

Hydrogen Fusion Using a Farnsworth Fusor

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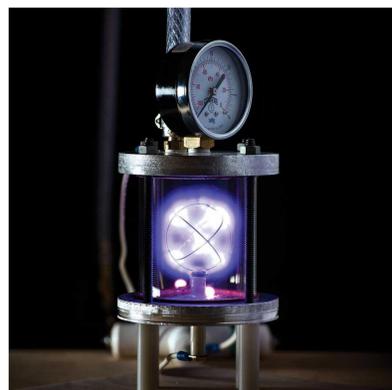
Abstract

Humankind has never had a more negative impact on its environment than it has had in the past 125 years. An energy revolution ignited by the use of fossil fuels has led to unprecedented amounts of harmful carbon dioxide in the Earth's atmosphere. As the world's population grows at an ever increasing rate and more and more people are demanding more and more energy, science is looked upon to come up with a solution for this burgeoning demand for energy. Its best answer, so far, is hydrogen fusion.

This poster will detail the attempt to build an elementary example of a nuclear fusion device. This device, in theory, would be capable of producing fusion reactions between two isotopes of the hydrogen atom. Although we were not able to complete construction of this device (known as a "fusor"), we learned an immense amount about hydrogen fusion as well as the time, resources, work, and research that must be invested into making even relatively simple fusion devices. These next few sections will share our experience in building a fusor as well as discuss the future plans for this project.

Building a "Star in a Jar"

We used a guide published in a magazine titled *Make* as the reference for building what would effectively produce the type of nuclear reaction that powers stars. Supplementing this guide, was a website titled "fusor.net" which provided us with in-depth technical and safety information to use while building and testing the device.



Goal of Construction

Source: http://makezineblog.files.wordpress.com/2013/10/m36_proj_spanglerfusor_opener4x3.jpg



Our Current Progress

Conclusion and Plans for The Future

This project was a great way to learn about nuclear and an incredible way to physically experience the work, effort, and ingenuity that is necessary for making it happen on Earth. As a team, we evolved from seeking a project that concerned energy research to soldering together electrical wire, machining solid aluminum flanges, building a rectifier out of PVC pipe and common electrical components, and, finally, hitting the difficulty of joining two very small diameter stainless-steel wires together using silver solder and a very limited experience with metallurgy. It truly pains us to say that this project is still in progress; although, we are extremely excited to finish and begin testing it next semester.

Our future plans for this device include observing its energy output through a variety of tests as well as manipulating its environment in the goal of optimizing its energy production. We will employ photospectroscopy (analysis of emitted light-waves), video analysis, electrical analyses, and radiation detection analysis as a means of determining the energy output of the device. These analyses will be applied to the device while it is in a variety of environments.

Environmental manipulations includes:

- Electrical input
- Vacuum level
- Internal gas composition
- Operating time (zero to two minutes)
- Inner-grid metal composition and structure

Using these various manipulations, we are confident that the device will produce very interesting results which will further our knowledge and curiosity surrounding hydrogen fusion.

Thank you for reading!

The Basics of Fusion

Hydrogen fusion occurs when two isotopes of the hydrogen atom (deuterium and tritium) are slammed together under immensely high pressures and temperatures (see Figure 1). Only two viable methods of producing this reaction on Earth are currently known: magnetic confinement and inertial confinement. The first method uses ionized hydrogen plasma that is circulated around a very large magnetized ring known as a "tokamak" (Connor, 2014). The second method uses the principle of electrical charge attraction to accelerate and slam atoms together and is much easier to replicate on a smaller and less expensive scale than magnetic confinement. It is for this reason that we chose to build and investigate the use of a Farnsworth fusor, a device which uses inertial confinement of ionized hydrogen, in producing fusion reactions that can take place on a desktop.

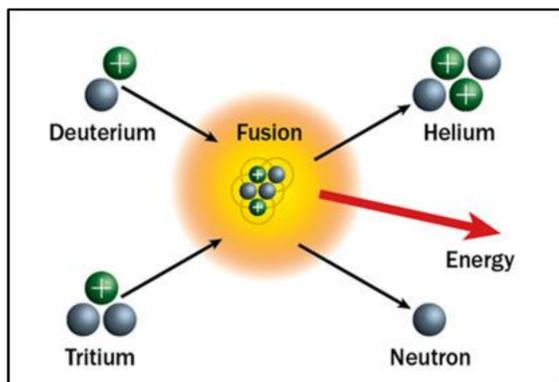


Figure 1: Hydrogen fusion

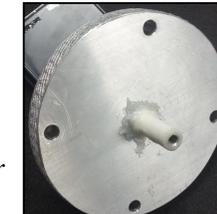
Source: <https://www.sciencenews.org/sites/default/files/17498>

The Path to Desktop Fusion

Step One: Machine Flanges from a Bar of Aluminum so the Device can Work Under a Vacuum

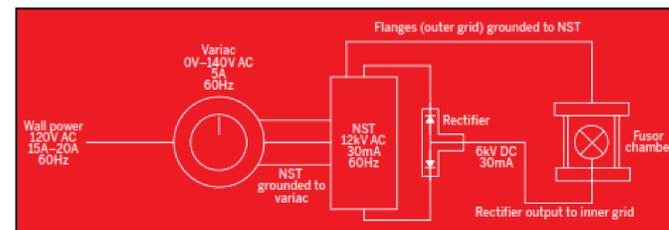


Left: Top flange with ports machined for vacuum supply and vacuum gauge.



Right: Bottom flange with sealed, insulated port installed and used for electricity feed.

Step Two: Make a Rectifier to Supply the Device with Direct Current Electricity



Upper Left: The constructed rectifier for converting alternating current (AC) to direct current (DC). Upper Right: Electrical diagram of powered fusor.

Upper Right Source: <http://makezine.com/projects/make-36-boards/nuclear-fusor/>

Step Three: Solder Together the Inner-Grid and Assemble the Fusor (status: in progress).



Left: Specialists at Make Magazine soldering (technically brazing) together the inner grid using MAAP gas and silver filler metal.

Source: <http://makezine.com/projects/make-36-boards/nuclear-fusor/>

References

Connor, S. (2014, February 13). The lasers fuelling hopes of unlimited, clean nuclear energy. *The Independent*. Retrieved from <http://www.independent.co.uk/news/science/the-lasers-fuelling-hopes-of-unlimited-clean-nuclear-energy-9124237.html>

<http://www.fusor.net/>

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Acknowledgements

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