Nuclear fusion – power for the future?

As an experiment, some of our SciBar participants prepared this glossary, independently of Professor Browning. You may find it informative to consider these concepts and visit these websites in your own time. Your comments on this are most welcome.

Breeder A component of a fusion power plant used to 'breed' or produce tritium via nuclear reactions.

Cold fusion A fusion reaction using targets at room temperature or below, such as by accelerating deuterium and tritium ions in a sealed tube. It has not been reported to produce net energy. Compare to 'hot fusion' which forces nuclei together at very high temperature and pressure.

Deuterium An isotope of hydrogen, in which each atom has twice the mass of an ordinary hydrogen atom. The deuterium–tritium fusion reaction is used in experimental fusion reactors.

Fusion plasma This plasma is different from a naturally occurring 'solar plasma'.

Fusion reactor Generates power from nuclear fusion reactions. The energy carried by neutrons, produced in fusion reactions, will be used to generate electricity. It offers the hope of a carbon-free source of energy. But, it requires very high temperatures to achieve ignition.

Ignition The 'break even' moment, at which a fusion device produces more energy than is required to keep the reactions going.

Inertial confinement This controls the plasma by rapidly compressing it to very high densities, using lasers.

ITER Experimental tokamak being built in France.

JET (Joint European Torus) This is an experimental tokamak at Culham near Oxford.

Magnetic confinement This controls the plasma by using very strong magnetic fields. It works because electric charges (as in a plasma), moving in a magnetic field, are deflected.

Neutrons Neutral particles found in atomic nuclei. A neutron can be freed from a nucleus during a fusion reaction.

Nuclear binding energy This holds the nucleus together. It is calculated from the 'mass defect' Δm and is the difference in the individual masses of the protons and neutrons in the nucleus; $E = \Delta mc^2$. It is this energy that is release in nuclear fusion and fission.

Nuclear fusion Is a reaction in which nuclei combine to form a heavier nucleus with the simultaneous release of energy. Only happens under extremes of temperature and/or pressure, when nuclei can collide at speeds high enough to overcome the usual repulsion due to their electric charge.

Plasma This is an ionised gas, a 'sea' of positively charged ions and negatively charged electrons

Plasma heating The initial heating necessary to heat a plasma to the temperatures needed for fusion, 100 million degrees Celsius.

Tokamak Is a magnetically-confined fusion reactor, within a toroidal (doughnut shape) chamber.

Tritium Is an isotope of hydrogen, in which each atom has three times the mass of ordinary hydrogen atoms.

Useful weblinks:: www.fusion.org.uk/ Culham Centre for Fusion Energy (home of JET and MAST, the UK fusion experiment)
www.jodrellbank.manchester.ac.uk/research/solar/plasma.html