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Corry, Leo (IL-TLAV-HS)

Fermat meets SWAC: Vandiver, the Lehmers, computers, and number theory. (English summary)

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This article describes the work of Derrick Henry Lehmer, Emma Lehmer and Harry Schultz Vandiver on calculations to prove Fermat's Last Theorem one exponent at a time.

The history begins with the marginal note of Pierre de Fermat that he could prove that the equation $x^n + y^n = z^n$ has no nontrivial integer solution with $n > 2$. It continues with the results of Sophie Germain, Adrian Marie Legendre, Peter Lejeune Dirichlet and Gabriel Lamé. Next comes the brilliant contribution of Ernst E. Kummer, who connected the problem to Bernoulli numbers, introduced "regular" primes and gave an algorithm for proving Fermat's Last Theorem exponent by exponent. Calculations by Kummer, Martin Ohm, John Couch Adams and Sergei Serebrenikoff are mentioned.

The case of Fermat's Last Theorem in which x, y and z are assumed to be relatively prime to n is easier than the general case. Edmond Maillet, Dimitry Mirimanoff and Leonard Eugene Dickson proved it for all $n < 7000$ more than a century ago. Results of Arthur Wieferich, Philip Furtwängler, Vandiver and Georg Ferdinand Frobenius in this case are also mentioned, as are calculations by Waldemar Meissner, Dimitri Grawe, and N. G. W. H. Beeger, who was the first to use a mechanical device in connection with Fermat's Last Theorem.

Vandiver's first article on Fermat's Last Theorem appeared in 1914. His collaboration with the Lehmers began in the 1930s, when it was difficult to publish tables in mathematical journals. In the 1950s, they, John L. Selfridge and Charles A. Nicol used the SWAC (National Bureau of Standards Western Automatic Computer) at UCLA to prove the theorem in the general case for all $n < 4002$. In publishing the work, Vandiver stressed the importance of the numerical tables for the theory and classification of cyclotomic fields. Indeed, tables of irregular primes continued to be published even after Andrew Wiles proved Fermat's Last Theorem in 1994.

This tribute to three great computational number theorists sheds light on the ideological and institutional aspects of number theory research in the United States during the twentieth century and depicts the incursion of computer-assisted methods into pure fields of mathematical research. The article contains photos of the three number theorists and many quotations from their correspondence.

Reviewed by *Samuel S. Wagstaff, Jr.*