Dr. James E. Faller (1934-2023)

Dr. James E. Faller passed away on June 14, 2023 at the age of 89, after a series of strokes. He was an experimental physicist who made significant contributions to precision measurements, experimental relativity, and innovative instrumentation, and he mentored many students and postdocs. Dr. Faller was an internationally renowned physicist in the Quantum Physics Division of the National Institute for Standards and Technology and a Fellow of JILA (University of Colorado Boulder and NIST).

James Elliot Faller was born January 17, 1934 in Mishawaka, IN where he spent his childhood. He graduated with an A.B. in Physics (summa cum laude) from the University of Indiana in 1955. He obtained his M.S. (1957) and Ph.D. (1963) degrees in the storied Princeton physics group led by R.H. Dicke.

After an initial postdoctoral appointment at JILA (1963-1966), Dr. Faller held faculty appointments at the Wesleyan University Department of Physics from 1966 until 1972 when he returned to JILA as a Fellow and NIST staff scientist. After serving terms as Chairman of JILA (1995-6) and Chief of the NIST Quantum Electronics Division (1996-2004), Dr. Faller retired in 2006. He enjoyed a position as a Visiting Professor at the University of Glasgow from 2001 until 2023.

Dr. Faller's scientific career spanned precision measurement of physical constants, fundamental tests of basic laws and innovative instrumentation. Starting with is doctoral thesis at Princeton and continuing with numerous graduate students, he developed a succession of absolute gravimeters for measuring the Earth's gravitational acceleration 'g.' The core idea of his doctoral thesis was interferometrically measuring the descent of a dropped object. He improved on that original idea with the incorporation of a stabilized laser, a reference mass on a suspension with long-period vibration isolation (aka, superspring), and a throwing system that measured both upward and downward travel with a high repetition rate. The gravimeters were all more-or-less portable to facilitate gravity mapping and side-by-side comparisons at reference locations. Both research and commercial versions became standards for gravimetry, geodesy and fundamental tests of 'fifth force' and Newton's Law of Gravitation.

One of Dr. Faller's most enduring research contributions was the proposal for precision ranging to the Moon using lasers and retroreflector arrays left on the Moon by the Apollo 11, 14 and 15 missions. He originally proposed the concept while still a graduate student, supported the refinement of the design and carried out the first successful ranging at Lick Observatory with Joe Wampler. Initial ranging accuracy of centimeters, and now millimeters, enabled unique lunar science, geophysics and fundamental tests of Newtonian gravity and General Relativity.

In another career-spanning endeavor, Dr. Faller developed multiple torsion pendulums for improved Eötvös experiments. Most were based on test masses floating in liquids with electrostatic and magnetic torsion springs. These torsion pendulums were primarily used to test the Equivalence Principle.

In the field of gravitational waves, Dr. Faller made important contributions to the quartz-fiber final suspensions and the active seismic isolation systems incorporated into Advanced LIGO. He collaborated with students and faculty at the University of Glasgow in developing silicate bonds for final suspensions. The active seismic isolation system is critical for the low-frequency response of the instrument that enables detection of merging stellar-mass black holes which make up the bulk of the revolutionary detections.

In 1981 Drs. Faller and Peter Bender proposed the first workable concept for a space-based, gravitational-wave detector that would operate in the millihertz band where the richest array of sources is found. Working with Dr. Bender and others, he pioneered the conceptual design that became the Laser Interferometric Space Antenna (LISA). LISA promises to detect massive black hole binary systems throughout the Universe and other gravitational-wave sources that are undetectable by ground-based instruments. LISA is now a major space mission in the European Space Agency's program, with an anticipated launch date in the latter half of the 2030s. Dr. Faller recognized that laser frequency noise could be canceled in an un-equal armed interferometer by suitable combinations of time-delayed signals.

Dr. Faller performed other notable precision measurements, such as a test of Coulomb's Law and upper limit on the photon rest mass, a measurement of the Newtonian Gravitational Constant ('G'), and a test of the anisotropy in the speed of light.

Many of Dr. Faller's students will remember him for his persistent concern for their motivation and his empowerment of them. He was extraordinarily successful at engaging students in creative instrumental solutions to major experimental challenges in ways that transformed their careers. For example, he was justifiably proud of achieving the first successful laser ranging to the Moon with a coterie of undergraduates and one graduate student, all of whom went on to earn doctorates in physics. In his later years, he frequently spent his summers at the University of Glasgow coaching graduate students on how to tackle experiments, how to choose, build and operate the right instrumentation, and how, in the right circumstances, to transfer that knowledge to industry.

Dr. Faller received many prizes over his illustrious career, including: the National Bureau of Standards Precision Measurement Award (1970), the Arnold O. Beckman Award of the Instrument Society of America (1970), the NASA Group Achievement Award (1973), the NASA Exceptional Scientific Achievement Medal (1973), the Department of Commerce Gold medal (1990), and the Joseph F. Keithley Award (2001). He was a Fellow of the American Physical Society, Optica, the American Geophysical Union and the American Association for the Advancement of Science.

Dr. Faller was a passionate devotee of Medieval, Renaissance and Baroque music and played the recorder for many decades. He was also an avid sports fan, particularly of tennis and basketball. He lectured occasionally on the nexus of sports and physics.

Dr. Faller is survived by his wife, Jocelyne Bellenger, his brother Larry Faller and his two sons, William and Peter Faller.