

COLUMBIA CHEMISTRY DEPARTMENT PRESENTS

CHEMISTRY NEWS

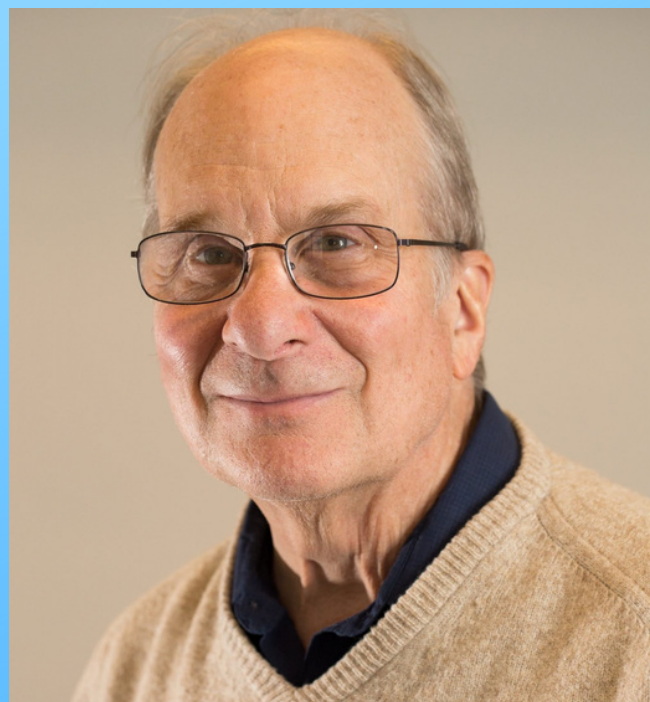
FALL 2023
SPECIAL EDITION

Professor Emeritus

Louis E. Brus

wins

**Nobel Prize in
Chemistry**



COLUMBIA | CHEMISTRY

Columbia Chemistry Professor Emeritus Louis E. Brus



Columbia Nobel Laureates in Chemistry.

In the middle, Louis Brus (2023), Department of Chemistry.

On the left, Joachim Frank (2017), Department of Biochemistry and Molecular Biophysics.

On the right, Martin Chalfie (2008), Department of Biological Sciences.

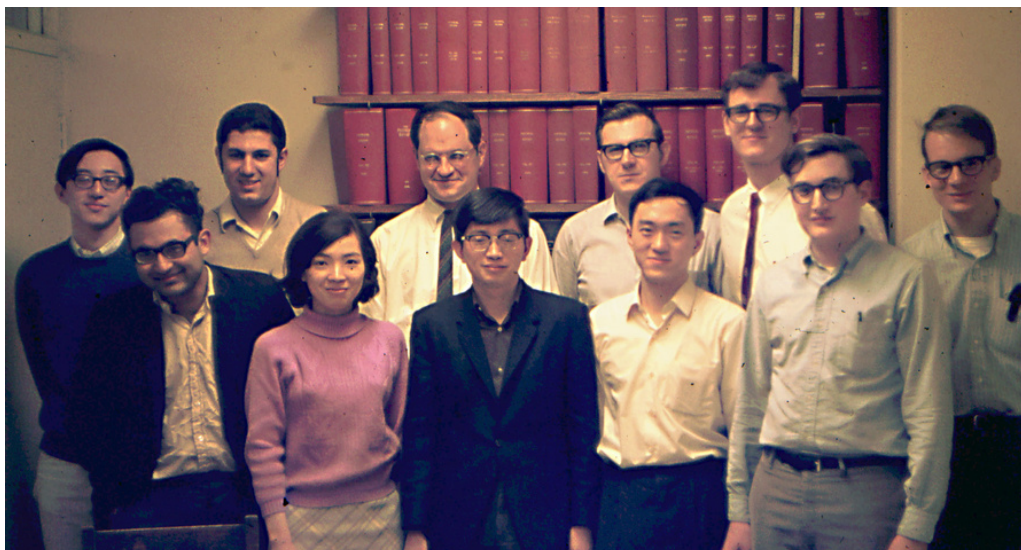
Photo by Barbara Alper for Columbia University

On October 4, Louis E. Brus, Samuel Latham Mitchell Professor Emeritus at Columbia University, was awarded the Nobel Prize in Chemistry alongside Mounqi G. Bawendi of the Massachusetts Institute of Technology and Alexei I. Ekimov of Nanocrystals Technology Inc. for the discovery and synthesis of quantum dots.

