Tihiro Ohkawa, Inertial Fusion Pioneer

Dr. Tihiro Ohkawa's many significant contributions to the science of magnetic fusion are well known and widely celebrated. Less known are his pioneering contributions to the understanding of the physics of inertial fusion.

In 1970, Dr. Ohkawa undertook an extensive theoretical analysis of the physics of inertial fusion, exploring the heating and energy loss mechanisms to achieve the density and temperature conditions that might make possible the use of lasers to compress and heat fusion fuels to the point that more energy would be released than had been expended. He documented this analysis in a General Atomics (then called Gulf General Atomic) internal report GAMD-11006 "Laser Fusion", issued on 20 August 1970 (Part I) and 23 October 1970 (Part II). In these reports he concluded that while laser fusion would be a difficult challenge, there appeared to be a possibility that a small target of fusion fuel could be compressed and heated sufficiently to release more energy than had been expended with a laser energy input on the order of kilojoules. He concluded that "it is certainly worthwhile to make further studies on this approach."

This work was all original analysis. In 1970 there was no unclassified literature on inertial fusion. The only reference cited in Dr. Ohkawa's report was from a German journal discussing photoionization. He developed the theory of inertial fusion purely on the basis of his theoretical physics analysis.

Unfortunately, Dr. Ohkawa was not able to continue these studies. His report was considered classified material. Dr. Ohkawa did not have a security clearance and as a non-US citizen (Japan), it would have been difficult if not impossible for him to get one. Dr. Ohkawa was not allowed to pursue his inertial fusion studies further. His report was not declassified until 11 January 1985.

On 31 July 1972, John Nuckolls, Lowell Wood, Albert Thiessen and George Zimmerman of Lawrence Livermore Laboratory submitted for publication the first unclassified analysis of the physics of inertial fusion - "Laser Compression of Matter to Super-High Densities: Thermonuclear (CTR) Applications," *Nature* v239, pp139-142, 15 Sept. 1972. This report reached the same conclusions as Dr. Ohkawa had: inertial fusion would be a difficult technical challenge but there appeared to be a pathway to practical application using small pellets and ~kilojoule lasers that were within the reach of current technology. This pathway has been pursued and appears on the verge of reaching target energy break-even (energy out of the target > energy in to the target), although with lasers on the ~megajoule scale.