The Polywell Nuclear Reactor

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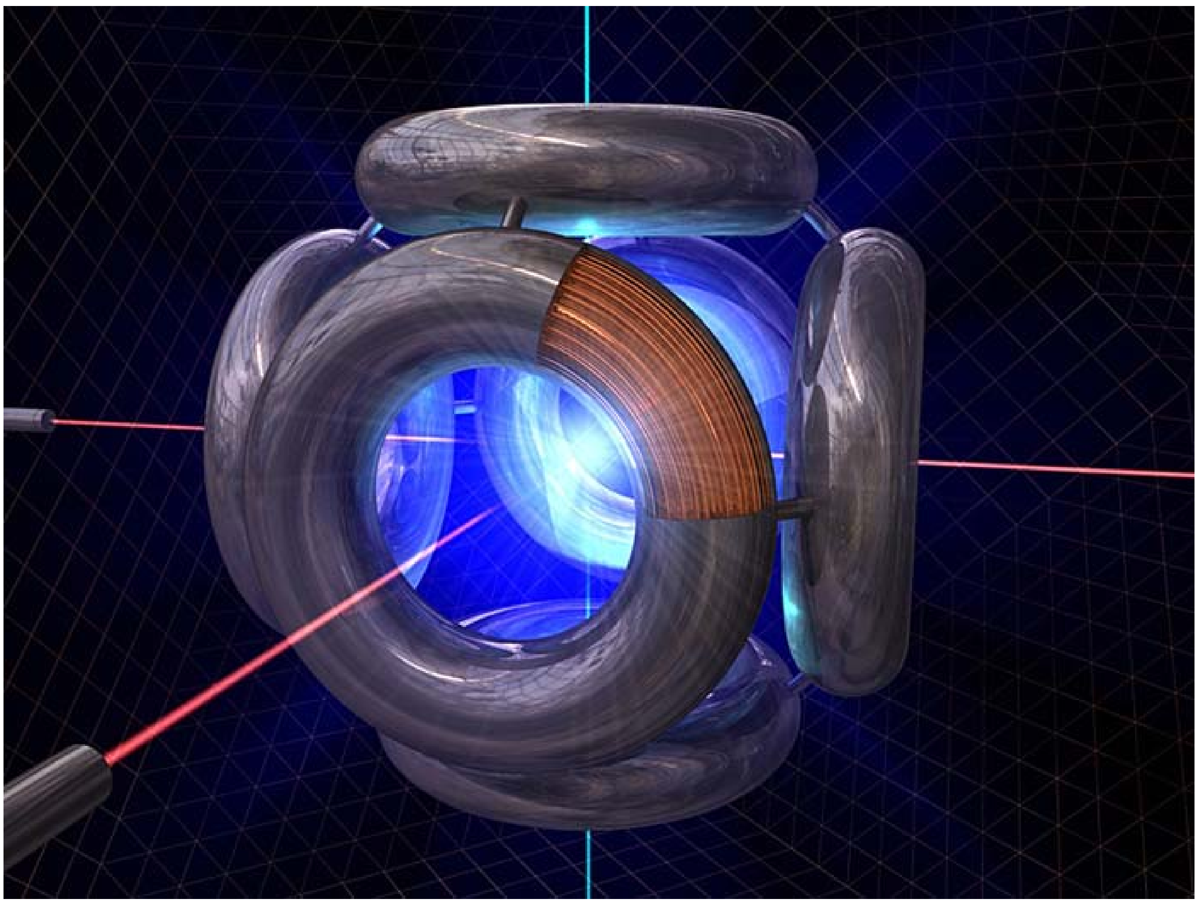
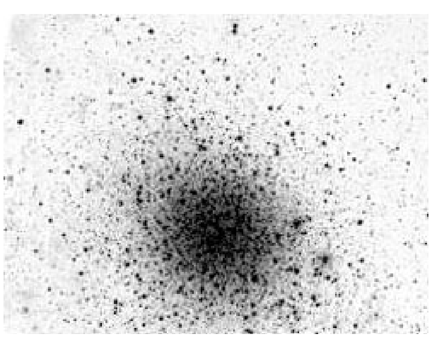
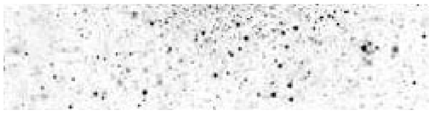
...uses electricity and magnetism to release nuclear energy stored in the nuclei of Hydrogen and Boron atoms. This reaction of Hydrogen and Boron is called a p-B11 reaction. It is one of the few nuclear reactions that is completely safe: no significant nuclear radiation is released by the fuels, the reaction, or the products.



The **poly**hedral (cubical) group of stainless steel donuts pictured above is called a magrid. The magrid is positively charged to more than 50,000 volts.

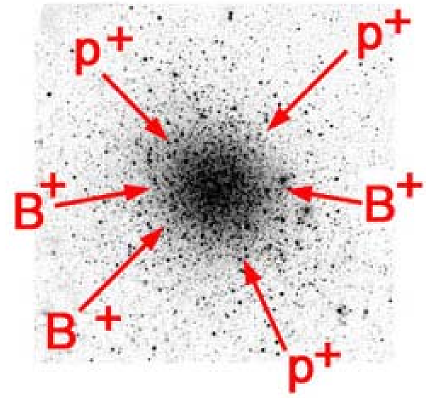


The coil inside of each donut is creating a magnetic field of 2 Tesla (20,000 Gauss). The red streams shooting into the center of each donut are positive Boron and Hydrogen (proton) ion beams. The blue-green stream is an electron beam. The magnetic field is a trap that captures and contains most of the electrons. They accumulate at the center of the cube, becoming a cloud of electrons (left), somewhat like a swarm of bees. This accumulating cloud of electrons is a concentration of negative electric



charges. Such a large concentration of electric charge creates what is know as a potential **well**. (Hence, the name **polywell**.)

