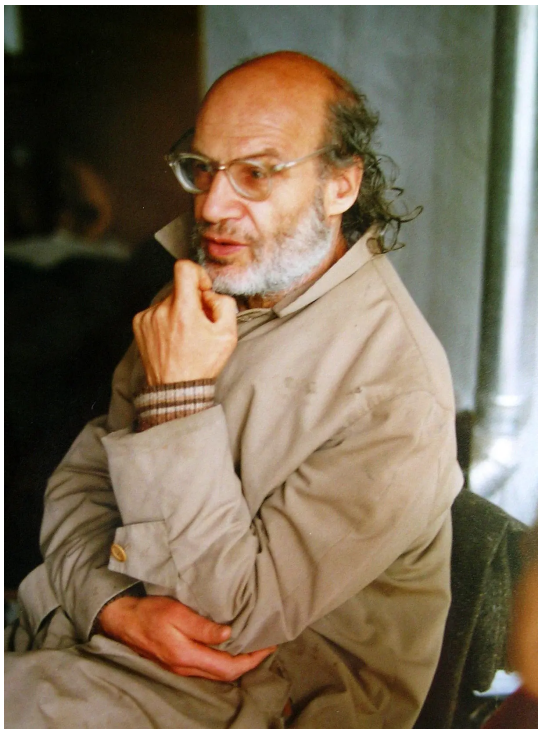
The New York Times https://www.nytimes.com/2014/11/16/world/europe/alexander-grothendieck-math-enigma-dies-at-86.html

Alexander Grothendieck, Math Enigma, Dies at 86

By Bruce Weber and Julie Rehmeyer

Nov. 14, 2014



Alexander Grothendieck in 1988.
Erika Ifang

Alexander Grothendieck, whose gift for deep abstraction excavated new ground in the field known as algebraic geometry and supplied a theoretical foundation for the solving of some of the most vexing conundrums of modern mathematics, died on Thursday in Ariège, in the French Pyrenees. He was 86.

A vexing character himself, Mr. Grothendieck (pronounced GROAT-en-deek) turned away from mathematics at the height of his powers in the early 1970s and had lived in seclusion since the early 1990s. His death was widely reported in France, where the newspaper Le Monde described him as “the greatest mathematician of the 20th century.” In a statement on Friday, President François Hollande praised him as “one of our greatest mathematicians” and “an out-of-the-ordinary personality in the philosophy of life.”

Algebraic geometry is a field of pure mathematics that studies the relationships between equations and geometric spaces. Mr. Grothendieck was able to answer concrete questions about these relationships by finding universal mathematical principles that could shed unexpected light on them. Applications of his work are evident in fields as diverse as genetics, cryptography and robotics.

“He had an extremely powerful, almost otherworldly ability of abstraction that allowed him to see problems in a highly general context, and he used this ability with exquisite precision,” Allyn Jackson wrote in a 2004 biographical essay about Mr. Grothendieck for Notices of the AMS, a journal of the American Mathematical Society. “Indeed, the trend toward increased generality and abstraction, which can be seen across the whole field since the middle of the 20th century, is due in no small part to Grothendieck’s influence.”

His background and early life were tangled and harrowing. His father, whose name is usually reported as Alexander Schapiro, was a Jewish anarchist who fought against the Russian czarist government. He was captured by the Bolsheviks during the Russian Revolution and eventually escaped to Western Europe. Along the way he lost an arm.

Schapiro made a living as a street photographer and met Johanna Grothendieck, known as Hanka, an aspiring writer who was married to a man named Alf Raddatz, in Berlin, in the mid-1920s. By then Schapiro had changed his name to

Alexander Tanaroff, according to Mr. Grothendieck's biographer, Winfried Scharlau. Introducing himself to Raddatz, Tanaroff said, "I will steal your wife," and proceeded to do so.

Alexander Grothendieck, who for an unknown reason was named Raddatz at birth (not Schapiro, Tanaroff or Grothendieck), was born in Berlin on March 28, 1928.

