Report March 5, 2025

Summary:

- **New Wefunder Campaign, Reg D Offering**
- **Progress Towards Boron Fusion: Finding the Cold Spots and Optimizing the Breakdown**
- **More Impossible Galaxies Show Big Bang Hypothesis is Impossible**
- **Study Group Videos Are Online**

New Wefunder and Reg D Offering

LPP Fusion has started a new crowdfunding campaign on Wefunder, open to all. We have also started a new Regulation offering, which is open to all accredited investors around the world. Details on investing are here. SEC regulations prohibit the description of the crowdfunding offering except on the crowdfunding site, so please follow the links for more information.

LPPFusion ended the StartEngine crowdfunding campaign as of December 13, 2024. We decided to end the StartEngine campaign early, with no results, because StartEngine unilaterally voided the promises they made to us about letting their 700,000 members know about our campaign. These promises included sending an email to their members when the campaign started and another one once we reached 100 investors on their platform. In addition, they blocked any update we proposed to send to those considering investments. Given this situation, which we clarified with them in phone calls and emails, we saw no possibility of being able to raise money or indeed of reaching out to their members at all.

In addition, because StartEngine imposed the exclusivity condition that no other fundraising effort can be run in parallel with theirs, LPPFusion was unable to run any PR or marketing elsewhere toward direct (Regulation D) investments in our vital R&D of fusion energy.

We don’t consider this a wasted effort. Our work on this campaign created a new, effective short video introduction and some short ads, all of which we are using for our new campaigns on Wefunder and with Reg D. Check us out!

Progress Towards Boron Fusion: Finding the Cold Spots

Since starting work with hydrogen boron fuel in November, the LPPFusion team has made considerable progress towards achieving fusion reactions with this ideal fuel. However, as usual, progress is slower than we expected.

The first problem that has slowed progress is the multiple cold spots in the device that block the flow of our fuel, decaborane gas, to the vacuum chamber where the electrodes are. As we noted in the last report, decaborane is a solid powder at room temperature and needs to be heated to emit enough vapor to fill the chamber. Like water vapor condensing on a cool surface, the decaborane vapor will condense on any cooler surfaces within the chamber. However, such cool spots can't be avoided just be turning up the heat. The Mylar insulation in the device must be kept cooler than 110C to avoid damage.

We knew that the cold spots were trapping or blocking the gas because we were using up 1 gram of powder for every 0.1 gram of gas that filled the chamber. But finding out where the cold spots were was tricky and time-consuming. Our first step towards solution was obtaining temperature tapes that we could attach in many different spots, a suggestion of thermal engineering contractor Shailesh Gupta. These temperature tapes showed multiple cold spots that we eliminated by improved insulation and relocating the thermocouples that controlled the heating tapes.

As the problem continued, we realized that we needed to monitored the powder in the sample jar, using a glass container instead of a metal one. However, glass containers are not normal parts of vacuum systems. LPP Fusion Mechanical Engineer Rudy Fritsch suggested a "sight glass" used in distilling operations (Rudy is an amateur distiller.) We also learned that our mesh filter was not fine enough to block tiny power particle from being swept out of the sample container so we order a one-micron filter. Unfortunate, holiday breaks pushed delivery of these items well into January.

While waiting for the parts, LPPFusion Research Scientist Syed Hassan acted to conserve our precious supply of pure boron-11 decaborane. Instead of using this $600/gm supply, Dr. Hassan found a $50/gram supplier of decaborane made from natural boron, which is a mix of the boron-11 and boron-10 isotopes. We felt that it was safe to use this cheaper product until we started to get fusion reaction. The reason for the far more expensive isotopically-pure decaborane is to avoid the reaction with B-10 that produces radioactive beryllium-7. But until we got fusion reactions, this concern was irrelevant.

With these improvements, we managed to fire our first shot with a full fill of 1.5 decaborane on Jan.24. We've been slowed since then by other blockages in thin pipes and valves, but we are tracking them down and solving them one by one.

