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OBITUARIES

Nathan Rosen

Nathan Rosen died in his sleep on 18 December 1995 in Haifa, Israel. In an eminent career lasting more than six decades, he remained active in research, and two of his articles have yet to appear in print. He taught his general relativity course into his eighties at Technion—Israel Institute of Technology.

Born in Brooklyn, New York, on 22 March 1909, Rosen was educated at MIT, earning an ScB in electrochemical engineering in 1929 and an ScD in physics in 1932. His doctoral adviser was Philip M. Morse, and most of his early papers were in quantum chemistry. In making the first reliable quantum mechanical calculation of the structure of the hydrogen molecule, he used "entangled" wavefunctions, which could not be written as products of separate wavefunctions for the two electrons in the molecule.

During the Depression, Rosen held several postdoctoral positions—as a National Research Council fellow at the University of Michigan and Princeton Foundation, and then as an assistant to Albert Einstein at the Institute for Advanced Study in Princeton, New Jersey, from 1934 to 1936. Rosen and Einstein coauthored several articles, one of which was an outgrowth of Rosen's thesis work on entangled wavefunctions for molecules. Rosen pointed out to Einstein some of the bizarre properties of these wavefunctions, and after being joined by another of Einstein's assistants, Boris Podolsky, the three of them—referred to simply as EPR—published their provocative paper, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?" in the *Physical Review* in May 1935.

The question raised in the EPR paper was illustrated by an entangled two-particle wavefunction, chosen in such a way that the total momentum of the two particles is zero and their mutual distance has a large fixed value. According to EPR, quantum mechanics implies that, in spite of the uncertainty principle, both the position and momentum of each of the two particles are "elements of reality," because the value of either of these two quantities can be predicted for one of the particles when the position or momentum of the other, widely separated particle is measured. EPR concluded that "the description of reality as given by a wavefunction is not complete." In its wake, the EPR paper has produced a vast body of literature in physics and



NATHAN ROSEN

philosophy, and it has led to some ingenious experimental tests of the statistical correlations predicted for entangled quantum states.

Although he occasionally sought new ways of reconciling the quantum formalism with concepts of classical physics, Rosen personally never doubted the fundamental correctness of the statistical interpretation of quantum mechanics. However, his main interest shifted to the theory of gravitation, starting with seminal work on a precursor of the general relativistic wormhole, later dubbed the "Einstein-Rosen bridge." With Einstein, he also wrote a paper on gravitational waves, a subject to which he returned later. All of his papers reflect his commitment to simple arguments and clear exposition.

In 1936-38, like some other young physicists from the West, Rosen briefly worked in the Soviet Union, as a professor of theoretical physics at Kiev State University. Subsequently, he returned to MIT, taught one year at Black Mountain College in North Carolina, and from 1941 to 1952 was on the faculty of the University of North Carolina at Chapel Hill. During World War II he worked at UNC, through the Naval Research Laboratory, on a method for uranium isotope separation.

From the early 1950s on, the advancement of science in Israel was linked inseparably to Rosen's name. In 1953, attracted by the opportunity of building something new (and at the height of the McCarthy era in the US), he joined Technion—Israel Institute of Technology in Haifa as a professor of physics, to set up the physics department and the graduate school. He retired in 1979 as Distinguished Pro-

fessor, having held the Gerard Swope chair in physics.

Rosen's other contributions included helping to establish the Israel Physical Society in 1954 and serving as its president from 1955 to 1957, and being a cofounder of the Israel Academy of Sciences and Humanities in 1959. In addition, he was closely associated with the international conferences on general relativity and gravitation from their inception in 1955, and he served as president of the International Society for General Relativity and Gravitation from 1974 until 1977. Further, from 1969 until 1971, during the startup of Ben Gurion University of the Negev in Beersheba, he served as dean of the engineering school there.

All who knew Nate Rosen personally remember his kindness, modesty, integrity, gentle sense of humor and abiding concern for social justice, which he shared with his late wife, Anna. Until his last days, he was a familiar sight on the Technion campus, walking with his backpack to the office.

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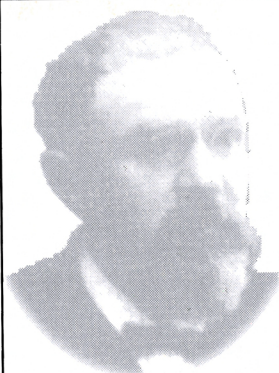
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Chapel Hill, North Carolina

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Haifa, Israel

Carson Dunning Jeffries

Carson Dunning Jeffries, a distinguished and beloved member of the physics department at the University of California, Berkeley, died of a brain tumor on 18 October 1995 at the solar home that he had built in the Oakland hills.

He was born on 20 March 1922 in Lake Charles, Louisiana, and earned his BS degree in physics at Louisiana State University in 1943. Soon thereafter he began wartime development work on radar countermeasures at Harvard University, where his talents caught the attention of Felix Bloch, who later persuaded him to become a graduate student of his at Stanford University. Carson's PhD from Stanford, awarded in 1951, involved a precision measurement of the magnetic moment of the proton, obtained by comparing the proton nuclear resonance and orbital rotation frequencies. In January 1952, after a year at the University of Zurich, he joined the Berkeley physics department, where he enjoyed



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