael Atiyah, the Arbeitstagung moved with the times, and new developments, outside Hirzebruch's own interests (which were broad) were encouraged. It carried on in virtually the same manner for 30 years and still goes on in modified form today.

The visitor programme which grew around this activity became a feature of the international mathematical scene, but it was still not quite like the Institute in Princeton which had been so formative to Hirzebruch's own development. Finally in 1980 he succeeded in giving this activity a more concrete form when the Max Planck Society agreed to found a mathematical institute in Bonn under his direction, expanding the previous activities and with a dedicated building. Although the directorship changed after his retirement in 1995, he involved himself with the planning of visitors and programmes at the institute to the end of his life.

Given Hirzebruch's standing in Europe, it was natural that he should become the first president of the European Mathematical Society when it was founded in 1990. He was awarded a host of honours from around the world. In Britain, he was a Foreign Member of the Royal Society and the Royal Society of Edinburgh and received honorary degrees from the universities of Oxford and Warwick.

He is survived by his wife, Ingeborg, and by two daughters and a son.

**Friedrich Hirzebruch, mathematician, was born on October 17, 1927. He died on May 27, 2012, aged 84**