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running the laser, the laser pulse, etc., must be more than matched by the total fusion energy output. Generally this output is measured as laser fusion gain. That gain is the ratio of the fusion energy output to the laser energy input. Given the relatively low efficiency of high-energy lasers, it is thought that the gain must approach 100-fold, or more. This is referred to as high-gain fusion.

Research on President's Reagan's Strategic Defense Initiative has led to major advances in high-power lasers, particularly gas lasers. Gas lasers have been generally more efficient than solid state (glass) lasers. They can also operate with a much higher firing rate. Both of these are essential characteristics in determining the economics of a laser fusion plant. But the extremely high power levels needed for laser fusion are not needed for intercepting missiles. As a result, while the technological base for realizing high-power gas lasers for inertial confinement fusion is being developed, the actual prototypes needed for high-gain laser fusion are not.

Gas versus glass

The National Academy of Sciences conducted a full review of the status of lasers for fusion, and found that while gas lasers could be immediately built for laser fusion, the quickest path to realizing the energy levels needed for experimentally demonstrating high gain would use glass.

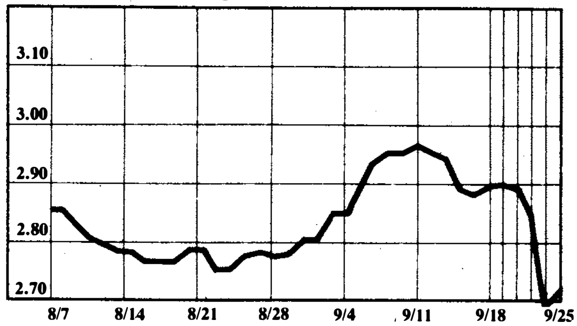
Glass lasers have hitherto been very inefficient; as the technology now stands, they are not capable of achieving the high firing rates needed for actual electric power reactors. But the experience with construction of high-power and accurate glass lasers apparently makes them the best candidates for near-term demonstration of high gain. As one source noted: "An advanced gas laser might be able to obtain the required energy and power level at the correct frequency, but lasers are complicated beasts and we could be faced with years of teething problems. With glass, we can certainly do it."

One complication noted by many researchers involves short wavelength optics. It is generally accepted that short wavelengths are essential for high-gain ICF. In the glass lasers, this is achieved by transforming the infrared laser output of 1.06 microns into .35 micron ultraviolet light by means of KDP crystals. As a result, most of the optics in the laser operate on only infrared light. Optics for the shorter wavelength .35 micron light involve great technical difficulties and many breakdowns and burnouts. In the case of gas lasers, the entire system would have to operate with short wavelength optics. While substantial progress in short wavelength optics is currently being made, the existing technology is not sufficient to assure reliable operation with extremely large and high-power lasers needed for ICF in the immediate future. From this operational standpoint for a successful experimental program, glass makes the most sense.

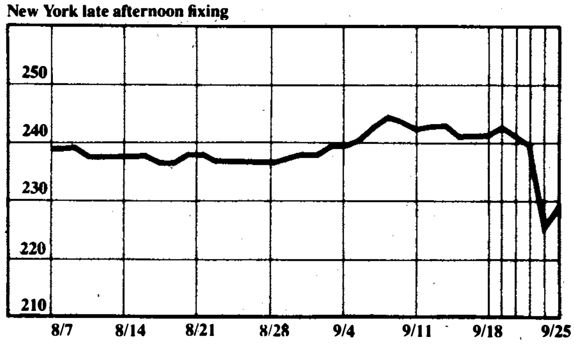
While existing glass laser technology is not capable of attaining high efficiencies or firing rates, research is ongoing into solid-state lasers that will.

Currency Rates

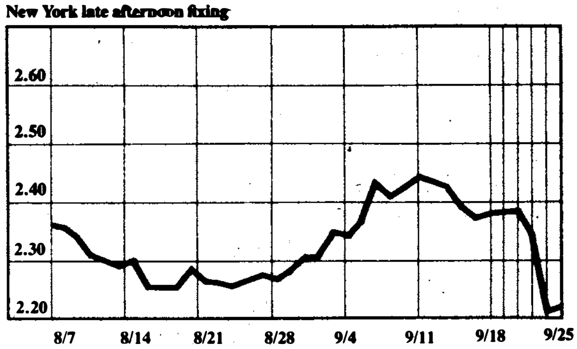
The dollar in deutschemarks
New York late afternoon fixing



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