

## Anthony E. Siegman: Laser pioneer, Optical Society president, friend, and colleague

Stephen E. Harris<sup>1</sup>

Department of Electrical Engineering and Applied Physics, Stanford University, Stanford, CA 94305

The death of Anthony E. (Tony) Siegman on October 7, 2011, was a profound shock to the worldwide optical science and laser community. An esteemed scientist and educator, Tony was also a kind and gentle man.

Tony was born November 23, 1931, and raised in rural Michigan. As an early National Merit Scholar, he attended Harvard University and received an AB degree summa cum laude in 3 years. After 2 years on a cooperative plan with the University of California, Los Angeles, and Hughes Research Laboratories, he obtained an MS degree in Applied Physics in 1954. He went north to Stanford and completed his PhD work under Dean Watkins on microwave noise in traveling wave tubes. In 1957, just 7 years after graduating from high school, he joined the Stanford faculty as an Assistant Professor of Electrical Engineering.

By all accounts, Tony's career was transformative, both to the field of electrical engineering and in the lives of his colleagues and students. In 1959, he attended the historic quantum electronics symposium at Shawanga Lodge. This was the beginning of the maser and laser era; amplification was now possible by using the quantum mechanical properties of atoms and molecules instead of the kinetic properties of electrons. Tony never looked back.

Tony's students universally remember him as a warm and skilled teacher. Burt McMurtry was Tony's first laser student and later contributed to Silicon Valley as a venture capitalist and president of Stanford's Board of Trustees. (Tony became the Burton J. and Ann M. McMurtry Professor in the School of



Photo courtesy of Jeannie Siegman.

Tony Siegman.

A prolific scientist and educator, Tony authored more than 200 papers, 20 of which have been cited more than 100 times each. He wrote *Microwave Solid-State Masers* (1964), *An Introduction to Lasers and Masers* (1972), and *Lasers* (1986). This last book, at nearly 1,300 pages, has become the standard reference in the field.

In a classic 1961 paper, Tony, together with Bill Louisell and Amnon Yariv, then at Bell Telephone Laboratories, gave the first description of the noise associated with parametric amplification. This led to the discovery (in 1968) of what was then termed parametric fluorescence at optical frequencies. Within 10 years, this type of light source became the standard for experiments with entangled photons, Bell inequalities, and quantum information.

region has a long and slender profile. Conversely, an unstable resonator corresponds to a divergent periodic focusing system. On repeated bounces, the beam expands to fill the entire cross section of the lasing media. This technique also allows excellent beam characteristics and discrimination against higher-order transverse modes.

Tony received numerous awards and honors, including the Institute of Electrical and Electronics Engineers (IEEE) W. R. G. Baker Prize (1972) and J. J. Ebers award (1977). He received the Optical Society of America (OSA) R. W. Wood Prize (1980), the OSA Frederic Ives Medal/Jarvis W. Quinn Prize (1987), and the OSA Esther Hoffman Beller Medal (2009). He was elected to the National Academy of Engineering in 1973, the American Academy of Arts and Sciences in 1984, and the National Academy of Sciences in 1998. He was Vice President and President of the OSA in 1996 and 1999, respectively.

Despite his successes, Tony was an exceptionally modest man. In the 25th Anniversary Report for the Harvard Class of 1953, he wrote: "Professionally I've been moderately successful and well rewarded, though what I have accomplished seems, in retrospect, to have come about more by my having been luckily in several right places at the right times, rather than by any deliberate process of my setting and then achieving goals."

Tony was also an outdoorsman. For many years, he and his wife Jeannie spent winters near Lake Tahoe, where they cross-country skied and hiked with their dogs. In earlier years, Tony and I backpacked and camped in the Sierras with our children. On one occasion in the early