# A TRIBUTE TO NICHOLAS C. CHRISTOFILOS

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I have been asked to make a few remarks in tribute to the contributions to physics by Nicholas C. Christofilos, who died September 24, 1972.

Nick Christofilos leaves a legacy of ideas and inventions in the diverse fields of particle accelerators, controlled fusion and other fields of applied physics. At the time of his death he headed the Astron controlled fusion experiment at the Lawrence Livermore Laboratory.

Born in Boston, Christofilos was taken by his parents to Greece at an early age and remained there through World War II. He studied engineering at the National Technical University in Athens. It was during his employment with a Greek elevator firm, and later in his own firm, that he began the private study of physics that was to reshape his career.

American physicists first learned of Christofilos as the independent co-inventor of the strong focusing principle for particle accelerators, which he had patented while still in Greece. His early contribution to this mainstay of the accelerator art of today was all the more remarkable in that he conceived and worked out these ideas while in almost complete isolation from any modern, active, scientific community. In 1963 he was awarded the Elliott Cresson Medal by the Franklin Institute for this and other outstanding work.

Communication with U. S. scientists about his accelerator ideas led to his first employment as a physicist at the Brookhaven National Laboratory in 1953. There he perfected his Astron concept of controlled fusion, which was first conceived in Greece when the subject was highly classified. This finally brought him to the University of California Radiation Laboratory at Livermore in 1956, where the Astron project was initiated soon thereafter. He continued to make important contributions to the accelerator field, in the development of proton linear accelerators and collective accelerators. However, with the Astron project, the dream of unlimited electric power from controlled thermonuclear reactions became the goal of his life.

His Astron idea calls for confining a plasma within the magnetic field produced by an intense circulating electron beam (the E-layer). The E-layer electrons would also serve to heat the plasma to thermonuclear ignition temperatures. Characteristically, his visionary approach first required the development of a new kind of electron accelerator. The result was the Astron linear induction accelerator that has become the main ingredient of the Astron experiment at Livermore and is among the most powerful electron accelerators in the world. The accelerator is equipped to fire bursts of pulses at approximately 1000 pulses per second. The object to build up the E-layer by repeated injection of pulses to achieve field reversal, which is the condition that the magnetic field of the E-layer current is stronger than the field confining the E-layer. Building up the E-layer by multiple pulse injection has proven to be very difficult and the experiment has now come to a close. However, in an experiment at Cornell University the field reversal condition has been achieved using a high current Marx injector and the Astron concept continues to be studied there. The full impact of Christofilos' contributions to controlled fusion is yet to be told.

Christofilos was intensely proud of his American birth and citizenship. He understood well the military needs of the Nation and conscientiously devoted a significant fraction of his life to these problems. One of his most imaginative defense projects known to the public is the Argus experiment. For the first time world wide measurements were made of geo-physical phenomena resulting from a precisely known disturbance. The idea, which Christofilos conceived well before the discovery of the natural radiation belts, involved injecting billions of high energy electrons into the earth's magnetic field at an altitude of 500 kilometers by means of small nuclear bursts. Experiments carried out in 1958 confirmed the prediction that electrons resulting from decay of the fission products would quickly spread out to form a toroidal electron shell surrounding the earth.

Mr. Chairman, I am sure that the members of the accelerator community join with me in expressing deep regret and sorrow upon the passing of one of the giants of the field.