Scientists take step toward usable fusion energy

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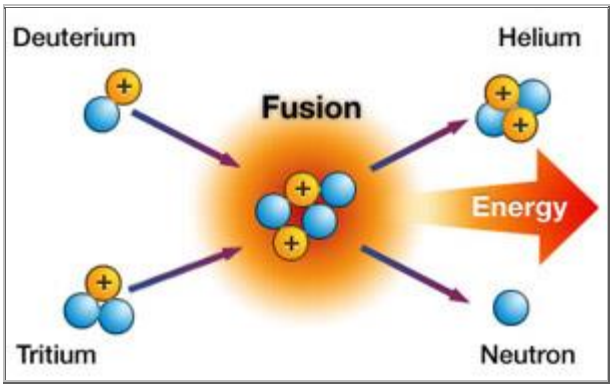
Scientists have taken a key step toward using fusion, the process that powers the Sun, to produce energy, according to a report to appear Feb. 13 in the research journal *Nature*.

Fusion energy is envisioned as a way to produce virtually unlimited power to supply the Earth's needs, but no one has succeeded in devising a fusion process that gives out more energy than it takes in.



Two atoms, deuterium and tritium, fuse together, forming a helium nucleus, a neutron and lots of energy. (Image courtesy F4E)

Physicists at Lawrence Livermore National Laboratory in California said they succeeded in at least releasing more energy through a fusion reaction than is absorbed by the fuel that triggers the reaction.

But that energy is still only about a hundredth of the total energy needed to set up the process in the first place, they said, most of which goes into compressing a fuel pellet where fusion takes place.

"The next necessary step would be to achieve a total gain, where energy entering the whole system is exceeded by the energy produced," the researchers said in a statement. Nonetheless, "we are closer than anyone has ever gotten" to obtaining fusion as a viable energy source, said Omar Hurricane, a researcher at the laboratory and one of the authors of the report.

The whole process took place in a space less wide than a human hair and in only the tiniest fraction of a second—150 picoseconds, to be exact.

Their process used inertial confinement fusion, which initiates nuclear fusion reactions by heating fuel pellets until they implode, compressing the fuel. The fuel consists of deuterium and tritium—isotopes, or variant forms, of hydrogen. When squeezed together, they merge creating a helium nucleus, and releasing energy along with a neutron, or subatomic particle.

The confinement squeezes the atoms of fuel "to get them running toward each other at high velocity, which overcomes their mutual electrical repulsion," said Hurricane.

The scientists said they used 192 lasers to heat and compress a small pellet of fuel to the point where the fusion reactions take place.

What made the process successful was that the scientists managed to initiate a process called "bootstrapping," a sort of vicious cycle, Hurricane said. In this, "the alpha particles [helium nuclei] that come out of that reaction start leaving energy behind and causing the temperature to go up" within the tiny chamber. "When the temperature goes up, the reaction rate goes up, and when the reaction rate goes up, you make more alpha particles