FUSION POWER

Closer and closer

Among the devices plasma physicists are using in experiments directed toward controlled thermonuclear fusion, the machine called Tokamak at the Kurchatov Institute in Moscow is regarded as one of the most promising. The director of the Kurchatov Institute, Dr. Lev A. Artsimovich, has been claiming that Tokamak has made a significant step toward controlled fusion.

A British team checking his figures now reports that he underestimated himself and is actually closer to controlled fusion than he thought.

Tokamak's toroidal magnetic field, improved by making the plasma generate some of its own magnetic field, was originally regarded as a particularly good possibility, and it was with some eagerness that fusionists awaited reports of its experiments. During a tour of the United States in April Dr. Artsimovich reported results that were both suprising and heartening. He claimed that Tokamak held a plasma of up to 70,000 billion ions per cubic centimeter at a temperature of 5 million degrees K. for 0.02 second (SN: 5/26, p. 397).

These figures indicated a confinement 10 times as long as any plasma of similar density and temperature had been held. Furthermore the density and temperature figures, unlike many previous experiments, were in a range that seemed within reach of sustained fusion. Sustained fusion depends on a balance of density, temperature and confinement time, but an example of the sort of thing that might do the job is a million billion ions per cubic centimeter, 100 million degrees K. and confinement for 0.1 second.

Encouraging as they were, Dr. Artsimovich's figures were regarded with some skepticism by his colleagues.

Even before Dr. Artsimovich's U.S. visit, a team of scientists from Great Britain's Culham Laboratory had gone to the Kurchatov Institute, taking with them plasma-measuring machines that they believed would get Tokamak's figures with greater accuracy than was possible with equipment the Russians had. They now report that Dr. Artsimovich underestimated his machine.

The visitors who went to Moscow in March were Dr. N. J. Peacock, M. J. Forrest and P. D. Wilcock. There they joined Dr. D. C. Robinson, who was spending a full year at the Kurchatov Institute.

Their method of diagnosing the plasma, as such a measurement is called, was to send a pulsed beam of laser light through the plasma. The light is scattered by the plasma particles, and the spectrum of the scattered light can be used to determine the temperature and density at any point in the plasma volume. By contrast, the Soviet estimates were based on gross measurements and estimates from neutron emissions—questionable because they represent the most energetic elements in the plasma, rather than the average.

From their measurements, however, the British team deduces that Tokamak's plasma is between 10,000 billion and 30,000 billion particles per cubic centimeter; its temperature is 10 million degrees K., instead of 5 million, and that the confinement lasts for more than 0.05 second instead of 0.02 second.

This combination of figures means that "conditions in Tokamak 3 fall short of a sustained fusion reaction by a factor of only 100," says Dr. Walter Marshall, director of research for the United Kingdom Atomic Energy Authority. The physicists at Culham already have some experiments under way that they consider promising, one of which Dr. Marshall calls "very like Tokamak."

Earlier success at Tokamak had already convinced scientists at the Oak Ridge National Laboratory that they should build a Tokamak-like machine, which will be called Ornak. The Russians, for their part, intend to build bigger and bigger and bigger Tokamaks, in which they hope to overcome that factor of 100. □

NOW MUELLER TOO

Musical chairs at NASA

Despite the importance of the first manned lunar landing, the National Aeronautics and Space Administration is quick to point out that Apollo 11 was not the end of its mission, although hugely one-sided budgets often provided grounds for wonder. Nevertheless, many NASA officials stayed only long enough to see this milestone in place before going their separate ways. Sam Phillips, George Hage and other familiar figures in the manned space program have felt their tasks well enough accomplished to permit departure for other Government endeavors or for industry.

Now the head of the whole manned space flight program, Dr. George E. Mueller, is reported to have resigned, and NASA officials privately confirm the reports. The departure is not surprising. It has been rumored for months that he has wanted to return to industry (he came to NASA in 1963 from TRW, Inc.). But it is a possibility that he is leaving after having been passed over a second time for a job he has long had his sights on.

The shuffling is complex.

On Sept. 25, NASA announced that Apollo 9 commander James A. McDivitt would become the new manager of the Apollo spacecraft program at the Manned Spacecraft Center in Houston. McDivitt took the place of George M. Low, one of the most popular men in the space agency's upper echelons, freeing Low for a vague, temporary "special assignment" working for MSC director Robert Gilruth "to plan future programs and work on organizational matters."

This week, with Dr. Mueller conveniently out of the country, it has come to light that Low is likely to be appointed by President Nixon as Deputy Administrator of NASA. And there, amid all the confusion, is a possible crux of the matter.

Low's appointment as deputy director represents the second time that Dr. Mueller had been passed over for the deputy's job. The first time was when Dr. Thomas O. Paine received the nod on Jan. 31, 1968. When Dr. Paine took over the top spot to replace retiring Administrator James E. Webb, the deputy post went begging, and has been empty ever since.

One possibly significant effect of Low's appointment is that it would place an engineer in the same job from which Dr. Paine, a scientist, went on to become head of the whole space agency. The controversy between engineers concerned with hardware development and scientists who feel disenfranchised has been bubbling for years in NASA, culminating around the time of the first moon landing in a number of high-level resignations from the space agency's scientific ranks (SN: 10/18, p. 355).

The latest major separation is that of Dr. Persa R. Bell, former manager of the Lunar Receiving Laboratory, who will leave NASA following the Jan. 5 meeting of principal investigators of the Apollo 11 lunar rock samples.

Like others to resign, Dr. Bell has been critical of the minimal role given to science in the Apollo Program. Typical of the controversy is that when Dr. Bell left his LRL post to become assistant to the director of science and applications at MSC, the job went not to another scientist, but—possibly with the effect of a final straw—to an engineer, Bryan Erb.

Prominent among others to leave was Dr. Bell's superior, Dr. Wilmot N. Hess, who had already left his prestigious post as chief scientist at MSC for similar reasons. His replacement is Dr. Gene Simmons, a geophysicist from Massachusetts Institute of Technology. □