

## BRIEF REFLECTIONS ON EDWARD TELLER'S SCIENTIFIC LIFE AT LIVERMORE

C. BRUCE TARTER

*Lawrence Livermore National Laboratory  
Livermore, California 94551*

As George Miller indicated in his welcoming remarks the theme of today's symposium is the scientific and educational legacy of Edward Teller. I will say a few words about his activities in those areas during the 50 plus years he spent at the Livermore Laboratory, Sig Hecker will touch on his re-engagement with the Los Alamos Laboratory during the last couple of decades of his life, and then we will show you a video with excerpts from the Memorial Service we held on November 3, 2003 after he passed away in September of that year. On the video you will get to hear comments by many of the people who knew Edward throughout much of his life, Hans Bethe, John Wheeler, Harold Agnew and many others.

At Livermore much of Teller's energy was devoted to national security and world affairs, but he always managed to retain his deep interest in science. Many of his individual contributions were made before he helped found the Laboratory in 1952, and Steve Libby will describe those in a later talk. I will concentrate on his impact on basic research, applied science, and education during the Livermore years.

When Teller joined Ernest Lawrence in starting the Livermore Laboratory he found himself in a very unusual situation. Among the initial staff of 100 he had no natural colleagues. Nobody from Los Alamos had come to Livermore, and none of the transplanted European scientists with whom he had so many fruitful collaborations joined him. Nearly everybody at Livermore in the initial years was one of Lawrence's team at the Radiation Laboratory

in Berkeley, or at the very least part of the University of California at Berkeley. And, Lawrence was an experimentalist, as were most of the initial staff, and everyone except for Teller and Lawrence were essentially at the post-doc level. Edward Teller was truly a stranger in a strange land.

Teller's solution to this conundrum was straightforward and of great benefit to the embryonic young Lab. If his former colleagues wouldn't join him full time at least they could visit. So, there began a steady stream of his closest colleagues, especially the Hungarians. John von Neumann, Eugene Wigner, George Gamow, Montgomery Johnson, his new RAND Corporation friends such as Albert Latter and many others made frequent visits to Livermore. Although most came to work on weapons, science was always on the table and many of the new Livermore staff participated in the free wheeling discussions that always characterized any Teller session. Not only did they gain insight from many of the best scientists in the world they also learned that there were no real barriers between physics and applied physics (or weapons physics). Throughout his 50 years at Livermore Teller would continue to use his prestige and personal associations to provide a powerful scientific conduit for the Laboratory.

His own research at Livermore would focus on areas he had worked on in the past. He had graduate students, post-docs and active collaborations in Monte Carlo studies, in nuclear physics, in shock wave phenomena, and chemical physics. He would occasionally do work in astrophysics, and as part of the Plowshare program he became active in geosciences. His last scientific hurrah gave him great pleasure – when high temperature superconductivity was discovered he immersed himself in the field, talked to many of the major participants around the world, and made several contributions. In short, his life in basic science was that of a very senior, very broad theoretical physicist who thought about science most of his waking hours.

His pursuit of applied science was equally intense and diverse. He was interested in nuclear reactors from the late 40's on and was always looking for novel ways to improve their performance and safety. He led an early senior review group for what is now known as magnetic fusion and developed a lifelong nervousness about any

“plasma based” system because of the instabilities encountered in all attempts to magnetically contain plasma. His special legacy, however, was his emphasis on high performance computing as a way to do science. From the earliest days it was well understood that nonlinear problems (like hydrodynamics) could only be done numerically, but Teller understood that the computer was essential to scientific progress, not an afterthought once the theory and intuition had been brought to bear. He made sure that Livermore always had the most powerful computer that was available or could be built, and he was relentless in his emphasis on computational physics (it is no accident that the *Journal of Computational Physics* was started and run from Livermore). The staff of the Laboratory joined in with great enthusiasm, and many seminal numerical papers were written by Livermore scientists in astrophysics, atmospheric science, statistical mechanics, and related fields (as well as fundamental developments in weapons physics).

Finally in education he has an extraordinary legacy. His reputation as a lecturer at Berkeley was legendary, and despite his politics his classes were always standing room only. He founded the Department of Applied Science (DAS) at the University of California at Davis, with the goal of creating a way for graduate students to do something between basic science and engineering—sometimes called engineering physics. The original faculty assembled at DAS — whose dominant Livermore branch became known as Teller Tech — was first rank, and many applied science students who had very successful careers received their PhDs at DAS. Perhaps his most lasting contribution is the Hertz Fellowship program. Established in the early 60’s as a complement to the prestigious NSF fellowships, Hertz Fellows were chosen equally selectively for their potential in applied science and a roster of Fellows is testimony to the power of the idea (and of the highly personalized process Teller set up to choose the Fellows).

In summary Edward Teller made important and long lasting contributions in pure science, applied science, and education that stand alone as testaments to a professional life of the highest order. When one realizes that he was doing all this while engaging in a full spectrum of national security and world affairs activities, it brings forth the only plausible explanation: these Hungarians really were Martians.