

gratory insertion reaction on copper surfaces.

Copper catalyzes another important and poorly understood synthesis, of dimethyldichlorosilane from silicon and methyl chloride; this reaction supports the billion-dollar-per-year silicone polymer industry. Before Brian, nobody had been able to get the reaction to go under vacuum conditions and thereby study its mechanism.

Other accomplishments of Brian and his coworkers, reported in papers that are widely admired for their insight and clarity, include resolution of the controversy over the role of radicals in classic syntheses bearing the names Ullmann, Grignard, Wurtz and Rochow; demonstration of the elusive Eley-Rideal mechanism, involving direct reaction between an adsorbate and a gas-phase species, in the plasma etching of organic polymers; and fabrication, from semiconductors, of new microelectronics materials by metal-organic chemical vapor deposition and chemical dry etching.

To his students at Columbia, Brian was a superb teacher and mentor, unfailingly patient, attentive and good-humored. The same wonderful human qualities marked his relations with his colleagues and with his scientific peers. He was an accomplished cellist, an athlete who had once held the world record—for 12-year-olds!—in the marathon, a devoted husband and father. He managed his intensely active and varied life with grace and modesty and the illusion of effortlessness. We miss him deeply.

**KENNETH B. EISENTHAL**  
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## Martin E. Rickey

**M**artin E. Rickey, a leading pioneer in the development of the second generation of isochronous cyclotrons and a professor emeritus of physics at Indiana University at Bloomington, died on 8 September 1996 in Berlin, Germany, at the age of 69.

Rickey was born in Memphis, Tennessee. After a year at the University of Tennessee, he enlisted in the US Navy in the spring of 1945. Upon discharge in 1946, he returned to school at Southwestern College (now Rhodes College) in Memphis, where he received a BS degree in 1949. Following a year of graduate work at Columbia University, he worked during 1951–54 at Brookhaven National Laboratory. He then entered the University of

Washington in Seattle for graduate studies in nuclear physics, working at the school's cyclotron, where he participated in one of the early investigations of time reversal. This work became a part of his thesis for the PhD degree, which he received in 1958.

After graduation, Rickey accepted an assistant professorship in physics at the University of Colorado in Boulder, which at that time was undertaking the construction of an early isochronous cyclotron. There, he played a central role in the first successful acceleration and extraction of negative ions in a cyclotron. This work was exploited some years later in the 500 MeV particle accelerator constructed at TRIUMF in Vancouver, Canada. In 1965, Rickey was attracted to Indiana University, which was planning a new accelerator facility to replace its aging cyclotron, constructed just prior to World War II.

From 1930 to 1960, cyclotrons had been of classical design with energies limited to well below 25 MeV per nucleon. The first-generation isochronous cyclotrons came into operation in the early 1960s at energies well above those achievable in classical cyclotrons. Despite the successes of these machines, a number of fundamental problems and limitations inherent in the classical cyclotrons remained unsolved.

Then Rickey, who was quite perceptive about the historic limitations and the future needs of nuclear physics research, conceived an ingenious second-generation isochronous cyclotron system incorporating a number of important ideas. Principal among these were the separated sector magnets, high-quality external beam injection and novel RF cavity structures. The genius of his accomplishment lay in putting together these various ideas in a cohesive design. The result was a multistage cyclotron accelerator system that would provide intense particle beams with energies that could vary continuously up to 200 MeV, having far higher precision than achievable with existing isochronous cyclotrons.

Rickey developed the practical implementation of this concept while serving as chief designer of the proposed Indiana University Cyclotron Facility (IUCF) from 1965 to 1972. He served as the first director of IUCF during 1971–72, at this crucial stage of its construction.

Since going into operation in the fall of 1975, the IUCF has become one of the major medium-energy nuclear physics user facilities in the world. Cyclotrons using the basic concepts of the "Rickey design" have also appeared in countries around the world. Never fully recovered from an automobile ac-

cident in 1967, Rickey resigned as director in 1972 to take a sabbatical and to prepare to do experiments with the new accelerator.

