

# OBITUARIES

## Gene Dresselhaus

A man ahead of his time, Gene Dresselhaus excelled as a theoretical physicist, student mentor, husband, and father; he was the embodiment of the consummate human being for the 21st century.

Gene was born on 9 November 1929 in the Panama Canal Zone, a former US territory. He grew up in California and studied physics at the University of California, Berkeley, where he earned both his bachelor's degree in 1951 and his PhD in 1955. His PhD adviser was Charles Kittel, and his thesis was titled "Electronic energy bands in semiconductors with cubic crystal structure." Gene was a postdoctoral fellow at the University of Chicago in 1955–56. There he met his beloved wife, Mildred. They got married in 1958 and moved to Cornell University, where Gene started his junior faculty position and Millie did a postdoc.

In 1960 Gene gave up his professorship to search for a single solution to the "two-body" problem, and the couple moved to work together at the MIT Lincoln Laboratory. In 1967 Millie joined the MIT faculty, and in 1976 Gene accepted a research appointment at the Francis Bitter National Magnet Laboratory, also at MIT. They both worked at MIT until their last days (Millie died in 2017).

Gene is best known for his seminal contribution on spin-orbit coupling in crystals, known later as the Dresselhaus effect. He based his analysis on the effective mass theory for explaining the cyclotron resonance in semiconductors. His work on the spin-orbit interactions that occur in the absence of an inversion center made Gene a go-to authority in semiconductor physics. His single-authored paper titled "Spin-orbit coupling effects in zinc blende structures,"

published in *Physical Review* in 1955, has been cited more than 4000 times, and it paved the way for the determination of the electronic structure of semiconductors.

That was just the shining starting point of Gene's brilliant scientific career; his nonstop research activities continued for nearly 60 years. His scholarly output included 559 peer-reviewed journal papers—with more than 60 000 cumulative citations, according to Scopus—and eight books, among them *Science of Fullerenes and Carbon Nanotubes* (1996), *Physical Properties of Carbon Nanotubes* (1998), *Raman Spectroscopy in Graphene Related Systems* (2011), and *Group Theory: Application to the Physics of Condensed Matter* (2008).

Gene and Emmanuel Rashba were jointly awarded the American Physical Society's 2022 Oliver E. Buckley Condensed Matter Physics Prize for their "pioneering research on spin-orbit coupling in crystals, particularly the foundational discovery of chiral spin-orbit interactions, which continue to enable new developments in spin transport and topological materials." The prize is considered the most prestigious award in the field, and in 2008 Millie received the same prize for her work on the electronic properties of materials.

For most of their lives, Gene and Millie worked close to each other on campus. Gene contributed, in some sense unofficially but in all senses unequivocally, to the research group of his wife. Gene didn't travel abroad much and would support the group while Millie was traveling tirelessly around the globe. At meetings of the group, known as mgm, everyone would have lunch together and engage in lively discussions. Graduate students and researchers came to the mgm group from all over the world, and it was inspiring watching Gene always treating young people from many countries as equals and engaging them with his unique humor. Gene understood exactly what we said in our poor English and helped us flesh out the most important points of our research data, and he was always available to give us advice and answer any questions, whether work or nonwork related.



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Everyone who shared their time will lovingly remember seeing Millie and Gene leaving from the end room on the third floor of MIT Building 13 to the elevator at 5:00pm after every working day. Gene would have to urge Millie to keep moving through the corridor as many students and collaborators tried to talk to her about their work. Another of our vivid memories is working with Gene on weekend mornings, then joining him to have a bagel for lunch and hike to the suburbs to stay in good health.

It is our impression that the great progress of research in the mgm group, despite the various cultures and values, was because of Gene's ability to attract students with his kindness and humor and Millie's oddly powerful ability to promote research. Gene left us on 29 September 2021, at age 91, and we are grateful to him for his guidance in our research and impact on our lives.

**Ado Jorio**  
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*Tohoku University*  
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