REMEMBERING THE STRANGE ATTRACTIONS OF STAN ULAM

From Cardinals to Chaos: Reflections on the Life and Legacy of Stanislaw Ulam

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Reviewed by Peter Lax

The traditional Western form of rendering homage to a distinguished scholar is the festschrift. At its best, a festschrift provides valuable raw material for historians of the intellect by tracing a master's ideas from their sources to their reworkings and elaborations. Also, the sensitive delineation of creative personalities by those who were closest to them can instruct and amuse us. The value of such a volume depends on the originality of those ideas and on how strong and how colorful that personality is.

The festschrift *From Cardinals to Chaos*, dedicated to Stanislaw Ulam, is intriguing on both counts. Born in 1909, Ulam made his reputation in the 1930s with his precocious series of unexpected results in set theory, topology, measure theory and functional analysis. These studies, and the scintillating quality of his mind, earned him the admiration and friendship of many mathematicians, especially John von Neumann. It was von Neumann who brought Ulam to Los Alamos in 1944; that experience of being part of a vast enterprise in which physics and mathematics played such decisive roles profoundly altered the scientific outlook of both men. Each turned his back on the mathematical paradigm prevailing in

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Ulam in his prime (above) and (below) with John von Neumann (left) and Richard P. Feynman (middle) in 1949. (Both photos courtesy Los Alamos National Laboratory.)

the mid-1940s, which placed the highest value on studying elaborate structures using methods of extreme technical intricacy: von Neumann partly because he found doing technical mathematics too easy, Ulam because he found it too hard. What was more important, they both found irresistible the lure of brand-new problems arising in physics, biology and neurophysiology. Ulam shared the vision that von Neumann outlined in a lecture in Montreal in 1945 that (as quoted in the book) "high-speed computing devices may, in the field of nonlinear partial differential equations, as well as in many other fields which are now difficult or entirely denied of access, provide us with those heuristic hints which are needed in all parts of mathematics for genuine progress." The Fermi–Pasta–Ulam calculation provided precisely such a hint for the field of nonlinear lattice dynamics.

The remarkable essay entitled