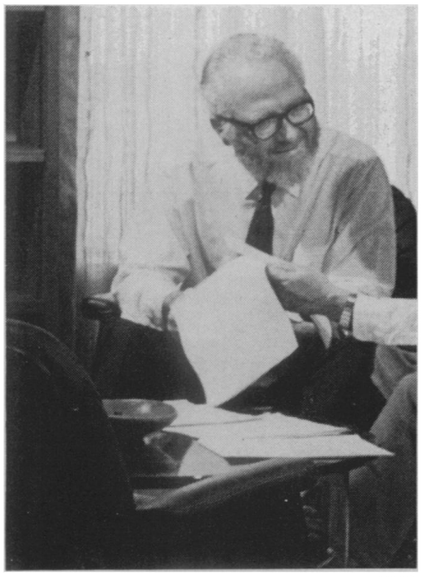
Laser fusion: Industry moves in

About a month ago the United States Government decided to lift some of the security classifications that had been imposed on research aimed at achieving laser-induced thermonuclear fusion. The result has been a number of announcements that indicate the field has come quite a distance while it was under wraps.

The first thing out of the box was a description, by John Nuckolls and associates of the Lawrence Livermore Laboratory, of a means whereby they hope to achieve laser fusion with much less laser energy than people had thought would be needed (SN: 5/20/72, p. 328). The basic problem in laser fusion is to transfer the energy from a pulse of laser light to a fuel pellet of solid deuterium and tritium in such a way that the pellet will be ionized into a plasma and the deuterium and tritium nuclei will fuse with each other and produce energy. The suggestion of Nuckolls and his co-workers is to increase efficiency by bombarding the pellet with laser light from all sides, thereby inducing compression of the pellet that concentrates the energy into a small volume.

This is not the only approach, but it illustrates the progress in the field, which is now so far along that industrial firms are getting into it. Last week three corporations, KMS Industries, Esso and General Electric announced they would be working or supporting work in the field. KMS will develop an approach similar to that of Nuckolls and associates. KMS's approach, however, was developed by its own people, and the company has 19 patent applications pending. Esso and General Electric will cooperate with the University of Rochester on a different approach. Stemming from the work of Moshe Lubin and associates at Rochester, it will stress means of increasing the efficiency of absorption of the laser energy by the fuel rather than compression.



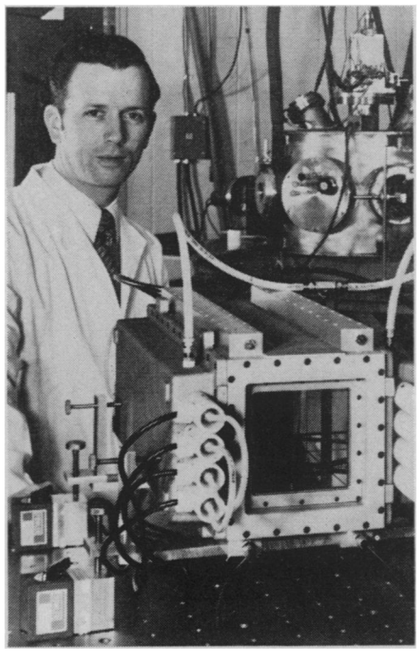
KMS

Brueckner's idea can now be discussed.

KMS's interest in the field goes back several years. About two years ago there appeared a rather cryptic announcement that Keith A. Brueckner of KMS had developed a theory for a new and more efficient way to achieve controlled thermonuclear fusion (SN: 8/15/70, p. 136). Although it had been suggested that further details would be made public, inquiry revealed that the security classifiers had put a lid on it. Presumably that had to do with what is now announced. Asked how his approach differs from that of the Livermore group, Brueckner said that there were differences, but "as much as they can say about their approach is what we can say about ours." In what has been said, significant differences are not apparent. Asked whether the difference lay in the shape of the fuel pellets, Brueckner would not answer. A good deal about pellet design remains classified.

Lubin, who is director of the University of Rochester's Laboratory for Laser Energetics, has worked for years on means to increase the efficiency of the fuel's absorption of the laser energy. As he points out, compressing the fuel yields an advantage that increases with the square of the decrease in size; improving absorption gives an advantage that rises as the fourth power of the absorption.

A neodymium-glass laser of 5 kilojoules energy is being developed for Lubin's next step. Its output will be split and amplified into multiple beams to strike the target. Multiple beams are used not to achieve symmetrical compression, but because under present conditions they happen to be the best way to deliver the energy. Esso and GE are putting up about $3 million for the program.



Univ. of Rochester

Lubin: Improving energy absorption.

All of those who have so far spoken —including the Livermore group, who continue to work on Government time and money—hope to achieve break-even, the point where more fusion energy comes out than laser energy goes in, within two or three years. But Lubin says that break-even by itself is not all that interesting. "You break even with a hydrogen bomb," he points out. What interests him more is the scaling of the reaction: If the energy input is doubled, how does the output increase. Lubin hopes to reach a state where a doubling of input produces a manifold increase in output.

What the industrial companies hope to get out of it all appears various. At the KMS annual meeting last week the eventual existence and construction of fusion reactors were discussed, and a general spirit of optimism prevailed, even go-for-broke optimism. Said one officer: "I'm gambling our company and everything I know."

Others appear to think reactors a rather futuristic topic and have more interest in possible profitability of ancillary developments in lasers, in gadgetry to make the fuel pellets and in similar instruments and machinery. A corner on laser fusion for any one company or consortium is not likely to develop. There are too many people in the field, and too much of it is in the public domain. □