FUSION ENERGY FROM A STAGED Z-PINCH (Simplified)

The Staged Z-pinch is a relatively recent invention designed to produce net energy by thermonuclear fusion; it is well quantified and based on established technologies. The plasma in a Staged Z-pinch is cylindrical and one centimeter in diameter and length. The drive energy is electrical, stored in an array of capacitor batteries. When these batteries are discharged several million amperes of current flows through the load, impulsively accelerating the plasma to the axis. The plasma compression occurs as if driven by a massive, supersonic hammer. If configured according to our formulation, the Staged Z-pinch is projected to produce 100 times more energy than is provided by the electrical driver presently in operation. The major advantage of using this scheme is that the entire process of heating and compression remains remarkably stable contrary to any other proposed scheme. The fact that this scheme of heating and compression remains stable has been observed in experiments and demonstrated extensively in numerical simulations using state of the art codes. Simulation is the process where the experiment is done on the computer, including all the details of establishing physical models that are then verified from the experimental observations. These simulations became easily available only in past decade, due to the advent of super-fast computers. These simulations in the future, every serious experiment will have to be tested on computers, as the probability of success of such simulations is so high that simulations using state of the art codes. These simulation models are so vital that, in the future, every serious experiment will have to be tested on computers, as the probability of success becomes very high unless serious flaw exists in the physical models. The model used for this study has been developed in two decades, and is benchmarked by various experiments performed in prestigious national laboratories.

Fusion energy is one form of nuclear energy, released when the nuclei of hydrogen isotopes combine to form a heavier nucleus, i.e., helium. The amount of energy released per unit of mass is several million times larger than that obtained from a chemical or fossil-fuel energy source (http://en.wikipedia.org/wiki/Energy_density), for example, gasoline. Moreover, fusion does not produce greenhouse gases, or serious radioactive contamination.

The temperature, density, and confinement time threshold requirements needed to produce energy from fusion are incredibly high; especially when compared with those values that non-scientific individuals are familiar with. Fusion occurs widely in the universe, for example in stars, of which our sun is one with a core temperature of 60-100 million Degrees Fahrenheit and a material density beyond solid. On earth, fusion energy has been produced in a hydrogen bomb, demonstrating its potential to produce enormous amounts of (uncontrolled) energy. Today the fundamental challenge remains: that is, to produce fusion in a controlled manner, so that it may be productively used. Plasma science is a technical discipline that deals with fusion for such purposes; and the term “plasma” simply refers to a gas that has been ionized significantly.

The fuel used in fusion is abundantly available in the seawater, a gallon of which can produce the energy equivalent of three hundred gallons of gasoline. Thus, fusion fuel reserves are virtually unlimited and could last indefinitely into the distant future. Considering the challenges facing the earth at present, energy produced by fusion may be the only way that can provide long-term option, and potentially for saving the human race.

There is no doubt that the first laboratory device to produce a controlled fusion reaction will be worldwide headline news; the impact of a successful fusion concept would have an unprecedented impact on the economics of worldwide energy generation and technologies that may be derived using fusion.
Generating electricity commercially from fusion remains our long-term objective. Nevertheless, this will take several years of additional research and development. Therefore, we intend to pursue a lower risk development path involving the use of the Staged Z-pinch technology at a much lower output energy for the production of medical isotopes, specifically the radionuclide, Mo99. These heavier radionuclide isotopes are commonly used to diagnose and cure various diseases like cancer, tumors, and heart failure. At present these radionuclide are only produced in nuclear research reactors. There exists an ongoing acute shortage of Mo99 and similar isotopes; these isotopes are used in medical procedures to diagnose critical life or death health conditions.

**GLOSSARY**

**Ionization** - the physical process of converting an atom or molecule into an ion by adding or removing charged particles such as electrons or other ions.

**cylindrical** - relating to having the form or properties of a cylinder

**axis** - line around which a three-dimensional object rotates

**radionuclide isotopes** - Radionuclides are often referred to by chemists and physicists as radioactive isotopes or radioisotopes, and play an important part in the technologies that provide us with food, water and good health.

A radionuclide is an atom with an unstable nucleus, which is a nucleus characterized by excess energy which is available to be imparted either to a newly-created radiation particle within the nucleus, or else to an atomic electron (see internal conversion). The radionuclide, in this process, undergoes radioactive decay, and emits a gamma ray(s) and/or subatomic particles. These particles constitute ionizing radiation. Radionuclides may occur naturally, but can also be artificially produced.

**Mo99** – [molybdenum 99] – Technetium 99, processed from mo99, a radioisotope, used in body scans for cancer, heart disease, and kidney illness.