British scientists made measurements on the Russian experiments and showed that their Soviet colleagues were too conservative and the tokamak was beating Bohm diffusion by factors of 100.

This rapidly led to the adoption of tokamaks in U.S. and other magnetic fusion experiments around the world. Ironically, Soviet scientists continued to explore U.S.-type systems such as the stelarator and demonstrated in the mid-1970s that such systems were as effective as the tokamak in terms of confinement parameters.

The real reason for the poor performance of the original experiments had little to do with actual plasma dynamics. It turns out that non-hydrogen impurities entering the plasma from the vacuum chamber wall were dominating the energy flows. This fact was first demonstrated when the Alcator A in 1975 achieved extremely clean plasmas and showed that the previously projected density limits for tokamaks were pessismistic by more than a factor of 10. In 1975, the MIT Alcator A reached the confinement parameters needed for simple breakeven while attaining record-breaking densities.

This unexpected development led to an entirely new approach to tokamak magnetic fusion. High magnetic fields were utilized to attain high plasma densities. This opened up the prospect of cheap, compact tokamak fusion reactors. A private company called Inesco is in the process of developing prototype fusion power generating systems based on the Alcator approach.

At the Los Angeles meeting, Bruno Coppi, D. Bruce Montgomery, Ronald R. Parker, Leonardo Pieroni, and Robert J. Taylor were given the Excellence in Plasma Physics Award for their original work on the Alcator A.

Alcator C's results

By utilizing pellet injection of hydrogen fuel into the Alcator, higher-density operation was attained. The Alcator C achieved fuel ion densities of 2,000 trillion nuclei per cubic centimeter. With a peak energy confinement time approaching 50 milliseconds (.05 seconds), the Alcator C had essentially reached the goal of the Lawson product for simple breakeven.

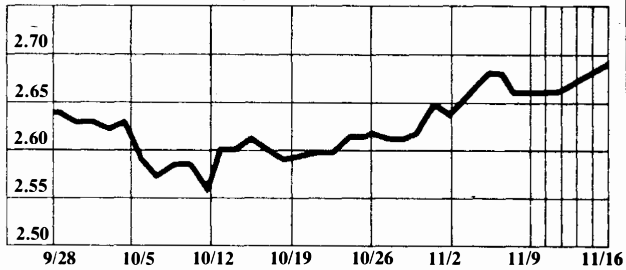
Moreover, the recent experiments on the Alcator C and the TFTR indicate that confinement time is a function of the product of the plasma density and the cube of the plasma column radius. This is far better than the most optimistic theoretical projections of the 1950s. Furthermore, experiments on the PLT, the PDX, and the German ASDEX tokamaks indicate that confinement can indeed improve with increasing temperature.

Contrary to earlier expectations, experiments on the Alcator C and PLT show that tokamaks could be made into steady-state devices, despite operating in a pulsed manner. Using microwaves, tokamaks can be kept running for up to a day at a time. It was previously feared that pulsed operation inherent in the tokamak would incur serious economic and engineering drawbacks in power plant design.

Currency Rates

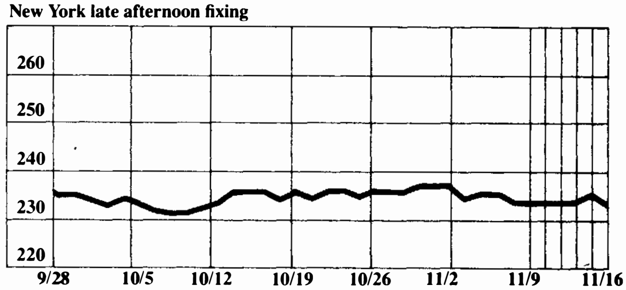
The dollar in deutschemarks

New York late afternoon fixing



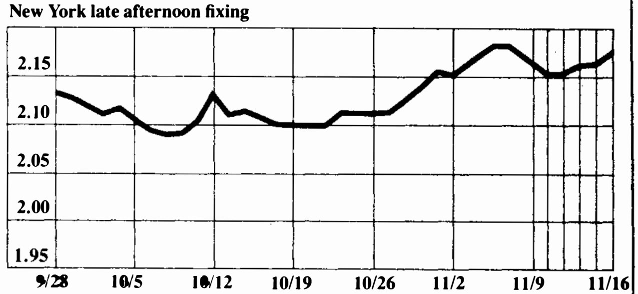
The dollar in yen

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing