HIRSCHFELDER, Elizabeth (Stafford). April 25, 1902–September 29, 2002. BROWN UNIVERSITY (WOMEN'S COLLEGE) (PhB 1923, MS 1924), UNIVERSITY OF WISCONSIN (PhD 1930).

Elizabeth Thatcher Stafford, the eldest of three children, was born in Providence, Rhode Island, to Evangeline K. (Flagg) (1877–1966) and Arthur Ervin Stafford (b. 1875), a banker. Her mother was a direct descendent of Roger Williams, the founder of Rhode Island. Her parents, both natives of Rhode Island, married in 1899, and she had two younger brothers, Stuart W. (b. 1904) and Harvey Chace (b. 1906). Harvey graduated from Brown University in 1927 and became an accountant in Manhattan.

Stafford's family lived very close to Brown University. Because of financial difficulties in 1918, she was only able to attend college by living at home. She attended Women's College of Brown, graduated in 1923, and remained at the university an additional year in order to earn her master's degree. In a 1995 interview for the Oral History Program at the University of Wisconsin, she mentioned both R. G. D. Richardson and R. C. Archibald when asked if there were any faculty at Brown who had influenced her. She noted that Archibald's influence extended beyond mathematics to his second interest, music, as he bought seats for students at Boston Symphony Orchestra concerts held in Providence. She also remarked that there were two other women in her class at Brown and all three got teaching jobs in colleges when they graduated; Ellen Clayton Stokes and Evelyn Wiggin (Casner) also received master's degrees from Brown in 1924. Elizabeth Stafford took a position as a last-minute replacement for a faculty member at the University of Texas. Letters of recommendation from Richardson reflect his high opinion of her. In one he noted that she was well-trained, well-balanced and cultured and that she would be a great success there. She spent the year 1924–25 as an instructor in pure mathematics (for $1800) at the University of Texas in Austin. In December 1924 Richardson notes in a letter to her that it is very ambitious if she takes a course for credit.

Since no position was available for Stafford at the University of Texas the following year, she applied for a job at Texas Technological College (now Texas Tech University) in Lubbock, which was scheduled to offer its first instruction at the postsecondary level in September 1925. She was hired as an adjunct professor and remained until 1928.

During the summer of 1927, Stafford attended summer school at Brown and took a graduate course from Mark H. Ingraham. Ingraham, who had received his PhD at Chicago in 1924 under E. H. Moore, left Brown for the University of Wisconsin in 1927 and urged Stafford to apply there for a fellowship so she could do graduate work with him. She took a leave from her position at Texas Technological College, studied at the University of Chicago in the summer of 1928, and entered the University of Wisconsin with a fellowship in mathematics that fall. In October 1929, she and seven men were admitted to candidacy for the PhD. She held a fellowship again in 1929–30, and in 1930 she received her degree in linear algebra as Ingraham's first doctoral student at Wisconsin.

While Stafford was in Texas she had worked with H. S. Vandiver on computations to check Fermat's Last Theorem. In 1929, Vandiver, who had come to the University of Texas in 1925, published a paper in the *Transactions* of the AMS in which he acknowledged Stafford's assistance with the computations. The following year,

while Stafford was at the University of Wisconsin, they coauthored a paper on the subject that appeared in the *Proceedings of the National Academy of Sciences.* Vandiver continued to publish papers on Fermat's Last Theorem and continued to acknowledge Stafford's contributions.

Stafford reported later that while she was at Wisconsin she "had fallen in love with this man who worked in the mathematics department" (Teicher interview 1995). She returned to Lubbock for the year 1930–31 and then went back to Madison, where on June 6, 1931, she was married to Ivan S. Sokolnikoff (1901–1976) of Russia. Ivan Sokolnikoff immigrated to the United States in 1921, did his undergraduate work at the University of Idaho, and received his PhD from Wisconsin in 1931. After a honeymoon trip to Manchuria to visit his parents that summer, both returned to the mathematics department at Wisconsin. He progressed from instructor to professor until he left in 1946 to finish his career at the University of California at Los Angeles.

