Clamour to recapture 'sun in a test tube'

SCIENTISTS worldwide have entered a race to reproduce what has become known as the "Utah Experiment", in which nuclear fusion was sustained in a test tube.

This new approach appears almost trivial in comparison with conventional methods.

At the Atomic Energy Authority's laboratory in Harwell, Oxon, sophisticated equipment is being used to to reproduce the results announced by Prof Stanley Pons of the University of Utah and Prof Martin Fleischmann of Southampton University.

The two scientists claim that, by using an electrochemical technique, they managed to sustain nuclear fusion at room temperatures instead of those in excess of 100 million degrees Centigrade used in previously attempts.

"What we have done is to open the door of a new reseach area . . . our indications are that the discovery will be relatively easy to make into a usable technology for generating heat and power," said Prof Fleischmann.

Although the Harwell Laboratory was shut on Thursday, Dr David Williams, Dr Derek Craston, Dr David Findlay and Dr Martyn Sené are continuing the fusion work behind closed doors.

Nuclear fusion regarded as science's next great frontier

Dr Williams said: "I am absolutely fascinated. We have got to believe them when they say something is going on and we are trying hard to repeat it. We have been working flat out.

"There are some subtleties that we do not fully appreciate.

"I have heard that at Utah some of the cells they have work and others do not, so that makes it even more interesting."

However, Dr Williams added that he understood a certain length of time was required to persuade the "test-tube fusion" to occur.

"When you present this to theorists, their first reaction is that this is an April fool's joke," he said.

"Now they are very keen to discuss it with Prof Fleischmann, they are champing at the bit to get hold of him."

The Harwell team is dealing directly with Prof Fleischmann, who is a consultant to the Atomic Energy Authority, giving them a head start over many other groups of scientists.

The team is awaiting Prof Fleischmann's return to discuss the results with him.

By Roger Highfield
Science Editor

Nuclear fusion—the power that fuels the sun—is regarded as science's next great frontier in developing new sources of energy.

But it has generally been considered to be years away from commercial exploitation.

It differs from the process that takes place in a conventional nuclear reactor because the nuclei of atoms are fused together rather than being broken apart.

"Instead of super-hot gases in mammoth circular reactors, the Utah experiment calls for relatively simple electrochemical techniques to fuse hydrogen atoms inside a solid material," Prof Pons, 46, said of their table-top experiment.

The scientists said they had produced a sustained fusion reaction for 100 hours in an electrode in a reaction vessel—a glorified test tube—in the basement of a chemistry building in the University of Utah.

The experiment, which the researchers said could have been completed with a school chemistry set, showed fusion can be triggered electrically by forcing atoms to fuse inside a solid material rather than in superheated gases.

"Temperature is not as important when using these electrochemical techniques," said Prof Pons.

Such reactions had only been carried out in nuclear weapons and in the centre of stars, including the sun, where gases reach a temperature of 100 million degrees Centigrade.

But the scientists cautioned that more research was needed to determine whether the process would work on a large scale.

"We don't know what the implications are. The science base has to be established as widely as possible to challenge our findings," Prof Fleischmann said.

"But it does seem there is a possibility of realising sustained fusion in a relatively simple device."

The two scientists are convinced that they have achieved nuclear fusion rather than a conventional chemical reaction, because very large amounts of heat are released over long periods, and they have detected neutrons and tritium, predicted by-products of nuclear fusion.

Dr Ron Bullough, chief scientist and director of underlying research at the UK Atomic Energy Authority, said he had authorised an experiment to verify the results last week.

But, until he sees neutrons in the authority's attempt to reproduce the result, he was "not prepared to speculate".

Neutrons are a critical sign that a nuclear reaction is taking place, said Dr Bullough.

The authority is performing the experiments "in probably the most sensitive neutron detector in the world", he said.

"If there are any neutrons coming off, we shall see them."

However, he said that none had so far been observed, and he had heard that not all the electrochemical cells used at Utah had produced radiation.

Dr Chan Choi, a fusion researcher at the School of Nuclear Engineering, Purdue University, Indiana, said: "People are pushing cold-temperature nuclear fusion quite vigorously these days.

"Like any science, this claim has to be reproducible. If it is indeed there, it is quite a discovery."

Dr Edward Teller, director emeritus of the Lawrence Livermore Laboratory, said the experiment "sounds extremely promising."

