

Mostly cold fusion

A primer on fusion ... nowhere near.

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Nuclear fusion, the process that powers the sun, requires a tremendous amount of heat and pressure to force two particles with positive charges close enough for the strong nuclear force to bind them together. As that fusion takes place, a great deal of energy is released. The challenge for those of us here on earth who view fusion as a potential clean energy source is to figure out how to create the heat and pressure needed in a way that's efficient enough that the resulting fusion releases more energy than we put in.

Most of these efforts, such as the long running ITER project, have involved large scale equipment designed to create environments similar to the sun. But a handful of researchers have focused on creating a hot, high pressure micro-environment within an apparatus that can operate near room temperature. Following the Pons and Fleischmann cold fusion fiasco, such research is now generally termed "desktop fusion", in order to distinguish it from its less credible relative. Most desktop fusion efforts use the same heavy isotope of hydrogen, deuterium, as are used in the large scale reactors. Scientists just use various tricks to create a limited environment in which fusion is more probable.

A big success in this field came last year when UCLA researchers reported a new method for getting reasonably efficient desktop fusion. In simple terms, the researchers immobilized some deuterium based on its affinity to a metal surface. Next up, they took advantage of what's called a "pyroelectric crystal". These crystals, when heated, build up a large charge difference. When such a crystal was placed in a container of deuterium gas, the charge on the crystal stripped the electron off of deuterium atoms and accelerated them towards the deuterium coated metal. Once they got there, the speed was enough to cause the accelerated particles to fuse with the immobilized ones.

Although successful, the amount of energy required to run the system still outweighed that produced by the fusion. The authors, however, noted, "Although the reported fusion is not useful in the power-producing sense, we anticipate that the system will find application as a simple palm-sized neutron generator." So the power of the sun in your hand is still a long way off, but you may at least get access to some of its output from a palm-sized device. Neutrons have a number of potential uses, including radiation treatment of cancers and sterilization of equipment or food, so the commercialization of this technique holds promise. In a recent paper in Physical Review Letters, researchers took another step in that direction. In addition to confirming the UCLA team's results, the researchers improved the efficiency of the device by targeting two of the pyroelectric crystals at each other, an arrangement that seems designed to create head-on collisions between the deuterium atoms. Although this new device still won't power a flying DeLorean, its small size and high neutron output may place fusion in your doctor's office long before it gets anywhere as an energy source.