NUCLEAR FUSION

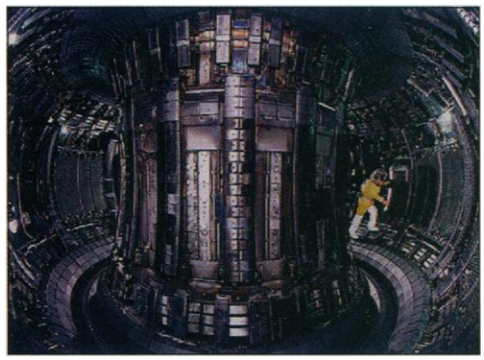
# JET Takes a Step Closer to Break-Even

Researchers at the Joint European Torus (JET), the European fusion test reactor at Abingdon near Oxford, announced last week that they have come closer than ever before to break-even, the point at which a fusion reactor produces as much energy as it consumes. Burning the same mixture of hydrogen isotopes that would fuel an actual fusion power station, JET produced 50% of the energy supplied to the reactor—close to twice the previous record.

In a fusion reactor, deuterium or tritium nuclei (hydrogen atoms with one and two extra neutrons in the nucleus, respectively) fuse and form helium nuclei and neutrons. A small amount of mass is lost in the reaction and is converted into energy. However, fusion takes place only when the deuterium and tritium nuclei are confined inside a torus by powerful magnetic fields and heated to temperatures of over 100 million degrees. Heating the gas to such temperatures with beams of neutral particles, radio waves, and electric currents running through the plasma requires a huge amount of energy.

Until recently, experimental fusion reactors all used a fuel consisting mainly of deuterium and a smaller proportion of tritium (about 11%), which yields less energy. In 1995, however, the Tokamak Fusion Test Reactor (TFTR) in Princeton, New Jersey, burned a 50-50 deuterium/tritium mixture to produce 28% of the energy needed to heat its plasma. Now JET, also burning an equal mix of deuterium and tritium, has moved halfway to break-even, in the process generating more than 12 megawatts of fusion power. "We hope to improve this [output/input ratio] somewhat over the next weeks," says JET director Martin Keilhacker. JET deputy director Alan Gibson explains that they plan to confine the plasma within several different magnetic field configurations: "So far, we have only used the first of these, and some of the others we think probably have promise to go to higher values of this ratio."

Gibson says that the output of TFTR, which was shut down earlier this year, was limited by geometry. "The shape of the cross section of the plasma in JET is D-shaped, while in the TFTR the cross section is circular," he explains. "The D shape has advantages from the point of view of stability," Gibson adds, and allows the use of a diverter, a circular chamber in the bottom of the torus vessel that siphons off impurities that would otherwise slow the reaction. Gibson believes that it may be possible to reach break-even with JET, which will operate until at least 1999. "It depends on how successful we are in fine-tuning the plasma behavior," he says. Experiments with an output/input ratio closer to one are interesting because "the self-heating in the plasma by the fusion power becomes progressively more important, and one of the things we plan to do at JET is to measure this self-heating," Gibson says.



JET

**Fusion first.** JET sets records with a 50-50 mix of deuterium and tritium fuel.

The results so far, continues Gibson, "are very encouraging for ITER"—the proposed $10 billion International Thermonuclear Experimental Reactor, which, if built, would use the same fuel mixture and would also use a D-shaped plasma and a diverter. However, Michael Mauel of Columbia University, who works on General Atomics' DIII-D tokamak in San Diego, stresses that today's tokamak experiments still aim at improving the physics of fusion rather than demonstrating fusion power. "The importance of the JET experiment is not to demonstrate ignition, but to demonstrate that we understand the physics of plasma at 100 million degrees," he says. "And what is so exciting is that our expectations and our understanding appear to be right."

Other fusion experts are also excited by the news. "It is wonderful that they have achieved high performance, and I hope they continue their experiments," says William Dorland, a researcher at the Institute of Fusion Studies of the University of Texas, Austin. "It is too soon to know what it means for ITER, but it could be good."

**–Alexander Hellemans**

*Alexander Hellemans is a writer in Naples, Italy.*

U.K. ASTRONOMY

# Staff Makes Bid to Privatize Observatory

**CAMBRIDGE, UNITED KINGDOM**—Efforts to save the 300-year-old Royal Greenwich Observatory (RGO) from closure will face a crucial test next week. Earlier this year, RGO seemed headed for oblivion when it lost out in a contest with the Royal Observatory Edinburgh to become Britain's single Astronomy Technology Centre (ATC), serving telescopes in the Canary Islands and Hawaii (*Science*, 11 July, p. 169). But RGO's staff has since come up with a business plan to transform the observatory into a private institution that would build small, robotically controlled telescopes, up to 3 meters in diameter, for the international market. On 8 October, the Particle Physics and Astronomy Research Council (PPARC), which currently funds the two Royal Observatories, will decide whether to allow RGO to pursue this plan. Failure to support it could kill RGO through loss of key staff members.

EADEN LILLEY

**Hoping for reprieve.** RGO director Jasper Wall.

PPARC's decision in July to merge the Royal Observatories and relocate all instrument-building and technical support to Edinburgh prompted fierce opposition from many astronomers. Science Minister John Battle backed the decision, but asked the council to try to find a way to save the name of the RGO, which is Britain's oldest scientific institution. RGO's rescue plan would achieve that, but it would still require shedding staff, perhaps as many as half of the current 110 employees.

In addition to turning RGO into an international telescope builder, the plan would maintain some functions RGO currently performs for other organizations. "About one-third of our income comes from other activities such as maintaining the Nautical Almanac, gathering satellite tracking data for the Natural Environment Research Council, and public understanding of science initiatives," says RGO director Jasper Wall. The observatory is also in talks with Cambridge University on the possibility of closer links. The RGO and the university's Institute of Astronomy, sited next door, have recently merged libraries. "We now have one of the world's finest astronomy libraries," says Wall.

Hopes that the RGO might survive in some form have won the backing of many British astronomers. "A lot of the world's