Progress Towards Boron Fusion: Optimizing the Breakdown

Once we were able to resume firing with the full pressure of decaborane, we started to solve our second main problem—the breakdown of the decaborane. Breakdown is the process, at the very start of the pulse, when the high voltage strips the electrons off the atoms, converting the gas to a plasma and allowing the current to flow.

With decaborane, we saw from the first shots that the breakdown was difficult. We saw this from two lines of evidence. First, there were large oscillations in the voltage and the rate of change of the current (fig 1 a and b). These were much larger than those for good, high fusion yield shots with deuterium(fig 1c and 1 d.). We could tell that these were associated with the difficulty of breakdown because they were very similar to those with high-pressure deuterium—around 40 torr—and we knew from both theory and observation that deuterium breakdown gets more difficult with higher pressure.

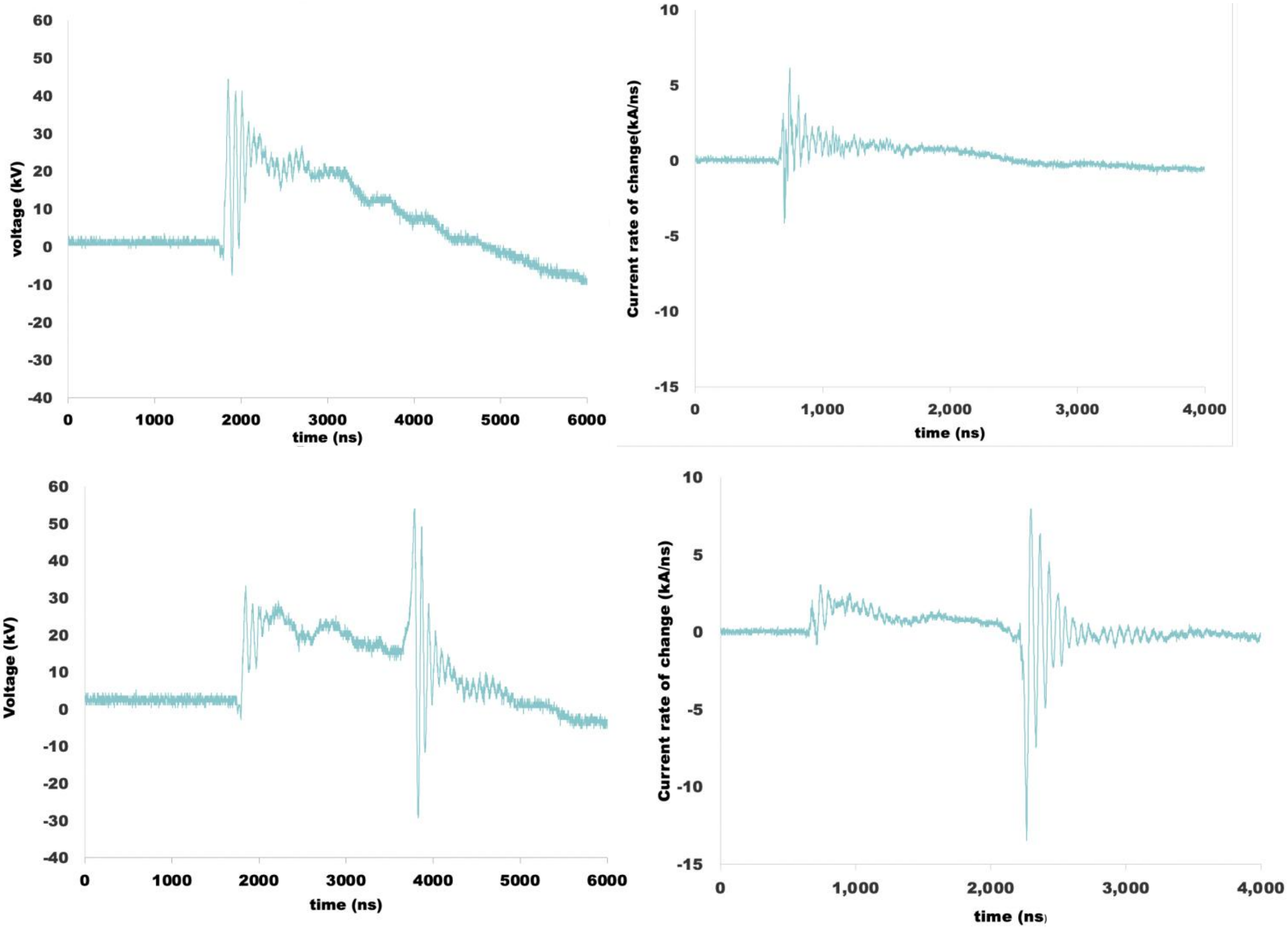

Figure 1. Oscillations early in the pulse indicate difficult breakdown which leads to no pinch (no large spikes late in the pulse). Top row is second shot with decaborane, voltage, left(a) and rate of change of current, right(b). Bottom row is voltage, right(c) and rate of change of current (d) of a fusion-producing shot with deuterium.

Second, we could observe the breakdown with trigger shots. In these shots, we used the 30-kA pulse from the circuit that send trigger pulses to the switches instead of the much large 1.8 MA current from the main bank. We saw that the breakdown was happening directly from the cathode to the anode, below the end of the insulator. That never leads to the thin sheaths of current that form filaments and drive the formation of plasmoids. Instead, the breakdown has to happen along the insulator, which is coated with a discontinuous layer of metal that channels the current (fig.2).

