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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
April 24, 2018

Summary:

- **Wefunder Equity Crowdfunding Enters Final Week**
- **Filament Images Confirm LPPFusion Theory**
- **New Astrophysics Discoveries Link to Fusion Research**

Wefunder Equity Crowdfunding in Final Week

LPPFusion's Wefunder equity crowdfunding drive pounds into its final week, running fast. In the past week, the second-to-last, investors put $53,000 into the campaign, lifting the total to $742,000. This was more than the $45,000 raised in the second week of the campaign. If the last week of the campaign can match the first week, when $246,000 was raised, the campaign will come very close to reaching its full goal of $1 million dollars.

Advertising on Facebook and in New Scientist magazine has drawn hundreds of viewers to the Wefunder page, but more public awareness is needed. As part of this effort, LPPFusion President and Chief Scientist will participate in an Ask Me Anything session on Reddit at 8:00PM EDT Wednesday, April 25. (Go to https://www.reddit.com/r/IAmA/).

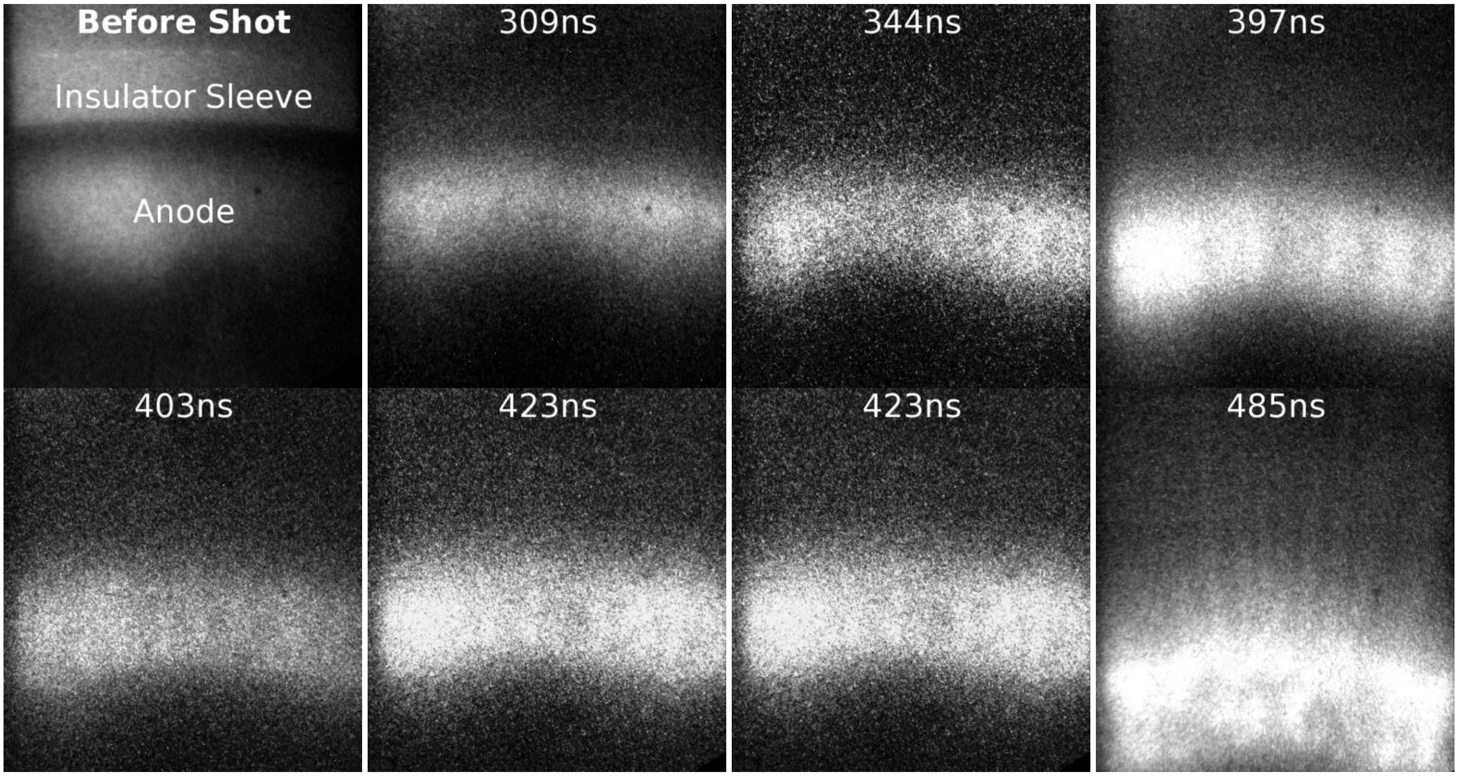
The LPPFusion team again urges all supporters to let everyone know about our campaign. This will be the last opportunity for quite a while for the ordinary US investor to invest in Focus Fusion. Non-US investors and US accredited investors will still have further investment opportunities, but after April 30 the minimum investment amount will return to $5,000, from the $1,000 minimum now available thorough Wefunder. So, if you have been intending to invest, now is the time.