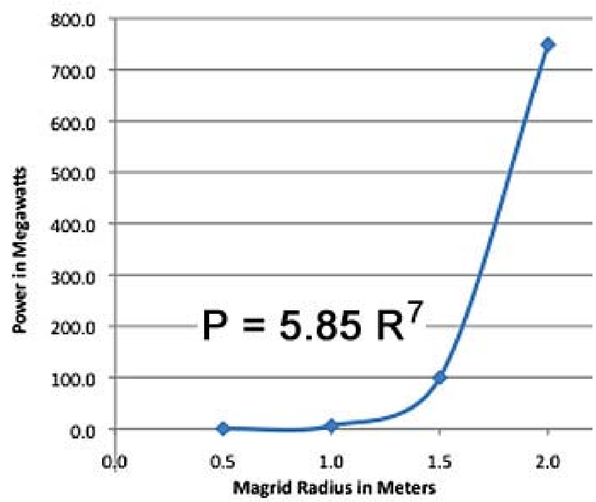
The negative cloud of electrons at the center creates a potent electric field of imaginary electric force arrows pointing in toward the electron cloud. The electric field accelerates the Boron and hydrogen ions (protons) to the center of the cloud (right). When the protons and Boron nuclei collide, a nuclear reaction occurs. The reaction creates high-energy alpha particles (helium nuclei), which carry large amounts of energy away from the center.



Compared to the 50,000 volt potential of the incoming proton and boron ions, the outgoing kinetic energy of the new alpha particles is truly hellish - on the order of 2,460,000 volts (2.46 million electon volts or 2.46 Mev).

A spherical metal collector, charged to +1.22 million volts, surrounds the whole affair. It uses electrical repulsion to slow the outbound alphas. This same repulsion pushes electrical charges down power cables which are connected to the Polywell, and the electrical energy is removed, to be used in our planet's power grid.

The power output of a polywell is proportional to R^7 (radius of the magrid to the seventh power). This means there is an optimum radius for the magrid, and that is about 1.5 meters. If you make the radius of the magrid much less than 1.5 meters, the Polywell will not put out enough power to charge its own magrid and power its own coils (it will not reach "break even"). And, if you make the radius much more than 1.5 meters, the power output will exceed the strength of any known materials, and the Polywell will blow itself to bits, every time you power it up. In the graph on the right, if R = 1 m, the power out is 5.8 MW; if R = 2 m, the power out is 749.2 MW.



So the diameter of our "full-scale" Polywell will be about 3 meters (almost 10 feet); and it happens that the power output of a 3 meter Polywell is about 100 MW (100,000,000 watts), which is just about the right size for powering the city of Port Angeles, Washington.

In a strange, but serendipitous coincidence, it just so happens that the diameter of a GE90-115B jet engine is about 3 meters (see photo left), and its power output is 86 MW (86,000,000) - pretty close to 100 MW. The GE 90 -115B is the most powerful jet engine made. It powers the Boeing 777 aircraft pictured below. The environment inside an operating jet engine is absolutely hellish requiring materials at the very limit of our technology; and the environment inside of an operating Polywell will be just as bad.

But there are also some big differences:
1. the jet engine uses carbon-based fuel and produces copious carbon dioxide, but the Polywell uses Boron and Hydrogen, and produces **NO** (zero, nada, нуль) carbon dioxide.
2. the jet engine releases CHEMICAL energy (the atoms are conserved), but the Polywell releases NUCLEAR energy (the atoms are NOT conserved).
3. the GE 90-115B engines go for about $22 million each, whereas the estimated cost of a prototype 100 MW Polywell is about $350 million. (The cost of a production Polywell should be about $200 million.)

For Future Cost Comparison

How many 100,000,000 watt (100 MW) Polywells would be required to replace just half of the 12,900,000,000,000 watts (12.9 Terawatts), presently produced from carbon based fuels every hour here on Earth, assuming that the Polywells are operating at 60% (0.6) efficiency? And how much would it cost for that many Polywells?

6,450,000,000,000 watts/(100,000,000 watts per polywell x 0.6) = 107,500 polywells

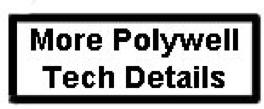
Each Polywell costs about $200,000,000 installed.

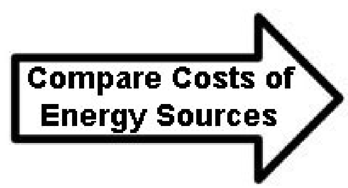
$200,000,000/Polywell x 107,500 Polywells = $21,500,000,000,000

Excuse me? $21.5 TRILLION dollars????

It's a pretty scary number, but just for future comparison purposes, to eventually put this number into perspective, let's calculate the cost per Terawatt:

$14.33 Trillion/6.45 Terawatts = **$3.33 Trillion/Terawatt** (remember this number!)





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