Bulletin of the AAS • Vol. 52, Issue 2

James L. Elliot (1943–2011)

Ted Dunham[1]

[1]**Lowell Observatory**

Published on: Sep 10, 2020

James L. Elliot died on Thursday the 3rd of March, 2011.

Credit: unknown

James Ludlow Elliot (1943–2011), professor at the Massachusetts Institute of Technology (MIT) and known to all as Jim, died at his home in Wellesley, Massachusetts, due to complications of treatment for a brain tumor. Jim was born in Columbus, Ohio, the eldest child of James and Doris Elliot. While growing up, Cedric Hesthal, a physics professor at Ohio State University (OSU) who lived two doors down the street, befriended Jim. Hesthal encouraged Jim's interest in mathematics, physics, and astronomy with his own backyard telescope and help with science projects. When Jim was in tenth grade he took a math entrance test for students applying to OSU and received the highest score. He set up a chemistry lab in the basement with his mother's equipment, and his chemistry teacher let Jim and his friends do their lab work at home. Jim graduated from North High School in 1961.

Jim was an undergraduate at MIT majoring in physics, graduating also with a Master of Science degree. He was introduced to sailing while at MIT. After MIT Jim went to graduate school at Harvard University, doing his thesis research with Giovanni Fazio on X-ray detection by atmospheric fluorescence. Jim completed his thesis work while also pursuing the 1971 β Scorpii occultation by Jupiter with Joe Veverka and Larry Wasserman (Cornell), and Bill Liller (Harvard). This collaboration was his first foray into occultations, and he was smitten by the richness and variety of the results that could be derived from these events.

While at Harvard Jim was a teaching assistant for Frances Wright's navigation class and became interested in navigation for ocean sailing. He also made lunar observations for Hector Ingrao, who happened to employ Elaine Kasparian as well. Jim and Elaine married in 1967. They had two daughters, Lyn and Martha.

Elaine and Jim were both avid gardeners and always had a sizeable vegetable garden in their backyard. Jim liked to plant turnips so there would be something fresh even in the winter. In Ithaca

there was an ongoing battle with the local deer, but we learned from their efforts that deer will not touch hot peppers. We also learned from the then-little girls the important distinction between salad and compost!

Jim was a very likable guy with an infectious smile and easy sense of humor. He was fond of joking around and was responsible for some memorable pranks over the years. He once bought a witch doctor bone at a tourist trap in Lesotho that, along with another Lesotho relic, adorned our equipment racks during occultation observations. His good humor and obvious competence fostered many long, enjoyable, and productive collaborations during his career.

Jim was an expert with electronics, developing his own equipment for his thesis, the equipment for the β Scorpii event, a goniometer for photometric measurements of solid surfaces, and a high-speed photoelectric photometer for his occultation research. Jim's interest in navigation and statistics served him well in occultation work. Occultation predictions and post-event geometrical solutions have much in common with navigation, and a clear understanding of statistics is essential for fitting models to data, another of Jim's strengths. Jim once told me that he was motivated to build his own instruments in order to get good data to analyze.

The β Scorpii event provides an excellent example of the interplay between Jim's instrumentation and data analysis skills. The photometer Jim made for the event was a then state-of-the-art photometer that could record data simultaneously at three wavelengths at ~10 millisecond time resolution. In addition to the original goal of measuring the thermal structure of Jupiter's upper atmosphere, this instrument made it possible for the first time to resolve the brief "spikes" in occultation light curves due to caustics ("ray crossings") in Jupiter's turbulent upper atmosphere. Jim realized that the observed time of a "spike" depended on wavelength because of the wavelength dependent refractivity of Jupiter's atmosphere. This effect made it possible to measure the hydrogen/helium ratio of Jupiter's atmosphere. As an additional bonus the spikes were effectively scans across line images of the components of β Scorpii, so the radii and separation of the components of the spectroscopic binary β Sco A could be measured. Together with other data the separation yielded individual masses of β Sco A's two components. Bob Millis once observed, "When Jim was done with a data set, every last droplet of scientific return had been wrung out of it."

After coming to Cornell University to work in Carl Sagan's planetary science group in the Department of Astronomy, Jim continued to pursue work in high energy astrophysics for a few years, but his newfound interest in occultations became his primary focus. In 1975 Joe Veverka, Jim, and I attempted to observe two lunar occultations of Neptune, one in Australia and the other a month later in South Africa. Bad weather ruined the event in Australia, and in South Africa an errant cloud occulted the moon at event time. This terrible turn of events led to a long discussion about possible ways to beat the weather. Jim recalled that Jim Houck had mentioned an airborne telescope used for infrared work (the

then-new Kuiper Airborne Observatory, or KAO). Jim agreed to find out if it might be possible to use the KAO for occultations. It seemed feasible, and six months later Jim's group observed its first event with the KAO. The high points in a long series of successful KAO occultation observations included: Mars/ε Geminorum (1976; central flash phenomenon discovered); Uranus/SAO 158687 (1977; Uranian rings discovered); and Pluto/P8 (1988; Pluto's atmosphere discovered).

