



Charles H. Townes - Commemoration

It is a great honor for me to present this commemoration of Charles Hard Townes. Charlie, as he was known to everyone, was one of my personal and scientific heroes. He was a man of science and a man of faith; a Nobel laureate and a public servant; and for me a teacher and a friend. He deeply changed both the science and technology of the 20th century. As inventor of the maser and laser, he introduced a device so ubiquitous to modern society that it is hard to imagine either scientific research or daily life without it. In astrophysics, he discovered the first triatomic molecules in deep space and he found evidence for the black hole at the center of our galaxy.

Charlie was born in Greenville, North Carolina. After finishing high school at the age of 15, he attended Furman University in his hometown, graduating in 1935. He got a master's degree from Duke university and a PHD from Caltech in 1939. He then joined the staff of Bell Labs, where he worked on the development of radar, a key technology for the Allies in World War II. That experience set the stage for his work on microwave spectroscopy of molecules that led to the 1955 book co-authored with Art Schawlow, entitled simply "Microwave Spectroscopy". It was one of the first books that I studied when I began my research career as an undergraduate at Juniata College. In 1948, Charlie went to Columbia University and continued to work on microwaves.

Searching for microwaves sources working at ever-higher frequencies, he developed the concept of the maser, an acronym for Microwave Amplification by Stimulated Emission of Radiation. Among the key ideas that made the maser a reality, was a resonant cavity, which stored and built up the stimulated microwave field. Famously, the idea for that came to Charlie during an early morning outing while he was sitting on a bench in Washington DC in 1951. It was in that same year that he married Frances Brown. He is shown with her here (see Fig. 1), sitting on a bench that was built many years later to commemorate that inspirational moment. Charlie and his young colleagues reported operating the first maser and here (see Fig. 2) Charlie is shown with Jim Gordon in front of that maser.

A few years later, in 1958, Charlie and Art Schawlow, who was also his brother-in-law, extended the idea of the maser to optical frequencies, coming up with the laser. Their idea was that the gain medium was now inside the mirrors of a Fabry-Pérot Cavity. In 1960, the first laser was made by Ted Maiman, and in 1964 Townes shared the Nobel Prize in Physics with Basov and Prokhorov who had independently come up with similar ideas. As the father of the laser, Townes' influence on science and technology cannot be overstated. Today, essentially everyone relies on lasers for a wide variety of applications that range from scientific research, to communication, data storage, and medical procedures.

After serving as an advisor to the US government for a few years, a role he played a number of times in his career, Charlie moved to MIT as the provost, and it was while he was at MIT that he received the Nobel Prize. In 1967, he returned to basic research as a professor at the University of California at Berkeley, pursuing interests in radio astronomy and astrophysics.

Charlie's change in research direction at such a late stage of his career was both impressive and productive. At a time when most people thought that the most complicated molecules in interstellar space were a few diatomic species, Charlie discovered ammonia and water, the first triatomics discovered in deep space. He pioneered mid-infrared astronomical interferometry; he made the first heterodyne spectrometer, and in the 1980s, using precision spectroscopy techniques, he identified the black hole at the center of the Milky Way galaxy, a feature that had been predicted by Martin Rees.

Charlie's enthusiasm and hands-on approach to research never faded. Although he was officially retired in 1986, over 20 years later, in his nineties, he could be found, as you see in this photograph (see Fig. 3), perched on a telescope mount, preparing the mirror for a night of observing by dusting off the surface.

Charlie was also a pioneer in the connection between science and religion. He was an important mentor to me and to others interested in this subject. In 1964, at the famous Riverside Church in New York City, where he was a member, Charlie gave a talk that became a 1966 published article, entitled 'The convergence of science and religion'. This was a landmark in the field of science and religion. I see it as the beginning of the modern study of science and religion, and its wide influence was a major factor in Charlie's receiving the 2005 Templeton Prize "for progress toward research or discoveries about spiritual realities". He was the first, and I believe the only person to receive both a Nobel Prize and a Templeton Prize.

I spoke with Art Schawlow, Charlie's collaborator on the invention of the laser, shortly before Art's death, and Art told me a story about how someone had characterized another prominent physicist as "the smartest person he knew". Art's response was, "not while Charlie Townes is alive". Charlie died just 6 months before his 100th birthday, leaving us richer for all that he did.

William Phillips