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Lawrenceville Plasma Physics, Inc

High technology research, development and consulting in plasma physics, X-ray sources, and Focus Fusion

LPPFusion Report
June 22, 2018

Summary:

- **$1 Million (more or less) from Wefunder Equity Crowdfunding**
- **Lab upgrade completes first phase**
- **Beryllium, Boron: more cosmic connections with fusion**
- **Simulation Researcher Warwick Dumas visits lab**

$1 Million (more or less) from Wefunder Equity Crowdfunding

LPPFusion's Wefunder equity crowdfunding roared to a successful conclusion April 30, but we are still counting the money. With a huge influx of $191,000 in the final exciting day and another $90,000 in the rest of the final week, the campaign concluded with $1,031,000 in signed contracts from 451 investors. So far, Wefunder has collected $934,000 and passed along to LPPFusion $846,840 of this, after deducting a 4% commission. (Wefunder will also be getting a 3% commission in LPPFusion shares). Some of the collected money still needs additional paperwork. We don't know for certain that all of the $100,000 still to be sent by investors will actually be collected. But we do know that we have basically achieved our maximum goal of $1 million.

Thanks so much to all of you who invested and to all who spread the word to friends and colleagues! This was a collective effort, but special credit goes to LPPFusion Director of Communications Ivy Karamitsos, who wrote and produced the Wefunder videos; to Torulf Greek, who volunteered his time to create amazing animations for the videos; to LPPFusion Systems Administrator Jose Varela, who assisted on all aspects of the campaign; and to our social media volunteers: Mark Klapheke, Warwick Dumas, and Ignas Galvelis.

We welcome our new investors to the LPPFusion effort. All of you will soon be receiving our share certificates by email and, as promised, you will be listed on a special page on our website. We are setting up a list-serve that will allow you to communicate and network with each other and all LPPFusion investors.

We now have the resources to devote our full attention to preparing for our beryllium experiments, and the hydrogen-boron experiments that will follow. We of course will continue to raise capital from accredited investors around the world through our ongoing Regulation D share offering, but we will now be raising money for our expenses in 2019, not for this year, which is now fully covered.

Lab Upgrade Completes First Phase

As part of our extensive preparation for our planned experiments with beryllium electrodes, LPPFusion Research Physicist Dr. Syed Hassan has completed the first phase of several major upgrades to our laboratory. The phase involved moving our oscilloscopes, trigger-pulse generators, data computer and other critical electronic equipment into a shielded Faraday cage (Figure 1). A Faraday cage is an enclosure completely surrounded by metal conductors that can shield out radio-frequency electromagnetic waves.

Figure 1. Dr. Syed Hassan presses the trigger button to test connections on the newly-installed Faraday cage protecting the oscilloscopes, data computer and several instruments.

The cage is needed to shield the equipment from the powerful RF pulse that our FF-1 fusion device produces when it fires. Up to now, we have relied on the big Faraday cage of copper mesh that lines the walls, and ceiling of FF-1's experimental room (X-room), plus multiple layers of shielding on the cables in the main room where our oscilloscopes are located. Even with many of the signals carried out of the X-room by optical fibers (which can't pick up the RF noise) we still had noise problems with some of the instruments. The better performance we expect with the beryllium electrodes will lead to still more noise, so we needed to upgrade the RF shielding. With the new Faraday cage, we now expect a great reduction in the noise picked up by our instruments and the oscilloscopes that record the data.

Dr. Hassan and LPPFusion Chief Scientist Eric Lerner are also working on the other major upgrades needed before the beryllium experiments. This includes reinforcing the spark-gap switches to improve their reliability and to cut down on maintenance. It also includes installing the glove box and other safety equipment needed to handle the beryllium electrodes and the decaborane fuel. These preparations are expected to continue throughout the summer, with the new experiments currently planned to start in early September. While we know how eagerly everyone is anticipating these experiments, careful preparations, even if slow, are the best guarantee of success.

Beryllium and Boron:
More Cosmic Connections with Fusion

Our new planned experiments will be critically based on two particular elements—beryllium for our electrodes and boron, which, together with hydrogen, will be our aneutronic fuel. These two elements, not coincidentally, are also bound together in their origins, for all beryllium and most boron are produced deep in space by cosmic rays. Only lithium and deuterium, an isotope of hydrogen, share this origin. All other elements that have nuclei lighter than that of iron are produced by fusion reactions in stars. The heavier elements are produced when large stars explode as supernova.