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Louis E. Brus



Bersohn Group, Columbia 1969

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Dr. Brus' research has had an immensely positive impact on the field of chemical physics and on the Department of Chemistry. To this end, this newsletter serves as a look at his early life as an aspiring researcher, provides insight into the defining work that he and his colleagues did at AT&T Bell Laboratories, and a gives a glimpse at the research currently being performed in the department that leans on Brus' discoveries.

Early Career

Louis Eugene Brus was born in 1943 in Cleveland, Ohio. He developed an early interest in math and science during his time at Shawnee Mission North High School in Johnson County, Kansas. He entered Rice University in 1961 with a

Naval Reserve Officers Training Corps (NROTC) college scholarship. When the opportunity came as a senior to postpone his military service and go to graduate school, he jumped at it. He graduated from Rice in 1965 with a B.S. in Chemical Physics and moved to New York City to join the Ph.D. program at Columbia University.

For his dissertation, he worked on the photodissociation of sodium iodide vapor under the supervision of Richard Bersohn, who remained an exemplar for Brus throughout his career for how he approached both science and mentorship. At Columbia, he was exposed to outstanding faculty and visiting scientists of all types, and learned to approach scientific problems. Furthermore, he

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learned to appreciate the value of chemical synthesis. Upon obtaining his Ph.D. in Chemical Physics in 1969, Dr. Brus returned to the Navy as a lieutenant and scientific staff officer at the United States Naval Research Laboratory in Washington, D.C.

Defining Work

Under the recommendation of his mentor, Bersohn, Dr. Brus left the Navy permanently and joined AT&T Bell Laboratories in 1973. It was at AT&T Bell Laboratories that he performed the work leading to his discovery of quantum dots alongside colleagues including Dr. Michael Steigerwald, now a research Professor in the Department of Chemistry at Columbia University, and his postdoctoral student and co-Laureate, Dr. Mounqi G. Bawendi. At Bell Laboratories, he worked initially on the electronic relaxation dynamics of small molecules trapped in rare gas matrices at

very low temperatures.

He then developed time-resolved Raman spectroscopy, and this led to an interest in colloidal metallic and semiconducting nanocrystals. The metallic nanocrystal research led to single molecule surface enhanced Raman spectroscopy (SERS) and photocatalysis on silver particles. The semiconducting nanocrystal work led to recognition of quantum size effects and development of colloidal core/shell quantum dot chemical synthesis. Dr. Brus' theoretical formulation of the connection between the crystal size of and the wavelength of the light that they emit has been named the Brus Equation after him.

Dr. Brus spent 23 years at AT&T Bell Laboratories. He explains in his biography for the 2008 Kavli Prize in

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Nanoscience, “Discoveries and new knowledge are often unpredictable in their application. For example, we first thought that semiconductor nanocrystals would be used in transistors. Actually, nanocrystals were first used as luminescent tags in biological imaging. Basic research is best supported as a whole, and its natural home is in the universities.”

In 1996, Brus left Bell Labs and joined the faculty in the Department of Chemistry at Columbia University. Here, at Columbia University, he spent the next decades conducting research in his laboratory and teaching and mentoring students. The Brus Group’s research focuses on the physical chemistry of materials, interfaces, nanocrystals, and nanotubes, especially in relation to optical and electronic properties. Dr. Brus and his group most recently published a paper in *The Journal of Chemical Physics* on non-local dielectric effects in nanoscience in July of this year.