"Initially, my opinion was that it could never happen," said Dr Teller, who is known as the father of the atomic bomb.

'A gallon of sea water could produce energy of 300,000 gallons of petrol'

"I'm extremely happy now, because I see a very good chance that I was completely wrong."

Since the 1950s scientists have spent hundreds of millions of dollars to control hydrogen fusion and develop devices that could handle extremely high temperatures and pressures previously believed necessary for fusion.

By comparison, Professors Fleischmann and Pons estimated they had spent only $100,000 (£58,000) of their own money over five years.

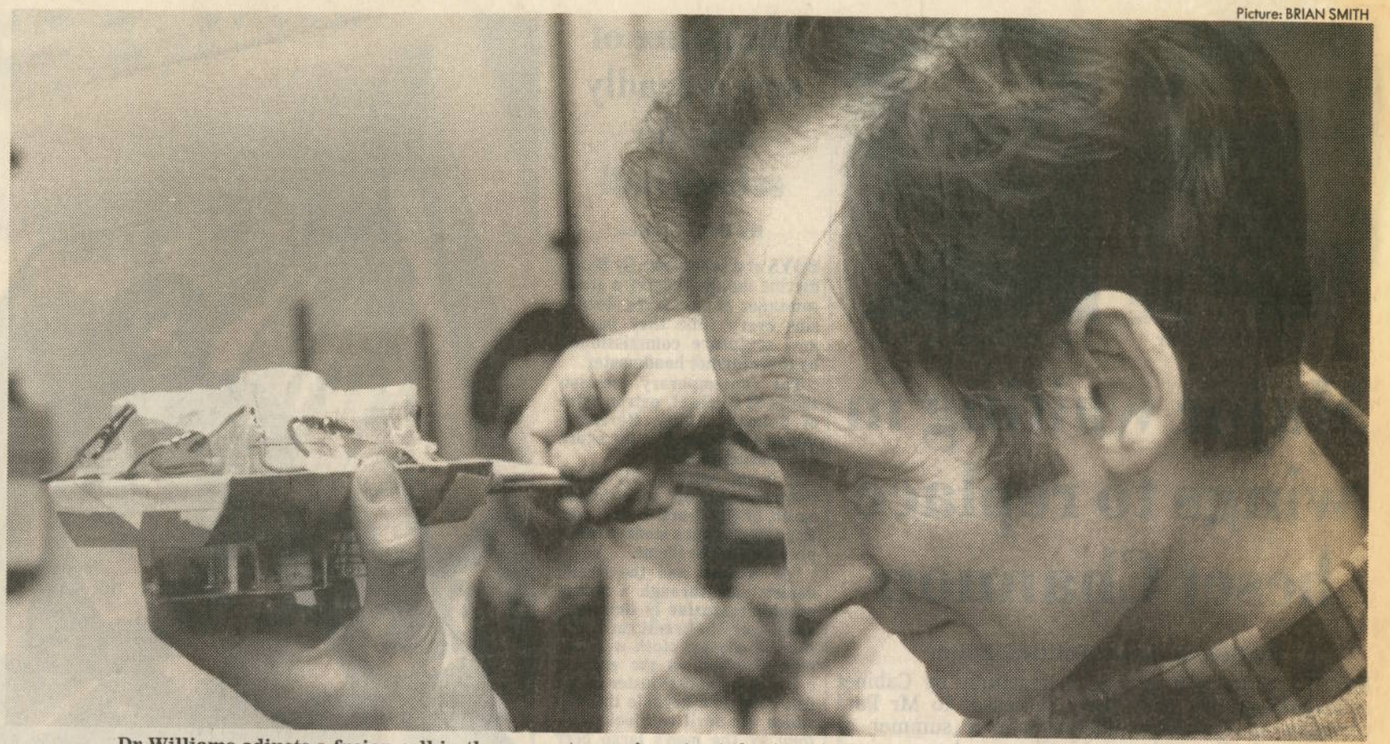
They used deuterium, a "heavy" form of hydrogen that can be extracted from sea water, as the fusion material.

A gallon of sea water could produce as much energy as 300,000 gallons of petrol, they said.