Throughout his career at Indiana University, Rickey also pursued his interest in music through the teaching of a course on the physics of sound and research on the physics of kettle drums. As an amateur pianist, he had a long-standing interest in the mechanics of the piano keyboard and invented a new keyboard action.

Rickey will be remembered by his colleagues for his fertile imagination and diverse interests. His legacy lives on in the physics still being carried on at the Indiana University Cyclotron Facility.

**ROBERT BENT**  
**DON LICHTENBERG**  
**DAN MILLER**  
**PETER SCHWANDT**

*Indiana University at Bloomington*

## Ganesar Chanmugam

**G**anesar Chanmugam, a professor in the department of physics and astronomy at Louisiana State University for 25 years and an internationally recognized expert on the physics of degenerate stars, died on 25 March 1996 in Houston, Texas.

Ganesh was born in Colombo, Ceylon (now Sri Lanka), on 24 October 1939. He received two undergraduate degrees in mathematics, both with honors: one from what is now the University of Colombo in 1961 and the other from the University of Cambridge in 1963. After a year spent teaching at the University of Massachusetts in Amherst, he went to Brandeis University for graduate studies. From the beginning of his career, Ganesh focused his mathematical skills and physical insight on many of the astrophysical problems associated with white dwarfs and neutron stars. His PhD thesis concerned the effects of three-body forces on the nuclear equation of state. He also published work with his thesis supervisor, Sylvan Schweber, on the role of electromagnetic many-body forces in dense matter.

Upon completing his PhD degree in 1970, he joined the physics department at Louisiana State University, where he remained for the rest of his career. For the next two and a half decades, a steady stream of insightful papers about degenerate stars were published by Ganesh and various colleagues with whom he often collaborated during summers and leaves of absence at universities and research institutions around the world. Though he would often return to questions concerning



GANESAR CHANMUGAM

the structure of neutron stars, his attention was most steadfastly focused on the magnetic and radiative properties of neutron stars and white dwarfs. It was here that Ganesh made his broadest range of contributions to modern theoretical astrophysics.

Ganesh was fascinated by and wrote about many unanswered questions: What is the origin of the strong magnetic fields of neutron stars and white dwarfs? Are these magnetic fields stable? Where do the enigmatic gamma-ray bursts come from? As long as he lived, Ganesh continued to contribute to our understanding of these and many more enigmas. His truly masterful review article, "Magnetic Fields of Degenerate Stars," published in the *Annual Review of Astronomy and Astrophysics* in 1992, will serve as a resource for future generations of astrophysicists.

Ganesh enjoyed teaching and was a clear and thoughtful lecturer. He loved music, and he was an avid tennis player and an enthusiastic baseball and cricket fan. When a colleague was stuck in trying to unravel a particularly tricky problem, Ganesh would encourage him by saying playfully, "You can solve it, Great Master." We will miss Ganesh's warm smile, gentle demeanor and generous nature. He was truly a Great Master and a joy to all who were fortunate enough to have known him.

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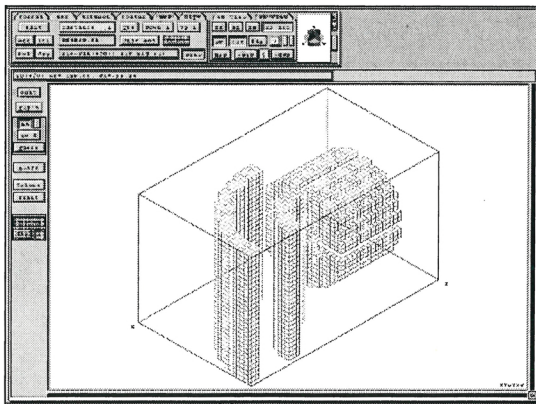
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