In 1974 Larry Wasserman finished his graduate work at Cornell and took a position at Lowell Observatory. Jim and Larry had worked together at Cornell and their collaboration naturally continued after Larry's move. Trips to Lowell fostered new relationships with others there, notably Jim's close friend and occultation co-conspirator Bob Millis, and Otto Franz, who understood the inner workings of the Fine Guidance Sensors of the Hubble Space Telescope (HST) and how they could be used for occultation work. Later on Jim was a collaborator on Bob Millis' survey of the Kuiper Belt. Jim also developed close ties to the observatory itself, often spending summers there as well as a sabbatical, and had a Lowell staff appointment. Many of Jim's students also spent time working at Lowell over the years.

Two years after the Uranian rings discovery, Jim's group moved from Cornell to MIT. For several years Jim's group focused on Uranian ring timing observations and measuring asteroid occultation diameters. Neither of these were good KAO applications. Large ground-based telescopes with infrared instruments were best for the Uranian ring work and portable ground-based equipment was best for asteroids. The Uranian ring timing work was particularly productive because of the extreme timing precision that could be reached for sharp-edged rings given high quality data.

Not long after moving to MIT Jim learned, to his chagrin, that MIT geology students could attend field camp during the January Independent Activities Period, but there was nothing equivalent for planetary science students. He solved this problem by creating a "field camp" of his own in collaboration with Bob Millis at Lowell Observatory. For three weeks in January students worked with astronomers in Flagstaff. This arrangement was very successful for both the students and the astronomers. Later on it expanded to include Wellesley College students and continues to this day. Jim was an avid hiker, so field camp always included a multi-day backpacking trip from the South Rim of the Grand Canyon to the Colorado River and back.

Jim was fond of going for walks, usually talking about research at the same time. The walks might be around the bridge circuit along the Charles River, on Section 17 at Lowell, on the trails around Wellesley (he was a member of the Wellesley Trails Committee), or wherever he might have happened to be. One summer he decided it would be a good idea to map the fire roads on Section 17 so he mounted the antenna of his logging GPS receiver to a construction helmet, and it went for walks too.

At MIT Jim found a need for classes to teach the art and science of astronomical observing. One of these classes was an introductory freshman seminar with observing sessions on the roofs of various buildings at MIT. Students learned the basics of how to use telescopes and find their way around the night sky. Then they had an opportunity to observe at MIT's Wallace Astrophysical Observatory, far from the light pollution of Cambridge. The other class Jim initiated was a higher level lab class with a heavy focus on equipment, statistics, data analysis, and observing. Students gathered data on targets of their choice using the telescopes at Wallace Observatory (of which Jim was the director). Both of these popular classes are still offered, and they have launched the careers of many professional astronomers.

Jim served as advisor to many Ph.D. students and was a mentor to many other students, both graduate and undergraduate. He was notably very supportive of women pursuing careers in science.

Jim was troubled by the large size of the KAO images and the impact of stray light from the planet when observing stellar occultations by planetary satellites. Jim's group was able to investigate this problem in the 1980's using a specialized high-speed CCD camera built with help from George Ricker's group down the hall. This investigation uncovered many problem areas in airborne imaging, and solutions to most of these issues were incorporated into the design of SOFIA, the Stratospheric Observatory For Infrared Astronomy.

The KAO was shut down in 1995, and the first SOFIA occultation observation with our instrument HIPO did not occur until June 2011, only three months after Jim's death. Because of this long delay the remainder of his observational work was done either with ground-based equipment or HST. During this period he worked on Triton, Pluto, and Kuiper Belt Object occultations. In honor of his contributions in these areas a crater on Pluto (the best one, according to Leslie Young!) was named for him.

Everyone who worked with Jim was struck by his penchant for preparation and its associated list-making. This trait is admirable for occultation work since an observer gets only one chance to observe a given event. I often wondered which came first, his occultation work or his insistence on careful preparation? Elaine set me straight. On their first date they went sailing, and Jim warned her to bring three changes of clothes in case she got wet. (She didn't get wet.) Jim's willingness to make careful preparations was a key factor behind his boldness in attempting novel observations and observational approaches.

Jim had a reputation for having amazingly good luck. In addition to stumbling on the central flash and the Uranian rings during the early KAO flights, there was the case where he observed the Triton/Tr180 occultation with HST. Not only did HST's orbit happen to take it through Triton's occultation shadow, it even dipped into the much smaller central flash region! Of course we make our own luck, to some

degree, by exploiting or creating opportunities. As Jim once said, “I’ve been pretty lucky. And the harder I work, the luckier I get.” In addition, to capitalize on a lucky break one has to be prepared and able to do so. We often hear the old saying, “I’d rather be lucky than good.” Jim taught us by example that it is best to be lucky *and* good.

The author gratefully acknowledges the contributions of Elaine Elliot (Jim’s wife), Amanda Bosh, Mike Person, Leslie Young, Cathy Olkin, Dick French, Bob Millis, Joe Veverka, and Larry Wasserman.