Scientists agree that the light nuclei deuterium, lithium, beryllium and boron can't be produced in space by stars for a simple reason—they burn up by fusion reactions too quickly after they are formed. This is connected with their small mass and small number of electrical charges in two ways. First, their nuclei have less binding energy than helium, so reactions that produce helium release energy, and a smaller charge means it take less velocity and therefore lower temperature to force the nuclei together to undergo nuclear reactions.

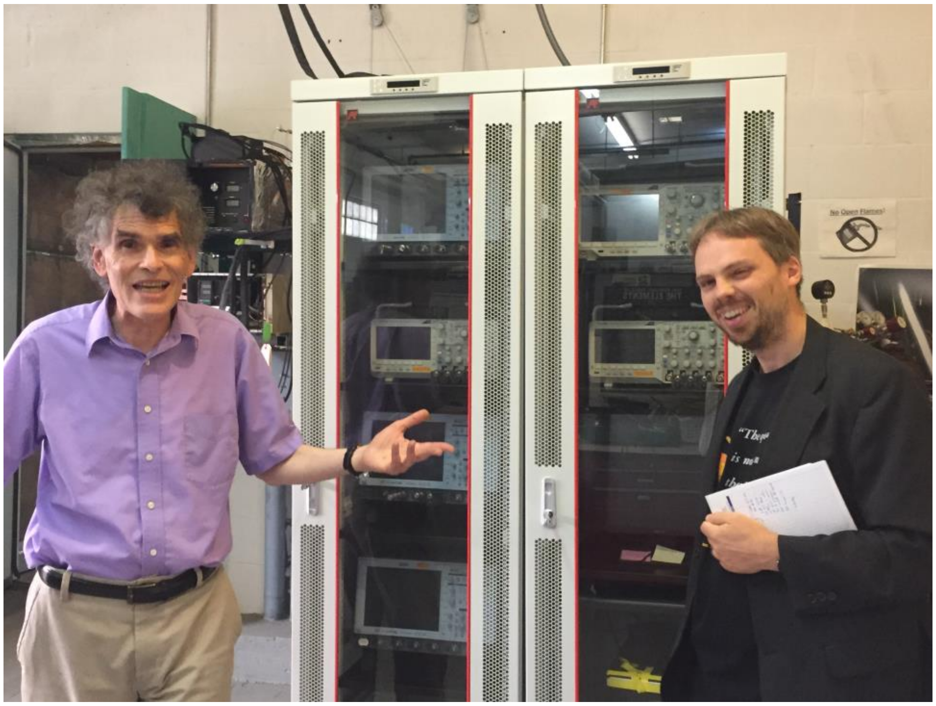
But these characteristics make boron an ideal fusion fuel—it burns fairly readily and produces no neutrons. Beryllium is desirable for us as an electrode material because its few electrons don't absorb many X-rays and because, as an impurity, it won't make much difference to the plasma.

The only reason we can use these materials is because they are produced by cosmic rays. Researchers are certain of this observationally because boron and beryllium are almost a million items more abundant in cosmic rays than in the solar system. From accelerator experiments we also know that when high-energy protons (tens of Mev to Gev) in cosmic rays smash into carbon, oxygen and nitrogen nuclei, they produce boron and beryllium. Carbon, oxygen and nitrogen, which are of course key components of all life, are the nuclear ashes left behind by fusion reactions. The energy for cosmic rays also comes from fusion reactions in stars, vastly concentrated by magnetic fields. So boron and beryllium could be viewed as the re-kindled ashes of stars.

In the next LPPFusion report, we'll explain how the abundance of boron and beryllium in stars can be used to test if the universe ever passed through a hot, dense stage—in other words if there ever was a Big Bang. Stay tuned!

Simulation Researcher Warwick Dumas Visits Lab

Simulation Researcher Dr. Warwick Dumas, who has been working for LPPFusion remotely from the UK paid a week-long working visit to the lab in June. Dr. Dumas has been developing an ambitious program to simulate the formation—and possible destruction—of filaments in the FF-1 device.



Dr. Dumas (right) and LPPFusion Chief Scientist Lerner share a few laughs in front of the new Faraday cage.

Dumas, Systems Administrator José Varela and Chief Information Officer Karamitsos savor some of Lerner's homemade Focus Fusion chocolate.