Young Alexander's parents left Germany as the Nazis took power — they participated in the Spanish Civil War — leaving him in the care of foster parents in Hamburg, where he first went to school. In 1939, he reunited with his mother and father in France, but his father was arrested, sent to an internment camp at Le Vernet and eventually moved to Auschwitz, where he died in 1942.

With his mother, Alexander lived in Le Chambon, where he finished primary school, and after the war attended college in Montpellier and later in Nancy, beginning his mathematical education in earnest. By the late 1940s he had entered the society of elite European mathematicians.

During the 1950s he taught in São Paulo, Brazil, and at the University of Kansas and lectured at Harvard. In 1958 he joined the faculty of the fledgling Institut des Hautes Études Scientifiques (IHES), which became a leading institute for the support of advanced research in mathematics and physics. (It is now in Bures-sur-Yvette, south of Paris.)

In 1966, Mr. Grothendieck was given the Fields Medal, an international award considered among the highest in mathematics.

He is widely credited for advances that made possible long-sought proofs for befuddling problems, including Fermat's Last Theorem, the 17th-century conjecture by the French mathematician Pierre de Fermat that no three positive

integers — a, b and c — exist that will satisfy the equation $a^n + b^n = c^n$ for any integer value of n greater than 2. The first successful proof was published by an Englishman, Andrew Wiles, in the 1990s.

Mr. Grothendieck's work was also a steppingstone to solutions of other enigmas famous among mathematicians, but far more arcane. He was instrumental in proving an especially thorny set of hypotheses known as the Weil conjectures. But characteristically he did not attack the problem directly. Instead, he built a superstructure of theory around the problem. The solution then emerged easily and naturally, in a way that made mathematicians see how the conjectures had to be true.

He avoided clever tricks that proved the theorem but did not develop insight. He likened his approach to softening a walnut in water so that, as he wrote, it can be peeled open "like a perfectly ripened avocado."

"If there is one thing in mathematics that fascinates me more than anything else (and doubtless always has), it is neither 'number' nor 'size,' but always form," he wrote in a long memoir in the 1980s, "Reapings and Sowings." "And among the thousand-and-one faces whereby form chooses to reveal itself to us, the one that fascinates me more than any other and continues to fascinate me, is the structure hidden in mathematical things."

Mr. Grothendieck had long held pacifist views, and by the late 1960s he had also become consumed by environmentalism. In 1966, he refused to travel to Moscow to receive the Fields Medal as a protest against the imprisonment of Soviet writers. He traveled to Hanoi at the height of the Vietnam War and lectured in Paris about the trip. He resigned from IHES, at least in part because some of its funding came from the French Defense Ministry, though he was also feuding with the institute's founder. And he helped found an organization, Survivre, that promoted environmental activism and opposed the proliferation of nuclear weapons. He studied Buddhism and mysticism.

Over the next two decades, though he taught mathematics for a time at the University of Montpellier, he gradually withdrew from society and, according to his biographer, began devoting himself obsessively to writing what he called his "meditations."

Mr. Grothendieck was married at least once, to Mireille Dufour. They had three children. He had two other sons with other women. Information about his survivors was not available.

A correction was made on Nov. 23, 2014*: An obituary last Sunday about the mathematician Alexander Grothendieck referred incorrectly to one aspect of the influence of his work. While it was a steppingstone to solving several arcane problems well known in mathematics, it was not a steppingstone to proof of the Poincaré conjecture. The obituary also overstated Mr. Grothendieck's involvement in proving a set of hypotheses posed by André Weil. Mr. Grothendieck proved two of the four hypotheses and developed a new proof of a third; his former student Pierre Deligne proved the fourth. Mr. Grothendieck and Mr. Deligne were not "working together."*

A version of this article appears in print on , Section A, Page 30 of the New York edition with the headline: Alexander Grothendieck, Math Enigma, Dies at 86