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## Chern, Shiing-Shen (1911–2004)

Shiing-Shen Chern was one of the most prominent mathematicians in the world in the twentieth century, a pioneer especially in the field of differential geometry, and an influential leader of the Chinese American scientific community. He made major contributions to the development of mathematics and science in China and the United States as well as strengthening the scientific relations between the two countries before his death in 2004.

Shiing-Shen Chern was born in Jiaying, a scenic town in Zhejiang province in southern China, on October 26, 1911, which fell amid a republican revolution that overthrew the thousands-year-old imperial system. Chern's father, Chen Baozhen, was a classically trained Confucian scholar who later became a civil servant. Chern learned Chinese and mathematics at home until 1920 when he enrolled in a middle school. Two years later, he went with his father to Tianjin in northern China and became interested in mathematics as a student in the Fulun Middle School there. In 1926, Chern enrolled at the new Nankai University in Tianjin. A course with Jiang Lifu, a Harvard-trained mathematician, got Chern interested in geometry. Upon graduation from Nankai in 1930, Chern first went to Qinghua (Tsinghua) University in Beijing, where he received a master's degree in 1934, and then to the University of Hamburg, Germany, where he finished his PhD dissertation on the applications of the great French mathematician Elie Cartan's theories in differential geometry. Chern spent a fruitful year with Cartan himself in Paris before returning to China on July 10, 1937, just days after the Japanese invaded China.

Chern was hired as a professor of mathematics at Qinghua University, which moved from Beijing first to Changsha and then to Kunming in southern China to escape the advancing Japanese army. At Kunming, Qinghua joined Beijing University and Nankai to form the Southwest Associated University (SAU) for the rest of the war years. There, in 1939, Chern married Zheng Shining, who had studied biology and who was the daughter of another mathematics professor Zheng Zhifan at Qinghua. Wartime isolation cut off much of Chern's contact with the outside world, but he was able to continue his research by studying Cartan's papers and working on problems they had discussed in Paris. His own publications in this period not only established him as a leading mathematician in China but also attracted international attention. In 1943, Chern received an invitation to visit the famed Institute for Advanced Study in Princeton in the United States.

The two years Chern spent in Princeton (1943–1945) represented the most productive in his life. Building on his profound understanding of mathematical problems and on discussions with other leading mathematicians, Chern made two of the most original and influential contributions to modern mathematics. First, he discovered an "intrinsic proof" of the generalized Gauss-Bonnet theorem. The classical theorem gives a formula that governs the relationship of geometric properties of a closed, two-dimensional Riemannian manifold (a region on a curved surface). Chern's work not only provided a proof of the theorem that was superior to earlier proofs, it also opened the possibility to generalize the theorem to higher dimensions. It was a monumental achievement and Chern later viewed it as his best piece of work. Then, capitalizing on insights from this work, Chern developed what became known as the "Chern characteristic classes," powerful analytical tools to classify so-called fiber bundles, a fundamental object of study in differential geometry. Mathematically simple and elegant, Chern's two discoveries together marked a turning point in the development of modern differential geometry.

At the end of World War II in 1945, Chern returned to China to be acting director of the new Institute of Mathematics of the Academia Sinica,

sponsored by the Nationalist government, at first in Shanghai and then in Nanjing. In late 1948, however, the Nationalists began to lose control of mainland China to the Communists in a civil war and the Institute of Mathematics faced an uncertain future. Once again Princeton came to Chern's rescue. J. Robert Oppenheimer, the physicist who had spearheaded the making of the atomic bomb during World War II and who was now director of the Princeton institute, invited Chern to return and he accepted. Chern brought along his wife, son Bolong, and daughter Pu (who later became a physicist and married the well-known Chinese American physicist Paul Ching Wu Chu) when departing for the United States on December 31, 1948.

Chern's coming to the United States in 1949 fostered a renaissance of differential geometry in the country. After a half-year stay at Princeton, he took up a professorship in mathematics at the University of Chicago and helped make it into a new center of mathematics in the world. During this period Chern also had a chance to work with the Chinese American physicist Chen Ning Yang, one of his former students at Kunming, with whom he would later share the Nobel Prize in Physics in 1957.

In 1960, after a decade at Chicago, Chern moved to the University of California, Berkeley, where he trained dozens of doctoral students, including the Chinese American mathematician Shing Tung Yau who would later win the coveted Fields Medal, and mentored numerous postdocs. Chern was naturalized as a U.S. citizen and elected a member of the U.S. National Academy of Sciences in 1961. He received the U.S. National Medal of Science in 1975 and the prestigious Wolf Prize in mathematics in 1983. Chern continued to be productive even after retiring from Berkeley in 1979. In 1981, he helped found and became the first director of the National Science Foundation-sponsored Mathematical Sciences Research Institute (MSRI) at Berkeley, a position he held until 1984.

"Retiring" once again in 1984 from the MSRI, Chern shifted his effort to a new endeavor: the founding and operation of the Mathematical Institute at Nankai University, his alma mater in Tianjin, China, and the development of mathematics in China in general.

Ever since the reestablishment of U.S.-China relations in the early 1970s, Chern had been active in promoting scientific exchanges between the two countries. Because of his and Yau's efforts, Beijing was made host to the 2002 International Congress of Mathematicians. In 2000, when his wife of more than 60 years died, Chern moved to a residence built for him in the Nankai Institute where he continued to be active in mathematical teaching and research. Chern died on December 3, 2004, in his Nankai home in Tianjin.

Zuoyue Wang

*See also* Yau, Shing-Tong

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### Cheung, King-Kok (1954-)

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King-Kok Cheung is a literary critic specializing in Asian American literature and a professor of English at the University of California, Los Angeles (UCLA). Her areas of expertise include Asian American literature, comparative American ethnic literatures, comparative heroic traditions, and renaissance British literature. She is also the associate editor of *Signs: Journal of Women in Culture and Society* and coeditor of *The Heath Anthology of American Literature*. Cheung has received numerous awards, including fellowships from the American Council of Learned Societies, the Andrew W. Mellon Foundation, the Center for Advanced Study in the Behavioral Sciences at Stanford University, and the Chinese American Literature Research Center at Beijing Foreign Studies University. She has received a Fulbright Lecturing and Research Award, and two Fulbright Senior Specialist Awards.