However, Professor Brus’ research has had an impact here at Columbia beyond the scope of his own lab. The Owen group’s research involving colloidal semiconductor quantum dots and control of their synthesis is possible in large part due to the foundational work Brus and his contemporaries laid out for future scientists. Additionally, much of the physical chemistry involving advanced Raman spectroscopic and imaging approaches seen in the research of the Roy Group, the Min Group, and the Nuckolls Group can be traced back to the research conducted by Professor Brus.

Professor Brus’ legacy will surpass the work he has done and even still continues to do to this day here at Columbia University. We are honored to consider him a part of our community where he continues to be an outspoken advocate for basic science and innovation.

Columbia Chemists have been honored by the Royal Swedish Academy of Sciences for more than 90 years. Professor Louis E. Brus is the 14th Columbian to receive a Nobel Prize in Chemistry. Columbia Chemistry Nobel Prize winners include:

Brus, Louis E. (2023)

Frank, Joachim (2017)

Lefkowitz, Robert (2012)

Chalfie, Martin (2008)

Grubbs, Robert H. (2005)

Knowles, William (2001)

Hauptman, Herbert A. (1984)

Hoffman, Roald (1981)

Stein, William H. (1972)

Leloir, Louis (1970)

Libby, Willard (1960)

Northrop, John Howard (1946)

Urey, Harold C. (1934)

Langmuir, Irving (1932)

Further Reading On Professor Louis E. Brus

The Nobel Prize Announcement

<https://www.nobelprize.org/prizes/chemistry/2023/summary/>

<https://www.nobelprize.org/prizes/chemistry/2023/brus/interview/>

Columbia Chemistry

<https://www.chem.columbia.edu/content/louis-e-brus>

The Kavli Prize

<https://www.kavliprize.org/>

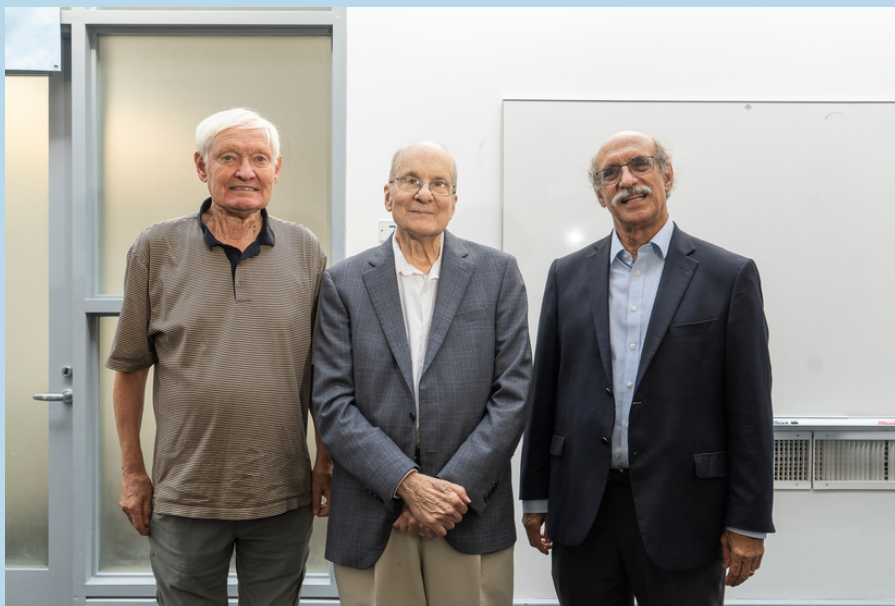
<https://www.kavliprize.org/bio/louis-e-brus>

Publications

<https://www.researchgate.net/profile/Louis-Brus-2>

Please send us your memories of Professor Brus! If you have memories or photos to share, please send them to Sheila Skaff at sms2281@columbia.edu.

Columbia University Reception in Honor of Louis Brus on October 4, 2023



Joachim Frank, Louis E. Brus, Martin Chalfie



Laura Kaufman, Louis E. Brus



Louis E. Brus with his wife, Marilyn, and children





Nobel Laureate portrait courtesy of Niklas Elmehed

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