Filament Images Confirm LPPFusion Theory

Since 2014, the LPPFusion research team has theorized that heavy metal impurities have limited fusion yields by disrupting the dense filaments that formed early in each shot of the FF-1 plasma focus device. Because the filaments are the first stage of compressing the hot plasma, disrupting them before the main compression phase that forms the plasmoid leads to lower final density and thus less fusion. However, while the team had plenty of indirect evidence for this theory, they did not have concrete proof that the filaments did in fact form and then dissipate.

But now analysis of ICCD photographic images taken of the early stages of the pulse demonstrate for the first time that the filaments do indeed form in FF-1 (as they do in other plasma focus devices) but that they then begin to expand and merge into each other. The filaments, seen coming off the anode near the end of the insulator, first form around 350 ns into the shot and are very distinct at 400 ns. But already at 500 ns are beginning to merge together. The tungsten impurities vaporized from the anode glow very brightly, outlining the filaments. But the tungsten ions also cause high resistance and rapid heating of the filaments, causing their expansion. (See video) By the end of the image sequence, the filaments are starting to merge together.

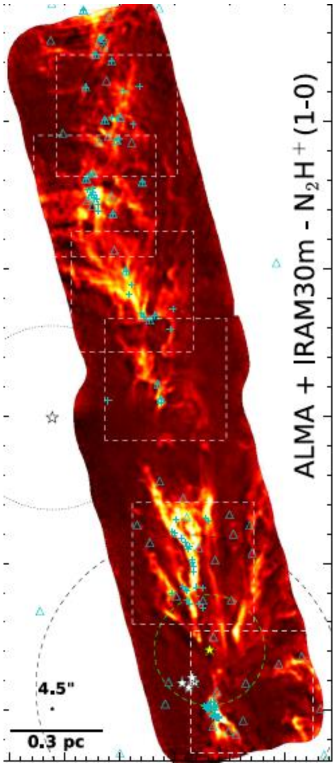
The new images provide confirmation of the LPPFusion theory, and thus build confidence that, without the heavy metal impurities, the filaments in the upcoming beryllium-electrode experiments will be preserved. In addition, the new set-up of the ICCD mirrors will let the team quickly monitor exactly what is happening at all stages of the pulse. This will allow them to better optimize conditions, getting to higher fusion yields faster.



This is sequence of ICCD photographs taken from similar shots of FF-1. The numbers on each frame show the time elapsed, in nanoseconds, since the start of the pulse. The region shown of the anode, close to the end of the insulator is a cm wide. The filaments (bright stripes) first form and become more distinct, then at the end of the sequence, begin to merge together, becoming destroyed. The bright regions near the lower end of the sheath are heavily contaminated with tungsten vaporized from the anode. Note in the last frame that the filaments still seem well-organized in the fainter upper regions, with less impurities, but are merging in the lower, brighter and more contaminated region. This shows the effect of impurities.

Filaments and Plasmoids in the Cosmos: News Astrophysics Discoveries Link to Fusion Research

Two new discoveries in astrophysics highlight the links between the key phenomena studied in the plasma focus and those that dominate the cosmos at large scales. First, the filaments that we are using in our fusion device also control the formation of structures in the universe. A new paper in the leading journal *Astronomy and Astrophysics* shows that a hierarchy of magnetized filaments-within-filaments leads to the formation of stars like our Sun. Physics Noble Laureate Hannes Alfven first hypothesized this process in 1972, and other researchers, including LPPFusion Chief Scientist Eric Lerner later elaborated on it.



