the *Journal of Mathematical Physics*, chairman of the Section of Applied Mathematical and Physical Sciences of the National Academy of Sciences and a valued consultant to many corporations—including GE, GM, Physical Dynamics, and Xerox—and to many governmental organizations.

Montroll's scientific contributions started at the University of Pittsburgh, when Gregory Wannier asked him to talk to the physics seminar about Mayer's theory of imperfect gases. Montroll discovered that a class of cluster integrals, now known as the ring diagrams, could be summed analytically. This work, published with Mayer in 1941, was the earliest of the diagrammatic resummation procedures that are now so prevalent in theoretical physics. In 1958 he and John Ward extended the diagrammatic approach to the study of finite-temperature Green's functions in quantum statistical mechanics.

Montroll's next major contribution to physics (while he was a post-doctoral fellow at Yale) was the invention of the transfer matrix method for calculating the partition function of an interacting lattice system. He used the method to work out the one-dimensional Ising lattice (another subject he got from Wannier). Onsager learned about the Ising lattice problem from Montroll, and used the transfer matrix method in his famous treatment of the two-dimensional problem. Years later, Montroll, Renfrey Potts and John Ward (1963) made an exact calculation of the spin–spin correlation functions of the two-dimensional Ising lattice using the Pfaffian method.

In 1947, Montroll did the first exact evaluation of the vibrational frequency spectrum of a two-dimensional lattice; he found a logarithmic singularity in the spectrum (nowadays referred to as a Van Hove singularity). Later, with Alex A. Maradudin and George H. Weiss, he wrote the classic "Theory of Lattice Dynamics in the Harmonic Approximation." The first of his celebrated lattice random walk papers, "A Note on Bessel Functions of Purely Imaginary Arguments," appeared in 1946. It evolved from his analysis of a discrete nonlinear diffusion equation governing the flow of an enriched component of a mixture through the levels in a cascade separation. In 1957, Montroll and Kurt Shuler treated the dissociation of a diatomic molecule as a random walk on the "vibrational ladder." Montroll, an omnivorous reader of the mathematical literature, recognized that the hitherto obscure "Gottlieb polynomials" could be used to effect an elegant solution of the random walk problem. In 1964, Montroll found the exact solution to a problem posed by George Polya—to find the probability of return to the origin of a random walk on a three-dimensional lattice. (Previously, only upper and lower bounds were known.) In 1965, Montroll and George Weiss introduced the powerful notion of a continuous-time random walk and the associated pausing-time distribution. This was the key ingredient in his work with Harvey Scher on dispersive transport in xerographic films and with Michael Shlesinger on the foundations of the Williams–Watts dielectric relaxation function.

Montroll's interests were extraordinarily broad. His papers on the mathematical theory of traffic flow were instrumental in helping to establish the subject as a new area of inquiry. In addition he worked on the melting of DNA, $1/f$ noise, and many aspects of the dynamics of complex social phenomena. (Some of the latter work can be found in the delightful book, coauthored with Wade Badger, *An Introduction to the Quantitative Analysis of Social Phenomena*.)

Montroll had a profound influence on the development of mathematical and chemical physics. His exceptionally lucid articles and lectures combined common sense and beautiful mathematics. He treated younger scientists with kindness and helpfulness and his vast knowledge of the historical development of physical concepts never failed to elicit interest and enthusiasm. He will be sorely missed by all who knew him.

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Richard Georg Ivars Allas

Richard Georg Ivars Allas, a physicist with the Naval Research Laboratory in Washington, D.C., died 19 March 1983 after suffering a massive stroke. He was 48 years old.

Allas was born in Riga, Latvia, on 14 September 1934. He spent his later childhood going from town to town in Germany, Austria and Czechoslovakia—one of the millions of displaced persons in war-torn Europe. Fate, luck and a lot of perseverance brought him and his family to Münster, where he entered the University in 1951. Immigrating with his family to the US in 1952, Allas enrolled at Washington University in St. Louis. He finished his undergraduate and graduate studies there, earning his doctoral degree in physics in 1961. His doctoral dissertation was on the study of proton polarization from deuteron-induced reactions on C^{12} and Be^{9}.

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After graduation, Allas became a resident research associate in nuclear physics at Argonne National Laboratory and worked with Luise Meyer-Schützmeister on nuclear structure and shell-model studies, especially in medium-weight nuclei. Together with Stan Hanna, Ralph Segel and Paul Singh, he also did some of the earliest studies on giant resonance through (p,γ) reactions on B^{11} and Al^{27}.

In 1964 he joined the newly formed cyclotron branch of the Naval Research Laboratory in Washington, D.C. Applying small mainframe computers to the acquisition of multiparameter nuclear-physics data, he contributed notably to the development of the facility. Somewhat after the new NRL cyclotron became operational, Allas shifted to few-nucleon studies. He helped establish the complete inadequacy of the plane-wave-impulse approximation when applied simultaneously to d(p,pn)p and d(p,pp)n reactions in the energy range of the NRL cyclotron. His later research with 4- to 7-nucleon systems culminated in a recent article on the He^3(p,2p)d and He^3(p,2p)d* reactions. He proved with each step the need for more sophisticated theoretical approaches than available with analyses based on plane-wave or distorted-wave impulse approximations. Using an intense neutron beam, Allas also demonstrated the effect of radiation-induced memory upset in static computer memory banks. Soon before his death he studied the sputtering and surface behavior of metals and binary alloys during ion implantation.

Allas, fluent in German and Latvian as well as English, maintained his appreciation of his European–Latvian heritage, and was a member of Tervetija, a Latvian professional fraternity, and other international social organizations.

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