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## Claudia E. Graf-Grossmann, Marcel Grossmann. For the Love of Mathematics.

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Claudia E. Graf-Grossmann. *Marcel Grossmann. For the Love of Mathematics*. Translated by William D. Brewer. (Springer Biographies.) xviii + 261 pp., bibl., illus., index. Cham, Switzerland: Springer, 2018. £24.99 (cloth), ISBN 9783319900766.

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Contemporary theoretical physics is so tightly bound to mathematics that it is unthinkable to pursue it as a career without a solid background in higher mathematics. This was not true at the turn of the twentieth century, when the subdiscipline was in its infancy, and Albert Einstein was a student at the Polytechnikum in Zurich (now the Eidgenössische Technische Hochschule, or ETH). The mathematical curriculum at the Polytechnikum was irreproachable in Einstein's day, and its teaching staff included two of the world's finest mathematicians: Adolf Hurwitz and Hermann Minkowski. Studying alongside Einstein at the Polytechnikum were several bright students, including his future wife, Mileva Marić, and the future mathematicians Louis Kollros, Marcel Grossmann, Jacob Ehrat, and Louis-Gustave du Pasquier. The young Einstein was inspired in particular by Minkowski's lectures on capillarity; at the time, Minkowski, like Einstein, was reading the masterworks of theoretical physics, a predilection that would soon lead him to abandon Zurich for Göttingen. He was disappointed by Einstein's performance in class, and was said to have referred to him once as a "richtiger Faulpelz", who paid no attention to mathematics (Carl Seelig, *Albert Einstein: Leben und Werk*

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*eines Genies unserer Zeit* [Europa, 1960], p. 45). By Einstein’s own account, he was a middling student, whose high grades in mathematics owed much to the lecture notes loaned him by Grossmann.

After graduation, Grossmann (1878–1936) went on to become a high school math teacher, a position for which Einstein was passed over. Einstein later found work at the Patent Bureau in Bern, on the strength of a recommendation from Marcel’s father Jules, a businessman acquainted with the Bureau’s director. In his spare time, Einstein rolled out a series of discoveries that rocked the world of physics, including the theory of relativity. Minkowski, now in Göttingen, took note of Einstein’s theory, and seized on the idea of the world as a four-dimensional spacetime manifold, thereby demonstrating the potential for pure mathematics to restructure the scientific worldview. Upon further formal elaboration by Arnold Sommerfeld, Einstein and others came to see the beauty and utility of Minkowski’s approach for a “generalized” theory of relativity that would include gravitational phenomena.

By 1911, Einstein occupied the chair of theoretical physics in Prague, while Grossmann, now a professor of descriptive geometry at the ETH, went about securing his brilliant friend a position on the faculty. Reunited in Zurich in the summer of 1912, the two men pursued the generalized theory of relativity, cosigning the two papers that are Grossmann’s claim to fame – as Einstein subsequently moved to Berlin and discovered the foundational field equations of general relativity.

Grossmann’s precise contribution to this discovery is better known, thanks to the preservation of a notebook kept by Einstein, referred to by Einstein scholars as the “Zurich notebook.” In a crucial step, Grossmann, following a literature search, introduced Einstein to Gregorio Ricci and Tullio Levi-Civita’s absolute tensor calculus (1901), a work known both to applied mathematicians and to physicists more attentive to the mathematical literature than Einstein, including Max Abraham and Friedrich Kottler.

Historical interest in Grossmann’s contribution to general relativity reflects a broader scholarly interest in Einstein and his sociointellectual milieu dating from the 1980s, when the *Einstein Studies* series and the vast edition project, the *Collected Papers of Albert Einstein (CPAE)* were launched. The book under review is an English translation by the physicist William D. Brewer of the biography in German (Römerhof, 2015) by Grossmann’s granddaughter, Claudia Graf-Grossmann. Occasionally, biographical portraits by descendants bring to light not only family history and genealogy, but archival documents, private correspondence, photos, diaries, notebooks, oral history, and more. In the case at hand, while there are numerous photos of Grossmann’s family and friends, and of various residences, the novelties are few.

Grossmann's granddaughter was born a generation after his death, and consequently she has no personal memories to pass on. Instead, she draws on the diaries of her father, Marcel Hans Grossmann, as well as the transcribed recollections of her aunt Elsbeth. The correspondence with Einstein, cited generously from the *CPAE* and the Einstein Archives, is a delight to read, comprising six letters from Grossmann, one of which is reproduced in facsimile, and eleven from Einstein. The historical setting of the exchange is sketched by one of the senior editors of the Einstein Papers, Tilman Sauer, in a much-abridged version of an earlier work, although surprisingly, Professor Sauer is not credited on the title page.

From the book's subtitle – *for the love of mathematics* – I had expected Grossmann's life in mathematics to get a little biographical love, but in this I was disappointed, as Sauer's sketch (pp. 171–193) alone engages with Grossmann's training and career. Apart from his collaboration with Einstein, Grossmann published a handful of papers on non-Euclidean geometry and several college textbooks on descriptive and analytic geometry. His scientific productivity was hindered by debilitating illness beginning in 1915, and he made no further significant contributions to mathematics. Readers with no mathematics will have no difficulty reading this biography, which should appeal to those with an interest in the Grossmann family history.