Friedrich Hirzebruch

One of Germany's finest mathematicians, who restored his nation's reputation in the field after the war

FRIEDRICH HIRZEBRUCH, who has died aged 84, was considered Germany's greatest mathematician of the post-war era, rebuilding the country's mathematics community from the ruins of conflict.

He himself avoided becoming a casualty of the Second World War only by chance. Drafted into the German army as the Allies were closing in, he was taken prisoner when many other teenage boys died in a futile last stand.

Earlier, as an anti-aircraft gunner in the Luftwaffe youth corps, he had plotted triangles between stars of the night sky, calculating their geometry as they curved in the apparent sphere overhead. In captivity he jotted his theorems on scraps of lavatory paper.

In the decades after his release in July 1945, his work centred on high-dimensional spaces, which are essential for mathematical descriptions of physical realities, as well as of great interest in their own right. There are many spaces, for all possible dimensions. For example, a point is 0-dimensional; a line is 1-dimensional; while a plane is 2-dimensional. A curve in a plane is also 1-dimensional, so the dimension does not in itself give all the information about the space. Our familiar space is 3-dimensional, and the space-time of Einstein's theory of relativity has four dimensions.

Mathematicians investigate the shapes and internal structure of unknown spaces using functions to known spaces, much as doctors investigate human bodies using X-rays to provide flat representations of curved objects. The study of high-dimensional spaces is founded in the work of the great 19th-century German mathematician Georg Riemann.
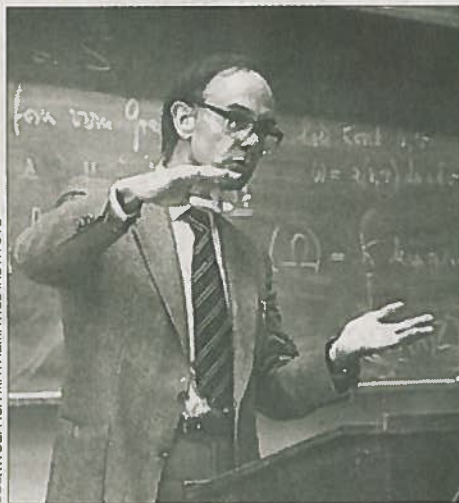
Hirzebruch at the blackboard: he was a prodigy

As a young man engaged in research in Princeton, New Jersey, Hirzebruch used sophisticated number theory and geometric intuition to make major discoveries on the nature of spaces arising in various mathematical contexts such as complex analysis, topology and algebraic geometry. The Hirzebruch Signature Theorem of 1953, and the Hirzebruch-Riemann-Roch theorem of 1954, were particularly ground-breaking, and made the young mathematician's name.

On his return to Germany, however, he found the exciting atmosphere of Princeton notable by its absence. The maths community was fragmented; once great institutions such as Göttingen University were a shadow of their former selves; brilliant Jewish minds had fled or been exterminated by the Nazis.

Even so, those mathematicians who remained were reluctant to grant a 29-year old a professorship. When one critic complained that Hirzebruch was "too young" it was pointed out that with a little patience "this problem will take care of itself".

Hirzebruch duly became a professor in 1956, and immediately set about re-establishing Germany's place on the maths map. His style was to be copy Princeton by being informal yet rigorous. In 1957, therefore, he created the first in a long series of *Arbeitstagung* (simply, "work meetings"), to lure the best brains back to Germany, among them Michael Atiyah from Britain. The first speaker was fixed in advance, but after that the conference unfolded in whatever order, covering whichever subjects seemed most useful at the time.

The process was improvised but the results were astonishingly productive: between 1950 and 1990 half the mathematicians to receive a Fields Medal (the world's greatest mathematical honour), had been guests at Hirzebruch's Arbeitstagung.

Friedrich Hirzebruch was born on October 17 1927 in Hamm, Westphalia. His father, Fritz, was a maths teacher and headmaster of the local school. At the age of 10 Friedrich was required to join the Deutsches Jungvolk, a offshoot of the Hitler Youth, and when he was 15 he joined his town's anti-aircraft battery. In March 1945 he was drafted into the Wehrmacht.

He was released by the Allies in July 1945 and later that year joined the University of Münster to study Maths. The city was almost completely ruined and students had to share facilities. Maths students had the use of a lecture hall once every three weeks. Hirzebruch studied under Heinrich Behnke, and it was he who introduced Hirzebruch to Heinz Hopf, celebrated for his work on algebraic topology.

Hirzebruch studied under Hopf for two years in Switzerland completing his thesis. He also got a taste of collaborative academic life that he promoted for the rest of his career. "For a German student who had lived through the war," Hirzebruch recalled, "Switzerland was a paradise academically." It's "international atmosphere" contrasted sharply with the isolation of the Nazi years.

Hirzebruch's eventually helmed 30 *Arbeitstagungen*. But his dream was to establish a research institute where scholars would be in residence not just for a few days, but all year around. In 1982 his efforts paid off when he secured funding to found the Max Planck Institute for Mathematics in Bonn. "And so," Atiyah noted, Germany had once more become "the centre".

Friedrich Hirzebruch retired in 1993, but remained active until his death, ending with more than 100 publications to his name. His fellow mathematicians considered him a worthy successor to Riemann as well as a lasting influence on modern mathematics, and on the mathematical tools used by physicists, notably string theorists.

Friedrich Hirzebruch married, in 1953, Ingeborg Spitzley, who survives him along with their three children.

Friedrich Hirzebruch, born October 17 1927, died May 27 2012