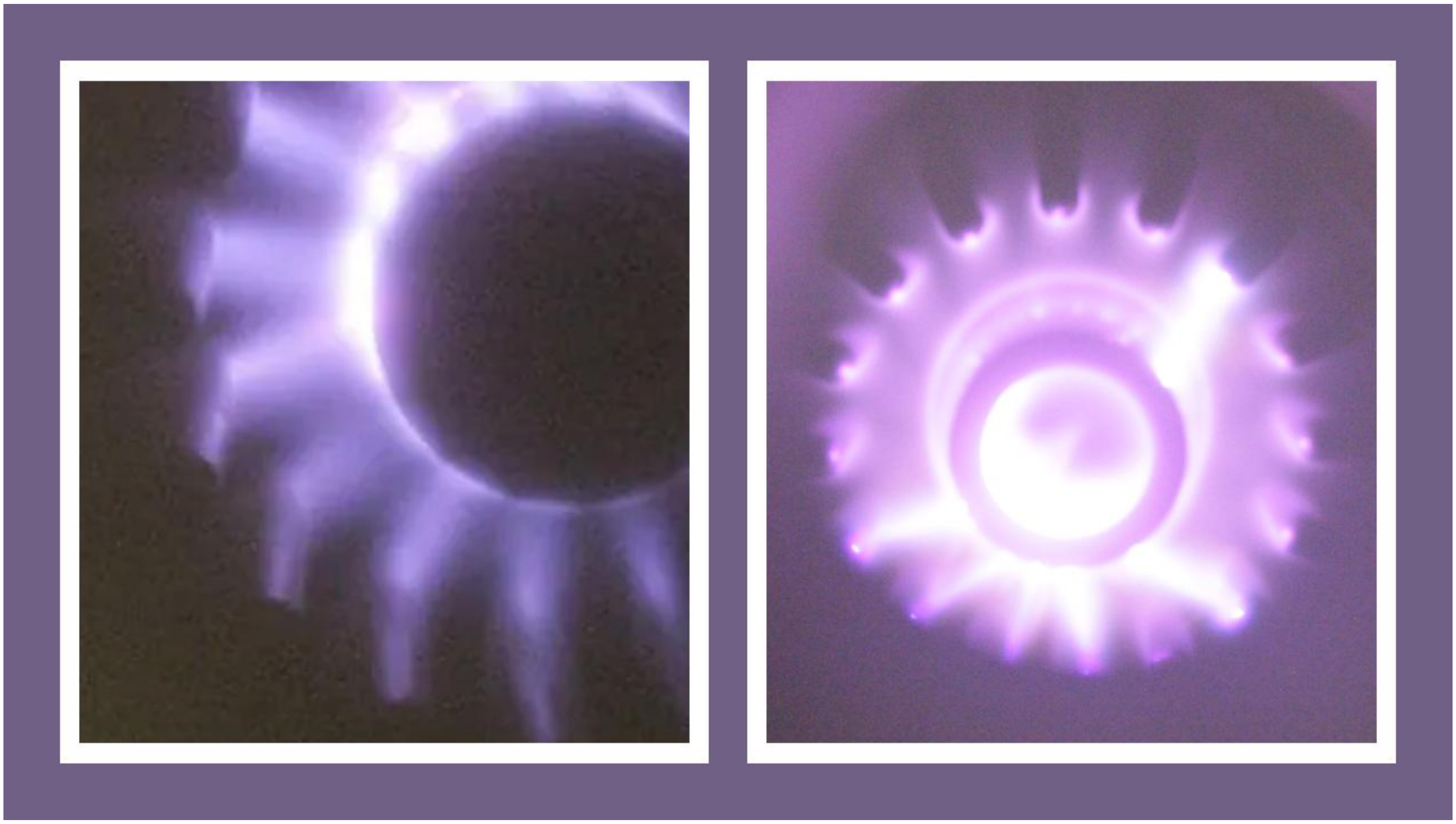

Figure 2. In a good breakdown as in the deuterium shot on left, current flows along the insulator (bright circle) and leaves the anode tip dark (black circle.) But in the poor breakdown we started with using decaborane, shown on right, the breakdown went from the outer vanes directly to the anode. The different colors reflect the different gases used. These are trigger shots with only 30 kA of current, not the 1.8 MA of the main shot.

After the first couple of shots, we wondered if part of the problem could be that the boron was depositing on the insulator and anode. Since boron is an insulator, it could cover up the metallic spots on the insulator, preventing breakdown there. To test the hypothesis, we went back to firing with deuterium. Sure enough, the first deuterium shot also had high oscillations and did not produce any fusion.

Fortunately, we found that the deuterium shots themselves could clean off the boron coating, leading to deuterium shots that had high fusion yield. This was a big relief because we had wondered for years how we would clean the boron deposits off. It turns out that simple deuterium does the trick.

Subsequent boron shots on Feb. 14 and Feb. 21 showed that the oscillations decreased after deuterium cleaning shots. Indeed, a combination of this cleaning and hydrogen mixes reduced the oscillations by 75% of the way to our minimum goals: the oscillation levels where deuterium produces fusion reactions. As seen in Fig 3, we are making rapid shot by shot progress toward as goal of 25 KV or less oscillations. While extrapolations are risky, we feel confident that we’ll reach fusion conditions soon.