Elizabeth Sokolnikoff first served as instructor at Wisconsin 1931–32 and then continued in a number of irregular positions. Correspondence in the archives at Wisconsin reveals circumstances of her initial appointment and of some appointments subsequent to it. On September 15, 1931, Warren Weaver, then the department chair, wrote to Dean Sellery, the dean of the college, noting that the department wanted to recommend the temporary appointment of Mrs. Sokolnikoff since an instructor had left. He wrote, "We could not hope to get a person of Mrs. Sokolnikoff's training and ability for the salary involved ($1800) except under very unusual circumstances." In a letter of February 8, 1932, Mark Ingraham, the new chairman, wrote to the dean regarding proposed budget cuts: "Mrs. Sokolnikoff has taught full time at a salary of $1800. Mrs. Sokolnikoff took her degree here a few years ago and is both from mathematical ability and teaching ability a person of very superior quality–one who could well rank as an assistant professor in any university. If we make the cut contemplated above, it would seem almost necessary to drop her from the pay roll or retain her only for part time. I feel in general it is not well to tie ourselves up with husbands and wives on the pay roll, but it is with great reluctance that I would make this change during the year when we have lost Professor Weaver." On May 19, 1932, another letter from Ingraham to the dean followed regarding the Sokolnikoffs.

> There is no reason in justice why he [I. S. Sokolnikoff] should not be getting as much as the other assistant professors in the Department. Moreover, although Mrs. Sokolnikoff is one of our best instructors and is better prepared than any other instructor to give advanced work, we have omitted her from the tentative budget for next year due to the fact that you do not feel it wise to retain the wife of a member of the Department on the staff. Although you may feel that this action is both necessary and wise, you can readily understand how it would be discouraging to the Sokolnikoffs in light of the fact that they must know that there are a number of other couples engaged in teaching at the University of Wisconsin. (folder Budget 1931–33, box 1: 1924–1937, Budget Files, Department of Mathematics, College of Letters and Science, University of Wisconsin–Madison Archives)

After a year as instructor and a year without a position, Elizabeth Sokolnikoff was hired primarily as a lecturer on an ad hoc basis for the next several years.

During World War II, Elizabeth Sokolnikoff, like Grace Hopper, wanted to join the US Navy WAVES (Women Accepted for Volunteer Emergency Service) but was told that she should teach mathematics instead. During the war, I. S. Sokolnikoff spent much of his time in New York and Washington working with the National Defense Research Council. Elizabeth Sokolnikoff spent the war years in Madison teaching calculus and differential equations to army and navy groups, geologists, and engineers. In her 1995 interview, she said that "we were separated a lot during those war years. . . . I was very much in favor of [Ivan's going to California] and very much in favor of my not going to California with him." Before their separation, the Sokolnikoffs had a fruitful mathematical relationship; in the period 1934 to 1941 they coauthored five significant mathematical papers in analysis and the classic text *Higher Mathematics for Engineers and Physicists.* They were divorced in 1947, the year after I. S. Sokolnikoff went to UCLA. In 1947 Elizabeth Sokolnikoff was given a three-year appointment as assistant professor. In 1952 she was an invited speaker at a symposium on the mathematical training of engineers held at the summer mathematics meetings in East Lansing, Michigan. The symposium was described in an article in the *Monthly* the following year.

On March 7, 1953, Elizabeth S. Sokolnikoff married Joseph Oakland Hirschfelder (1911–1990), a professor of chemistry at Wisconsin. She took a leave of absence for the year 1953–54. Joseph Hirschfelder was a native of Baltimore who had done his undergraduate work at Yale and received a PhD from Princeton in physics and chemistry in 1936. He joined the chemistry department at Wisconsin in 1937 and remained until his retirement in 1981 except for military research during World War II. Between 1942 and 1946, he was with the National Defense Research Committee (NRDC) in Washington, D.C., was a group leader at Los Alamos working on the development of the atomic bomb, and was at a naval ordinance test station in California. Some years after his return to Madison, he was the founder of UW-Madison's Theoretical Chemistry Institute. He was elected to the National Academy of Sciences in 1953 and was awarded the National Medal of Science in 1976. After their marriage, Elizabeth Hirschfelder spent the summer proofreading a lengthy, and later, classic text that her husband coauthored. Joseph O. Hirschfelder also acknowledged the help of his wife in papers he published in the mid-1950s. He retired from Wisconsin in 1981.

In 1954 Elizabeth "Betty" Hirschfelder resigned her position as assistant professor of mathematics in order to be able to accompany Joseph "Joe" Hirschfelder when he traveled to give lectures. In 1957 they took a trip around the world. In the mid-1970s they began to split their time between Madison, Wisconsin, and Santa Barbara, California, where Joe Hirschfelder was an adjunct professor at the university. Joseph Hirschfelder died of cancer in their home in Madison in 1990. In the early 1990s, Betty Hirschfelder helped endow a fellowship at the University of California at Santa Barbara; the UCSB Faculty Women's Club makes awards of the Broida-Hirschfelder Graduate Fellowship in the Sciences to doctoral students in all fields of engineering, science, and mathematics. She provided funding for the Joseph O. Hirschfelder Prize in Theoretical Chemistry established at the University of Wisconsin in 1992 in honor of her late husband and was a leading donor for an

addition to the chemistry building there for which ground was broken in September 1999.

