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Roy J. Glauber, 93, Dies; Nobel Laureate Explored Behavior of Light

By Dylan Loeb McClain

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Roy J. Glauber, a theoretical physicist who was awarded the Nobel Prize in 2005 for using quantum theory to explain the field of optics and how light interacts with matter, laying the foundation for the field of quantum electrodynamics, died on Dec. 26 in Newton, Mass. He was 93.

His son, Jeffrey, confirmed the death. He said his father had entered Newton Wellesley Hospital that morning having difficulty breathing. No specific cause was given.

Dr. Glauber's seminal work addressed an area of research that had been largely ignored in quantum physics. For much of the first half of the 20th century, physicists had concentrated on trying to understand the nature of matter, neglecting the field of optics. That began to change with the development of the laser in 1960. Physicists wanted to understand how it worked vis-à-vis quantum mechanics, the mysterious rules that govern subatomic particles.

For his part, Dr. Glauber became intrigued by an experiment, performed in 1956 by the British astronomers Robert Hanbury Brown and Richard Q. Twiss, to measure the apparent angular diameter of visible stars. (The angular size of a star is essentially how large the dot of light appears in the night sky.) The two scientists had set up two detectors, which received photons and sent them to a central device for measurements.

The results confirmed a central idea of quantum physics: that light, though made up of particles, also behaved as if it came in continuous waves. What was missing was a mathematical framework to explain what was happening. Dr. Glauber set to work.

Beginning with a landmark 1963 paper titled "The Quantum Theory of Optical Coherence," he used sophisticated techniques to apply quantum mechanics to different forms of light. Light had previously been analyzed only by using classical, pre-quantum physics methods and mathematics.

Part of what Dr. Glauber confirmed was that there was nothing inherently contradictory in the idea that the energy of particles could interfere with one another both constructively and destructively, just as waves had long been known to do.

Dr. Glauber's theory about how photons interacted contradicted part of the work of Paul Dirac, the British theoretical physicist whose equations had created the mathematical foundation for quantum physics. Dr. Glauber explained in his Nobel lecture that Dr. Dirac had written that photons could only interfere with themselves.

"Well, forgive me, this is quantum mechanical scripture, but it is also nonsense," Dr. Glauber said.

Dr. Glauber's theory was able to explain the differences between the diffuse light of a light bulb, which is composed of electromagnetic radiation of many frequencies, and the intense beam of a laser, which has a constant frequency and phase. His theory helped lay the groundwork for developing quantum computers and quantum cryptography, and for the use of quantum mechanics to create an unbreakable code.

"It was Glauber's theory which was the basis for all of that," said Daniel Kleppner, a professor of physics at the Massachusetts Institute of Technology. "You didn't need Glauber's theory to invent the laser, but you needed Glauber's theory to understand its properties."

For his discovery, Dr. Glauber received half the Nobel Prize in 2005. The other half was shared by John L. Hall, an American, and Theodor W. Hansch, of Germany, who were recognized for their work on precision spectroscopy.

Dr. Glauber in 2007 during a lecture at Harvard, where he spent most of his career.
Jane Rosett

Roy Jay Glauber was born on Sept. 1, 1925, in New York City to Emanuel and Felicia (Fox) Glauber. His father was a traveling salesman who took his wife, who was trained as an elementary schoolteacher, and his son on the road with him.

“After long hours spent driving through endless farmlands,” Dr. Glauber wrote in an autobiographical sketch for the Nobel committee, “we would stay overnight at the houses of farmers who had hung the sign ‘Tourists-Vacancy’ near the road — never two successive nights in the same house. That was long before the days of roadside motels.”

The stock market crash of 1929 ended the family’s itinerant ways; his father lost his job, and the family had to move back to New York, though again the family bounced from living quarters in Manhattan, Queens and the Bronx.

Dr. Glauber became interested in science and astronomy as a young teenager. He built a telescope by hand, even grinding his own mirror, and he started attending lectures at the Hayden Planetarium at the Museum of Natural History.

In the fall of 1938, Dr. Glauber entered the Bronx High School of Science, which had just opened. He graduated three years later and was accepted to Harvard.

In October 1943, during his sophomore year, Dr. Glauber was recruited to join the top-secret program to build an atomic bomb known as the Manhattan Project, in Los Alamos, N.M. He arrived by train and shared a ride to the lab with the mathematician John von Neumann.

At Los Alamos, Dr. Glauber was given the job of checking calculations on the critical mass necessary to explode the bomb.

Returning to Harvard, he graduated with a bachelor's degree in 1946 and earned his doctorate there in 1949. His thesis adviser was Julian Schwinger, the theoretical physicist who was awarded the Nobel Prize in 1965 for his work on quantum electrodynamics.

After finishing at Harvard, J. Robert Oppenheimer, who had led the Manhattan Project, invited Dr. Glauber to work at the Institute for Advanced Study in Princeton, N.J., where Dr. Oppenheimer was the director. Dr. Glauber ended up collaborating with Wolfgang Pauli, who had won the physics Nobel in 1945.

Dr. Glauber spent a year teaching at the California Institute of Technology in Pasadena (replacing Richard Feynman, a future Nobel winner, who had gone on sabbatical to Brazil) before returning to Harvard in 1952 to teach. He would spend the rest of his career there.

Dr. Glauber's marriage to Cynthia Rich in 1960 ended in divorce in 1975. He lived in Arlington, Mass., outside Boston.

In addition to his son, Jeffrey, he is survived by a daughter, Valerie Glauber Fleischman; a sister, Jacqueline Gordon; his companion of 13 years, Atholie Rosett; and five grandchildren.

Dr. Glauber was known for his sense of humor. Before receiving the Nobel Prize, he participated in the annual Ig Nobel Prizes, a parody of the Nobel ceremony held at Harvard to honor unusual or trivial scientific achievements. His role was as "keeper of the broom," which entailed sweeping the stage of paper airplanes thrown during the event.

And in his Nobel lecture, he began: "Of course, we have surely had light quanta for more than a hundred years on earth. In fact, ever since the good Lord said, 'Let there be quantum electrodynamics,' which is a modern translation, of course, from the Hebrew."

Correction: *January 8, 2019*

An earlier version of this obituary misspelled the subject's surname in several instances. As the obituary correctly noted elsewhere, he was Roy J. Glauber, not Grauber.

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