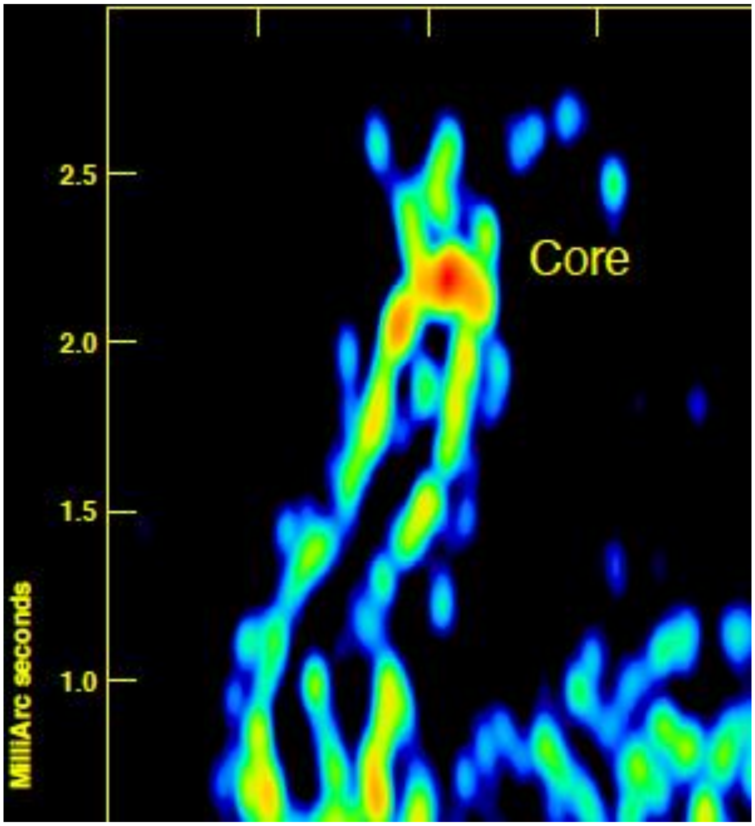
Filaments within filaments in the constellation Orion show how magnetic fields from vast electric current compress plasma to produce stars like our Sun. The scale of 0.3 pc is about 1 light-year.

A second important example came from new observations of a powerful active galactic nucleus (AGN). Quasars and AGN are generally supposed to derive their enormous power from a black hole. Back in 1986 Lerner published a theory (again an elaboration on one of Alfven's) that explained them as an electromagnetic phenomena, analogous to the plasmoid formation that occurs in a plasma focus device. In developing that theory, he found formulae that could predict how the plasma focus could be improved for fusion energy generation. These formulae led to LPPFusion's present fusion energy project. Now, over 30 years later, ultra high-resolution images of the nucleus of galaxy 3C84 have given strong, if partial, confirmation of Lerner's model.

In research published April 2 in Nature Astronomy and available online at Arxiv a large group of researchers using the RadioAstron space telescope together with ground-based radio telescopes showed that the jet of energy originating from the galaxy nucleus has a radius hundreds of times bigger than the hypothesized size of a black hole. The beam is about 0.06 light-year in radius and emerges from the nucleus as a cylinder, not a divergent cone. By contrast the hypothesized black hole is only 2.4x10^{-4} light years in radius.

In the 1986 paper, Lerner predicted that the radius of the emitting region of an AGN with the power of 3C84 would be around 0.03 light year in radius, just a factor of 2 smaller than the observed radius. In a plasma focus device, the equivalent emitting region of the ion and electron beams is only a few microns across.

The new observations are far from a complete confirmation of the theory as they are only of a single AGN. More observations of other AG and quasars are expected with the RadioAstron spacecraft. Its resolution, when used together with earth-based telescopes is equivalent to being able to read a book at a distance of 4,000 km.



A radio-telescope image of the core of galaxy 3C84 showing a hollow beam emitted from the core. The emitting core is hundreds of time bigger than a black hole, but just about the size predicted by Lerner's 1986 plasma theory.

If you want a very short summary of Lerner's new cosmology paper (in March, 2018 report) see this video.