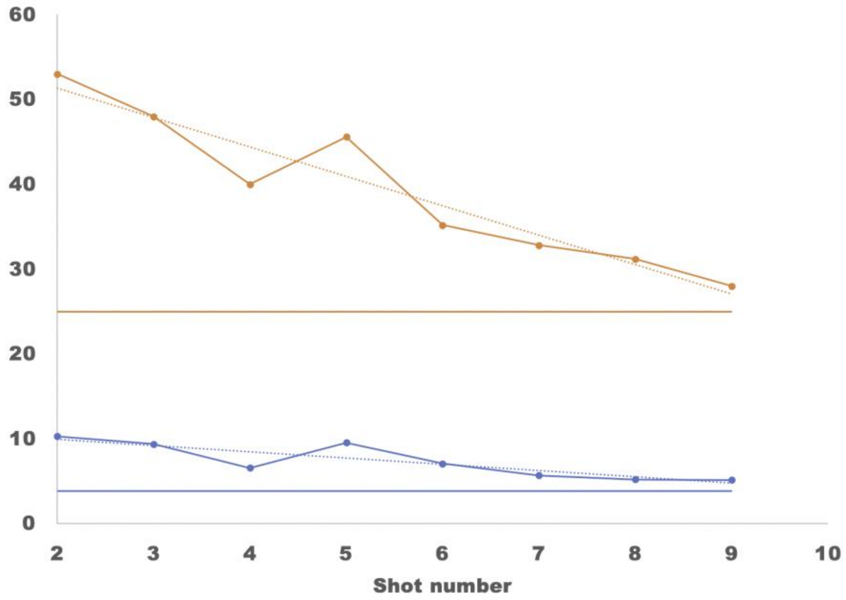

Fig 3. Oscillations are decreasing shot by shot, showing improving breakdown. The upper orange line shows the voltage oscillation amplitude in kV vs shot number. The lower, horizontal orange line is the level where we expect to get some fusion reactions. The upper blue line shows the rate of current change oscillations in kA/ns and the lower blue line is again the level where we expect to get some fusion reactions.

More Impossible Galaxies Show Big Bang Hypothesis is Impossible

This is the last in a series of updates catching up with the many discoveries in 2024 that we've not had time to report on. For reasons of time, we'll have to leave a few out, but we need to clear the decks for the biggest discoveries of 2025!

If the universe is expanding, a strange optical illusion is predicted to exist. Galaxies (or any other objects) in expanding space do not continue to look smaller and smaller with increasing distance. Beyond a certain point, they should start looking larger and larger. (This is because their light is supposed to have left them when they were closer to us.) This is in sharp contrast to ordinary, non-expanding space, where objects look smaller in proportion to their distance.

Since 2014, LPPFusion Chief Scientist Eric Lerner, along with colleagues Riccardo Scarpa and Renato Falomo, has been pointing out in published papers and popular articles that the observations of galaxy sizes from the Hubble Space Telescope and, more recently, the JWST completely contradict the prediction of the expanding universe—Big Bang hypothesis and completely confirm the prediction of the non-expanding hypothesis.

Big Bang theorists have long tried to paper over these blatantly wrong predictions by arguing that distant galaxies, which are observed as they were billions of years ago, were intrinsically tiny, thus just neatly compensating for the illusory expansions that is not observed. However, this idea that these tiny galaxies grew up over time into today's huge ones is countered by many other sets of observational data.

That contradiction grew a lot sharper in 2024 with the observation of more and more "impossible galaxies"—galaxies that would be physically impossible if they were as tiny as Big Bang calculations predict.

There is a simple way to measure the physical radius of a galaxy that is entirely independent of measuring the size of its image as recorded by a telescope. This is based on the equations of Newton's law of gravity that allows the radius of an object like a galaxy to be calculated from its mass and its velocity of rotation.

The velocity of rotation of distant galaxies can be measured from their spectra—the plot of light intensity against the wavelength of the light observed. Peaks in the spectra are spread out by the Doppler shift. This causes light from parts of the galaxy rotating away from us to be shifted to slightly longer wavelength and light from parts that are rotating towards us to be shifted to slightly shorter wavelengths. So, the width of the peaks measures the rotation velocity, entirely independently of any assumption about universal expansion.

The mass can be measured by the brightness of light of the galaxies—especially the light from the gas in the galaxies. This gives a minimum mass, since of course the galaxies also contain stars and dust as well as gas. Together these measurements yield a measurement of the minimum radius that the galaxy must have. This radius can then be compared with the radius calculated from the size of the galaxy's image. This latter calculation depends on the expansion or non-expansion assumption. So, comparing the two measurements becomes another test for expansion.

