Kinsey A. Anderson

1926–2012

BIOGRAPHICAL *Memoirs*

A Biographical Memoir by
Forrest Mozer

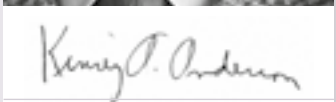
NATIONAL ACADEMY OF SCIENCES

KINSEY A. **ANDERSON**

September 18, 1926–June 11, 2012

Elected to the NAS, 1980

Photo courtesy UC Berkeley News Center.



By Forrest Mozer

Kinsey A. Anderson was born on September 18, 1926, and died from Alzheimer's disease on June 11, 2012. Between those two times, there lived a man who was an outstanding scientist and teacher, a loving family man, an avid nature lover, a Greek dancer, a classical music enthusiast, and a world traveler. Kinsey was a pioneer at the beginning of the space age, and through his research, he led us to our current advanced understanding of the plasma universe.

Kinsey began his research career in 1950 under John Winckler at the University of Minnesota. With support from the Office of Naval Research's Project Skyhook program, the Minnesota Cosmic-Ray Group flew helium-filled balloons to study, among other things, the latitude dependence of cosmic rays. Kinsey became involved in this work, and for his thesis, he flew balloons from several locations—including a U. S. Navy vessel near the Galapagos Islands—to study the secondary cosmic rays produced by primary cosmic rays that had had nuclear collisions in the earth's atmosphere. During this time, the cosmic-ray group at Minnesota was also working to optimize the design of balloons with volumes of a few hundred thousand cubic feet (later, millions of cubic feet) that lifted tens of kilograms (later tons) to altitudes of more than 20 miles. Charles Critchfield, a professor of theoretical physics at Minnesota, used an analog computer to determine the optimal shape for such balloons, and Kinsey was tasked with measuring the circumferential tension in the polyethylene material of the balloon. He invented

and built a measuring device in one day and used it to take measurements of an inflated balloon while sitting in a boatswain's chair more than 100 feet above the concrete floor. A patent was awarded for this device, and Kinsey later described its use as one of the most harrowing experiences of his life.

Kinsey received his PhD in June 1955, and he accepted a research associate position at the University of Iowa in September 1955 with an annual salary of $5,000. Auroral x-ray and other observations by Winckler and James Van Allen at Iowa convinced Kinsey that there were mysteries at high altitudes that needed to be investigated. He proposed to the International Geophysical Year (IGY) program that he build and fly 70 balloon payloads, each containing a scintillation detector, NaI(Tl), for x-ray spectral measurements. He was awarded funding to build and fly 17 payloads under the condition that they be identical to the Minnesota payloads that included only a Geiger tube telescope and an ionization chamber. (The Geiger tube telescopes at Minnesota were being built by a new graduate student named Daniel McFadden, who moved from physics to philosophy and later won the Nobel Prize in Economics.) This switch in detectors from scintillation counters (which would have produced the first long-duration, high-energy-resolution auroral x-ray measurements) to thick-walled ionization chambers enabled Kinsey to make the first direct observation of energetic protons (hundreds of MeV) coming from solar flares.

Anderson with an ionization chamber.

After the IGY program ended and Kinsey was no longer required to fly the standard IGY balloon package, he built and flew four balloon payloads from Alaska in 1959 to finally achieve his earlier goal of making the first long-duration, auroral-zone x-ray spectral measurements with a scintillation crystal and photomultiplier.

By late 1959, several events occurred that changed Kinsey's research life. First, Russian and American satellites were being launched to study auroral-zone processes and solar flares with greater efficiency than could be achieved with balloons. Second, he was

having difficulty building an independent research program at Iowa because of the heavy personnel demands of the Van Allen group, which was instrumenting the first American satellites. (Kinsey later wrote, "My brother, Phillip, at the time an architecture student, had no previous experience with electronics or balloon handling. But he was my only reliable assistant. Anything assigned to him was done well and quickly.") Third, Kinsey wanted to learn magnetohydrodynamics, the theory behind the measurements he had been making. Therefore, he went to Stockholm to work with Hannes Alfven, the man who almost single-handedly invented this field. While in Stockholm, he accepted a faculty position at the University of California, Berkeley, where he arrived in 1960. He would spend the remainder of his scientific life there.

Early 1960', holding an instrument he built for a NASA Interplanetary Monitoring Platform Satellite.
(Photo courtesy UC Berkeley News Center.)

