The New York Times

Elias M. Stein, Mathematician of Fluctuations, Is Dead at 87

By Kenneth Chang

Jan. 14, 2019

Elias M. Stein, a mathematician who pioneered work in a field that was originally devised to describe the vibrations of strings but that proved to have a wide range of applications, including charting the fluctuations of stock markets and gravitational waves, died on Dec. 23 at a hospital in Somerville, N.J. He was 87.

The cause was complications of lymphoma, his daughter, Karen, said.

Dr. Stein "had a knack of asking the right question," said Terence Tao, a professor of mathematics at the University of California, Los Angeles, who was a graduate student of his. "He had this great vision of where mathematics should go."

Dr. Stein's specialty was harmonic analysis, which breaks mathematical functions into a spectrum of simple components. It has been known for a long time that a musical note, for example, is a combination of pure harmonic tones. The basic techniques of harmonic analysis, devised centuries ago, were used to compute phenomena like the orbits of planets, the vibrating of strings and the properties of radio signals.

Dr. Stein showed how a similar approach could be applied to other problems and reveal hidden structures and patterns.

Instead of trying to compute exact solutions to a problem — which can be a hopelessly arduous task — harmonic analysis can often produce quicker but still useful estimates. "It's a very different style of mathematics," Dr. Tao said in an interview. "He pushed this style of thinking."

Charles Fefferman, a mathematics professor at Princeton who was another of Dr. Stein's graduate students, said some of Dr. Stein's early work developed fundamental tools that later turned out to be useful in figuring out how to compress images and sound recordings.

Another equation that Dr. Stein studied has since been applied to the fluctuations in stock prices.

Elias Menachem Stein was born on Jan. 13, 1931, in Antwerp, Belgium. In 1940, when he was 9, German troops invaded Belgium, and the Steins, who were Jewish, fled to the United States. Elias arrived with diamonds in the soles of his shoes; his father, a diamond merchant, had hidden them there.

His family settled on the Upper West Side of Manhattan.

Elias's interest in mathematics was kindled at Stuyvesant High School. In an interview conducted for the Simons Foundation in 2012, he recalled that members of Stuyvesant's math club had to do two things. One was to read an advanced mathematics textbook. The other was to steal a math book from Barnes & Noble's flagship store at Fifth Avenue and 18th Street.

"That is something I did," Dr. Stein said. "As it turns out, it wasn't a very valuable book."

He pursued mathematics at the University of Chicago, where he received a bachelor's degree in 1951, a master's in 1953 and a doctorate in 1955.

After working as an instructor at the Massachusetts Institute of Technology, Dr. Stein returned to the University of Chicago as an assistant professor in 1958. In 1963 he moved to Princeton, where he spent the rest of his career. He retired in 2012, although he continued to teach classes.

He was a member of the National Academy of Sciences and the American Academy of Arts and Sciences. He received a National Medal of Science in 2002, bestowed by President George W. Bush.

In addition to his daughter, Dr. Stein is survived by his wife of 59 years, Elly Stein; a brother, Daniel; a son, Jeremy; and three grandchildren.

Throughout his career, Dr. Stein advised more than 50 graduate students — a large number for a math professor. Two of his students, Dr. Tao and Dr. Fefferman, later won the Fields Medal, often considered the Nobel Prize of mathematics.

Dr. Tao marveled at Dr. Stein's well-constructed lectures. "Math lectures are often very dry," he said. "It's always definitions and theorems. He almost made it like an episodic TV show. Every hour had a setup, a good guy and a bad guy, and action, and the good guy wins at the end."

Lillian Pierce, a mathematics professor at Duke, took a class taught by Dr. Stein during her freshman year at Princeton. It was a standard course taken by mathematics majors about the underpinnings of calculus.

"It's really because I took that class from him that I made the jump to think, 'Ah, I think I want to pursue mathematics above everything else,' " she said in an interview. "I then took all the courses that he taught during those four years."

A version of this article appears in print on Jan. 15, 2019, on Page B13 of the New York edition with the headline: Elias M. Stein, 87, Mathematician of Fluctuations