When this was done for a set of 13 galaxies at redshifts from 3 to 4.7, based on data published in June 2024, Lerner found that the radii of the galaxies as determined from brightness and spectra compared with radii determined from images using the non-expanding hypothesis, the two measurements were about the same. The ratio for the whole sample was 1.22 +/- 0.26, consistent with the same results for both methods.

However, when the same calculation was done using the expanding universe hypothesis, the ratio for the whole sample was 11+/- 3.5. In other words, the radii from the measurements of mass and velocity were on average more than **ten times larger** than those for the expanding universe hypothesis. This is physically impossible—each galaxy can have only one radius, not two!

To see the impossibility in another way, we can turn the equations around and assume that the expanding universe hypothesis is right. We can then use the observed velocity and the assumed (expanding universe formula) radius to calculate the mass—this is called the "dynamic mass". We can then compare that with the observed gas mass, calculated from the brightness. In all cases the gas mass is much larger than the dynamic mass, which is supposed to include gas stars, any hypothetical dark mater, and so on. It's physically impossible for part of the mass to be larger than the whole mass. This is illustrated in Fig. 4.

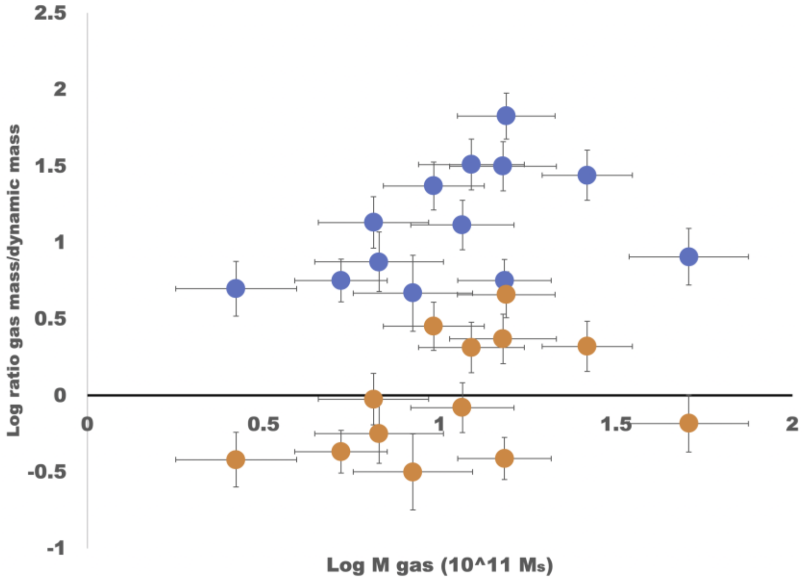

Figure 4. The blue dots show the logarithm of the ratio of the observed gas mass (independent of expansion or non-expansion) to the dynamic mass as calculated assuming expansion. On this log scale, it's clear that all the galaxies are "impossible" with gas masses 3 to almost 100 times larger than dynamic masses. The crosses show the mean error in the measurements. The orange dots show the observed gas mas compared with dynamic mass as calculated with the non-expansion hypothesis. The dots cluster around the horizontal axis, with a ratio of 1.

The physical impossibility of the EU radius scaling is also evident in other data sets. For example, Guia, Pauar and Muergh point out that the number of stars per unit volume implied for galaxies at z=4-8 extend as high as $10^8/pc^3$, a factor of 100 above the highest densities observed locally and a factor of 30 above that which theoretically would lead to runaway collisions of the stars with each other. These estimates of course use expanding universe formula for converting angular into linear radii. Since density estimates are reduced by a factor of approximately $(1+z)^{4.5}$ for non-expanding universe assumptions, maximum numbers of stars per unit volume are reduced by at least a factor of 1400, eliminating star densities that exceed those in the local universe and of course the physically impossible ones implied with EU.

Study Group Videos Are Online

Two more videos are online from the Evolution of Physics study group series. These are the first two that examine the revolution in physics starting at the end of the 19th century. Planck and the Quantum is here and X-rays and Radioactivity is here.