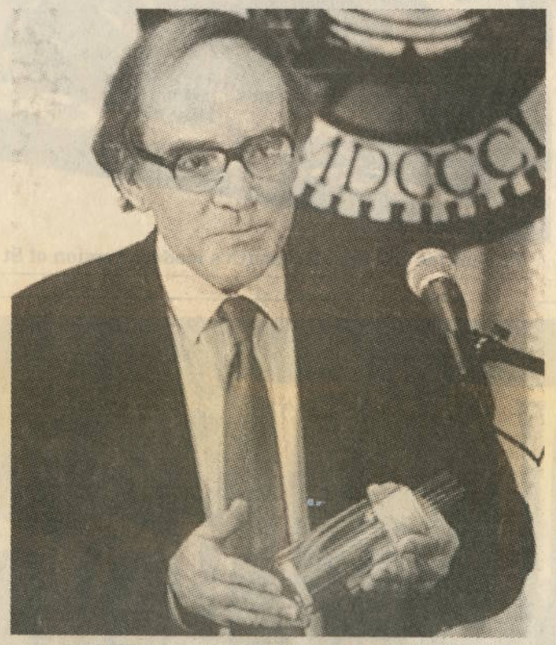
Profs Pons and Fleischmann met in 1975 when the former was studying for his doctorate at Southampton.

Prof Fleischmann said the research has been submitted to a scientific journal, which he declined to name. If accepted, it would be published in May, he said.

Picture: BRIAN SMITH



Dr Williams adjusts a fusion cell in the current experiments at the Atomic Energy Authority's laboratory in Harwell



Prof Fleischmann: 'We have opened the door'

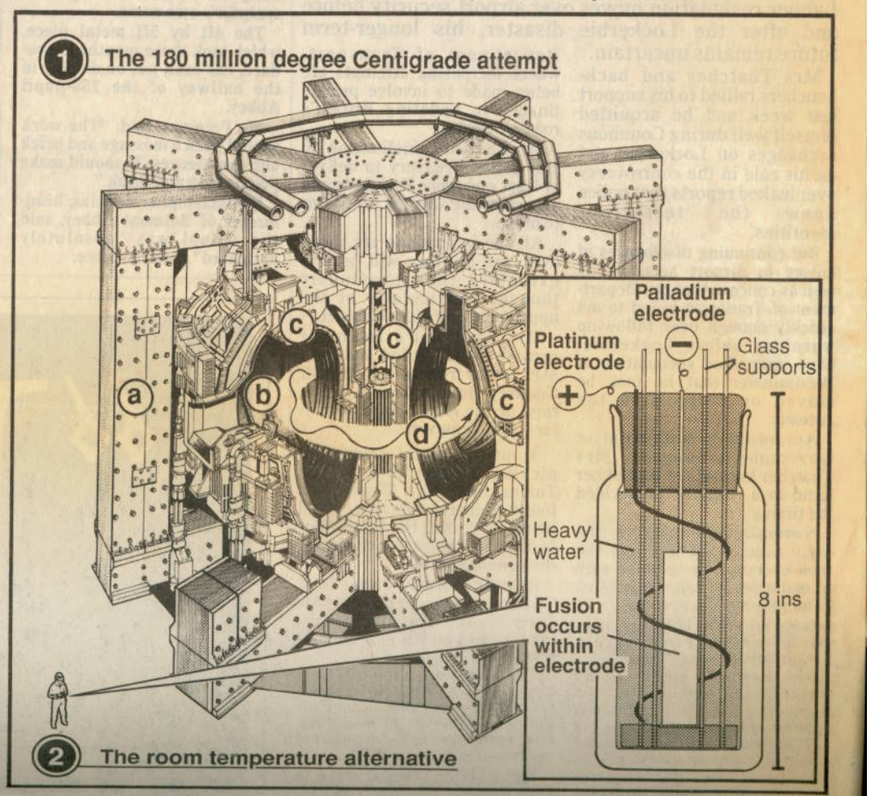
The pair are now seeking a grant from the federal Department of Energy to continue their research.

Mr Chase Peterson, President of Utah University, said the school has applied for patents to cover the techniques in the United States and internationally.

But some, such as Prof Richard Morse, a professor of physics at the University of Arizona, are sceptical.

To create fusion, scientists must prevent positive ions from repelling one another so that they can fuse together, he said.

This can be done by accelerating them to a high velocity but "I would be a little sceptical that anything of economic value could be achieved this way," he said. "Some of the limitations



Efforts to produce energy by nuclear fusion until now have involved huge machines such as the Joint European Torus in Oxfordshire, with a six graphite-lined vessel (B); giant magnetic coils (C); and charged particles (D) held at temperatures as