At Berkeley, he began a satellite instrumentation program that would produce fundamental results in magnetospheric physics, solar wind and the sun, and the magnetic fields of the moon and Mars. While starting this program, he continued his balloon x-ray work, motivated by a desire for higher time resolution auroral x-ray measurements. Earlier studies had time resolutions no better than several seconds, which is several orders of magnitude slower than the timing associated with fundamental physical processes involving auroral electron acceleration and precipitation. To produce faster measurements, Kinsey designed an entirely new x-ray detector system with a much larger acceptance solid angle and electronics capable of time resolutions down to one millisecond. He flew this instrument in 1962 and 1963, making the first observations of x-ray microbursts, which inaugurated the era of high time resolution measurements of phenomena in the terrestrial magnetosphere. This work was later continued on sounding rockets and satellites. Today, almost all measurements in magnetospheric research involve similar time resolutions.

During his first decade at Berkeley, Kinsey and his students successfully flew plasma and particle instruments on more than a dozen spacecraft, including IMPs (Interplanetary Monitoring Platform) 1-6, Explorers 33 and 35, and OGOs (Orbiting Geophysical Observatory) 1, 3, and 5. This might be a record for the number of space instruments built by a single research group during that time. This was a decade of discovery that ended with an improved picture of the Earth's magnetic-field geometry and of the plasmas in it. One of the features of the plasma is the plasma sheet in the magnetospheric tail, a pancakelike region with electrons that are more energetic and higher energy than those in the neighboring lobes. Kinsey discovered this feature in 1964 with his experiment on the IMP 1 spacecraft. He originally thought these electrons formed islands in a low-density background, and it required additional data to obtain the correct geometry of the plasma sheet.

Kinsey convinced NASA that the Apollo 15 and 16 missions, which landed on the moon in 1971 and 1972, respectively, should carry subsatellites that could be left in lunar orbit. The goal was to measure the shadowing of energetic electrons by the moon to determine the motion of the earth's magnetic tail. He and his then-student Robert Lin discovered, however, that electron detectors could also be used to measure the magnetic of energetic electrons by the moon to determine the motion of the earth's magnetic tail. He and his then student Robert Lin discovered, however, that electron detectors could also be used to measure the magnetic field on the surface of the moon through the reflection of incoming solar wind electrons by the magnetic field. Lin and Anderson subsequently built instruments for Lunar Prospector and Mars Global Surveyor that used this technique to map the surface magnetic fields of the moon and Mars, respectively. Other satellite programs in which Kinsey was active include Ulysses, Wind, and Mars Observer.

Kinsey was generous and shared his instruments and knowledge with many groups around the world. This led to collaborations with the University of Toulouse that produced instruments flown on the ISEE-1 and -2 satellites and on the Giotto mission to Comet Halley. Kinsey was awarded the Docteur Honoris Causa de l'Université Paul Sabatier de Toulouse for his leadership in these efforts.

Kinsey had 24 graduate students during his career, many of whom became faculty at other universities. About half of them remained with or returned to the friendly Berkeley research environment created by Kinsey for major portions of their research careers. A characteristic of Kinsey's approach was his unselfish leadership, which both required and enabled his students to manage all aspects of their own research programs. Former student Ed Roelof wrote:

> *I've come to realize that Kinsey left his mark on all of us—not as a recognizable 'school' that followed a particular scientific doctrine, but as a group of well-trained independent researchers who were not bound by any orthodoxy, because they let the data speak first and then followed where it led them (regardless of whether it conflicted with contemporary paradigms). I've tried to think back as to how we all picked up this highly productive trait, and I've concluded that it came just from working with Kinsey. That was the way he worked.*

His research achievements resulted in him being elected as a member of the National Academy of Sciences in 1980. He also received a Guggenheim Fellowship, the Space Science Award from the American Institute of Astronautics and Aeronautics, a NASA Medal for Exceptional Scientific Achievement, the Alexander von Humboldt Award, and fellowships in the American Geophysical Union, the American Physical Society, and the American Association for the Advancement of Science. Upon his retirement in 1990, Kinsey also received the Berkeley Citation for distinguished achievement and notable service to the university.

Another of Kinsey's lasting contributions came from his service as the second director of the Space Sciences Laboratory. During his decade-long tenure as director, the laboratory became independent and achieved its greatest growth toward becoming a world leader in space research. A major factor in this growth was the Senior Fellow program initiated by Kinsey. This program allowed research scientists to become principal investigators, thereby freeing faculty members from the administrative and technical burdens associated with the special needs of space-flight programs.

Kinsey's father, Malvin "Moppy" Anderson, was born in 1893 in Lacrosse, Wisconsin. As a young man, he was a ringer hired by local baseball teams to pitch for them. After his arm was broken by a fastball, he became an umpire, a role he performed for 50 years. He began his career as a banker and then turned to politics, serving several terms as county treasurer and then state legislator. Kinsey's mother, Allene Michener, was born

in 1899 in Cherry Grove, Minnesota. Allene was a music major and Carleton College graduate (as were Kinsey and nine other members of his family). A talented singer, she had the opportunity to train at the Metropolitan Opera but chose to stay in Preston, Minnesota, to raise a family. She continued to perform as a popular pianist and organist, and she sang in church services throughout the county and state.