Elizabeth S. Hirschfelder spent her winters in Santa Barbara and died at age one hundred in September 2002 in Madison, Wisconsin. She left significant bequests to the Broida-Hirschfelder Endowment and to the University of Wisconsin that allowed for the establishment of the Elizabeth Hirschfelder Fund for Graduate Women in Mathematics, Chemistry and Physics.

Organizational affiliations: AMS, MAA, Phi Beta Kappa, Sigma Xi.

Dissertation:

1930 [Stafford, E. T.] Matrices conjugate to a given matrix with respect to its minimum equation. PhD dissertation, University of Wisconsin, directed by Mark Hoyt Ingraham. Printed version, 1933, reprinted from *Amer. J. Math.* 55:167–80.

Publications:

1930 [Stafford, E. T.] with H. S. Vandiver. Determination of some properly irregular cyclotomic fields. *Proc. Nat. Acad. Sci. USA* 16:139–50. Review: *JFM* 56.0887.04 (T. Rella). Presented to the AMS, New York City, 27 Dec 1928; abstract: *Bull. Amer. Math. Soc.* 35:181 #65.

1933 [Sokolnikoff, E. S.] Matrices conjugate to a given matrix with respect to its minimum equation. *Amer. J. Math.* 55:167–80. Published version of PhD dissertation. Reviews: *JFM* 59.0902.07 (W. Specht); *Zbl* 006.38707 (C. C. MacDuffee). Presented as "On matrices conjugate with respect to the minimum equation" to the AMS, Chicago, 19 Apr 1930; abstract: *Bull. Amer. Math. Soc.* 36:362 #269.

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1935b [Sokolnikoff, E. S.] With I. S. Sokolnikoff. The problem of Dirichlet for an ellipsoid. *Terrestr. Mag. Atmosh. Electr.* 40:433–42. Review: *Zbl* 013.26702 (J. J. Gergen).

1938 [E. S. Sokolnikoff] with I. S. Sokolnikoff. Torsion of regions bounded by circular arcs. *Bull. Amer. Math. Soc.* 44:384–87. Review: *JFM* 64.0836.04 (G. Schulz). Presented by title to the AMS, Indianapolis, IN, 30 Dec 1937; abstract: *Bull. Amer. Math. Soc.* 44 (1, pt. 1): 45–46 #64.

1939 [Sokolnikoff, E. S.] with I. S. Sokolnikoff. Thermal stresses in elastic plates. *Trans. Amer. Math. Soc.* 45:235–55. Reviews: *JFM* 65.0946.02 (K. Marguerre); *Zbl* 020.26304 (P. Funk). Presented by I. S. Sokolnikoff to the AMS, Chicago, 8 Apr 1938; abstract: *Bull. Amer. Math. Soc.* 44:351 #266.

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1931 [Stafford, E. T.] A general Vandermodian determinant. *Amer. Math. Monthly* 38:367 #3. Presented to the MAA, Fort Worth, TX, 31 Jan 1931.
1952 [Sokolnikoff, E. S.] The student talks back. *Amer. Math. Monthly* 59:591 #4. Presented to the MAA, Milwaukee, WI, 10 May 1952.

Presentation not listed above:
Problems of mathematicians who teach engineers. Presented to the MAA, East Lansing, MI, 2 Sep 1952.

References to: AmMSc 5–8, 9P; AmWom 1935–40.
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Hirschfelder, Elizabeth 1902–2002. Interview by Barry Teicher, 16 Oct 1995. Oral History Program, University of Wisconsin-Madison Archives.

Other sources: Owens questionnaire 1940; Brown University Archives; University of Wisconsin–Madison Archives; Ralph Hull, "The mathematical training of engineers," *Amer. Math. Monthly* 60 (1953): 106–08; University of California: In Memoriam, [1979], 109–11 (Sokolnikoff, Ivan Stephan); "J. O. Hirschfelder, 78, Atom Bomb Developer," *New York Times*, 31 Mar 1990; "Joseph Hirschfelder, 78, Dies; Helped Develop Atomic Bomb," *Washington Post*, 1 Apr 1990; R. Byron Bird, Charles F. Curtiss, and Phillip R. Certain, "Joseph Oakland Hirschfelder," *Biographical Memoirs*, National Academy of Sciences; US Census 1900, 1910, 1920, 1930 RI, 1930 WI; SSDI.

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