Kinsey was born on September 18, 1926, in Preston, Minnesota. His interest in science was triggered and nurtured by a high school biology teacher who took him on many field trips. As a young adult while still in Preston, Kinsey discovered Darwin. This sparked a lifelong interest in the processes of the universe and guided him toward a scientific career. A precocious child, Kinsey was very intelligent, independent, and creative. He loved animals and had a menagerie of them who followed him around, including a flock of ducks. In early childhood, Kinsey was known as a mischief-maker in his small community. He was also considered extremely intelligent, and he taught chemistry in high school while still a high school student himself. He enjoyed outwitting his father, a member of the school board, by going fishing on the first day of school. With his knowledge of nature and of the local river, Kinsey knew just how and where to cross the river to keep his father safely—and in frustration—on the other bank!

Kinsey and Lilica Anderson at a cocktail party.

Kinsey served in the U. S. Navy from April 1945 to March 1946, after which he returned to Carleton College where he completed an undergraduate degree in physics. At Carleton, he met a Greek woman named Lilica in a physics class, and she was to become his wife and lifelong close friend. Lilica Athena Vassiliades was born May 26, 1927, in Alexandroupoli, Greece. She escaped Greece at the age of 14 and spent the war years in Cape Town, South Africa. She received a scholarship to Carleton College and arrived there in 1945. Kinsey married Lilica in 1954. Many family friends benefited from the Greek food and dancing Lilica brought to the marriage. The couple had two daughters, Danae and Sindri, and five grandchildren, Katrin, Dylan, Russell, Allene, and Melina.

Together, Kinsey and Lilica moved to the University of Minnesota in 1949, where Kinsey was awarded his PhD in 1955 during the same week his first daughter was born. After Kinsey completed his PhD, he and Lilica spent four years at the University of Iowa and one year in Stockholm before moving to Berkeley, where Kinsey would spend the rest of his career.

Kinsey found inventive, playful ways to transfer his love of art, music, culture, science, and nature to his children and grandchildren. A famous example occurred during a family gathering when the grandchildren responded to a knock at the door. When they opened it, there was Kinsey in a pith helmet, khaki shorts, and boots with a rubber snake dangling from his nose. He told the gawking children that he had been on safari and needed some help prying the snake loose. He took advantage of their focus and interest to sneak in some facts about the type of snake, its habitat, how it contributed to the ecology, and so forth.

Absorbed as he was in his career and interests, Kinsey always allotted quality time for his primary love: his family. He was an architect of experiences, exposing the family to as many aspects of life as possible, from the wilderness to French village life, from great art museums to "Saturday science seminars" for the kids, and so on. Far from proscribing a single way of interpreting our universe, his aim was to spark curiosity and responsibility, and to shape them as thoughtful, compassionate citizens of the planet. As Kinsey's grandson Russell said, "Opa inspired me. He made me interested in the natural world. He inspired me to strive for my highest potential, to not be afraid to follow my dreams—to be curious, kind, innovative, and hilarious!"

Kinsey had a truly profound connection with nature throughout his life. He immersed himself in the science and beauty of it all, including geology and plant and animal life. He loved to backpack and hike, especially in the Sierra Nevada Mountains. His trip to the Galapagos Islands in the 1960s, as discussed earlier, was a high point for him, both personally and professionally. Everyone who knew him recognized that Kinsey's scientific rigor was tempered by his humanism and empathy for others. He was immensely curious about human cultures and traveled the world to explore and experience them. He had a great respect for and fascination with both indigenous cultures, such as the Inuit, and the great Western cultures, especially Greece and France. He basked in the good life in France during sabbaticals and other journeys, enjoying the food, wine, and art. His broad interests included archeology (especially of ancient Greece), and he was closely involved with the Nemea Center at UC Berkeley. He ensured that the family participated in the

revived ancient games at the stadium in Nemea, Greece—barefooted and in togas.

He was deeply moved by the creative hand of man in every aspect and spent many hours in all varieties of museums all over the world. He loved classical music and opera but also enjoyed many other types of music. A skilled Greek dancer, he inspired respect from his Greek friends anytime he took the lead in a line dance. He collected everyday toys from the countries he visited, fascinated by how all people everywhere engage in play. He lived by Albert Einstein's motto, "Play is the highest form of research."

Anderson receiving an honorary degree in Toulouse.

He took a quiet but deep pride in being honored by the National Academy of Sciences, the Université Paul Sabatier of Toulouse, and other professional associations, not for the status they conferred, but for the confirmation of his worth as a scientist and colleague. The members of his global scientific community described him as humble and collaborative. He spoke to his family about the enduring sense of awe he had for the caliber of scientists he was privileged to work with throughout his career.

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