Report June 20, 2024

Summary:

- **LPPFusion ITER Presentation is Online**
- **Pushing to Higher Pressures**

LPPFusion ITER Presentation is Online

The presentation by LPPFusion's Chief Scientist Eric Lerner to the historic Inaugural Private Public Fusion Workshop at the ITER (International Tokamak Experimental Reactor) site in France is now online at LPPFusion's You Tube channel. This workshop was the first global fusion conference that drew together all the leading private fusion companies with public and university fusion projects. The ITER staff is still planning to post the presentation videos on ITER's own site, but in the meantime has sent the video to us to post ourselves.

In the presentation, Lerner explained that with our approach of imitating, rather than fighting, natural plasma behavior we've achieved the highest temperatures of any fusion experiment and the highest ratios of fusion energy out to device energy in (wall-plug efficiency) of any fusion company for an expenditure of only $10 million. The tentative observation of record 400 keV (4.4 billion degrees K) electron temperatures first reported in this presentation has now been confirmed in our lab (update on that below).

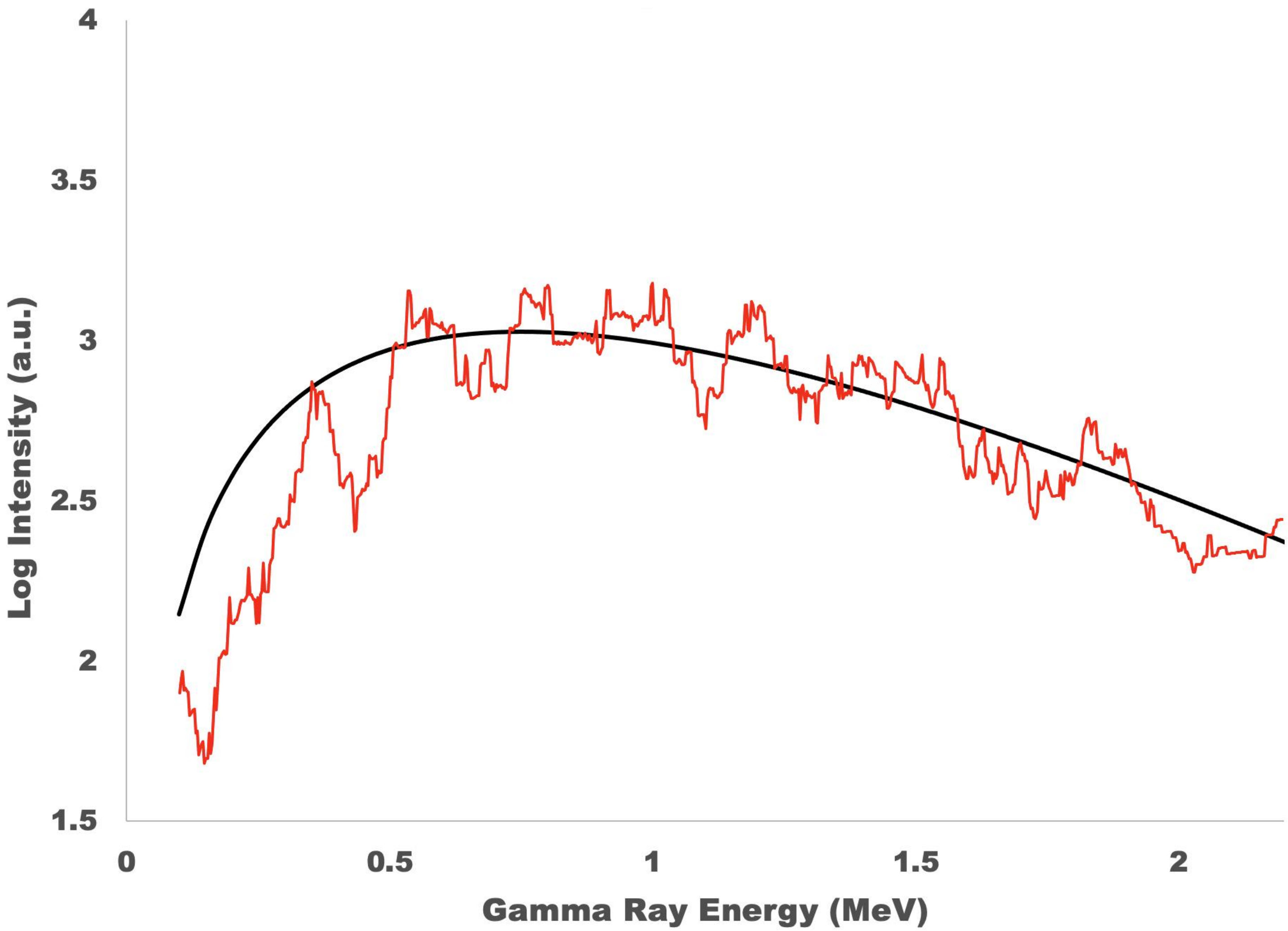
To keep our work rolling, though, we need a lot more of what you, dear supporter, can provide: money! We've still got $34,000 to go to get to our next goal of $200,000 by July 1. If you have already invested, please circulate the link to our new presentation video to convince others to invest. If you haven't invested yet—watch the new video (only 15 minutes) and then please invest what you can. Fusion needs you!

Pushing to Higher Pressures

Despite various delays, the LPPFusion team is winding up the control shots and preparing for the next set of tests using our new beryllium electrodes. Our remaining task is to optimize the function of the device at higher fill pressures (more gas in the tank). This involves overcoming the more difficult breakdown-- the transition to a plasma where electrons flow freely--at these high pressures. This week, we achieved record fusion yields for a fill pressure of more than 26 torr, but this still has not matched our best-ever fusion yield, obtained at only 18 torr. We expect to do better as we complete optimization.

To get some idea of what slows us down (other than the too-small staff!) in the past week the team fixed problems with both the pumps and the ultra-fast ICCD camera. It turned out that the scroll pump had too much moisture in it and the ICCD was not sufficiently protected against the huge electromagnetic pulse (EMP—a giant radio wave) that our device produces. These sound like easy problems, but finding them and solving them took many hours of work, limiting the number of shots we can take with the machine.

Our work has now fully confirmed the tentative observation, described in the last report, of extremely hot, thermalized electrons. Many shots have now shown the same 400-450 keV Maxwellian spectra which indicate a confined plasma. Some have even more exact fits to the theoretical curve (see Figure 1). Yes, we know it looks a bit fake—but trust us, no AI touched this graph. It's real data! Some other shots have shown two components—an ultra-hot 400 keV one and a just plain hot 100 keV component. Since that "cooler" one is over 1 billion K it's not exactly Antarctica. We'll have more on this unfolding story as we observe and interpret it.



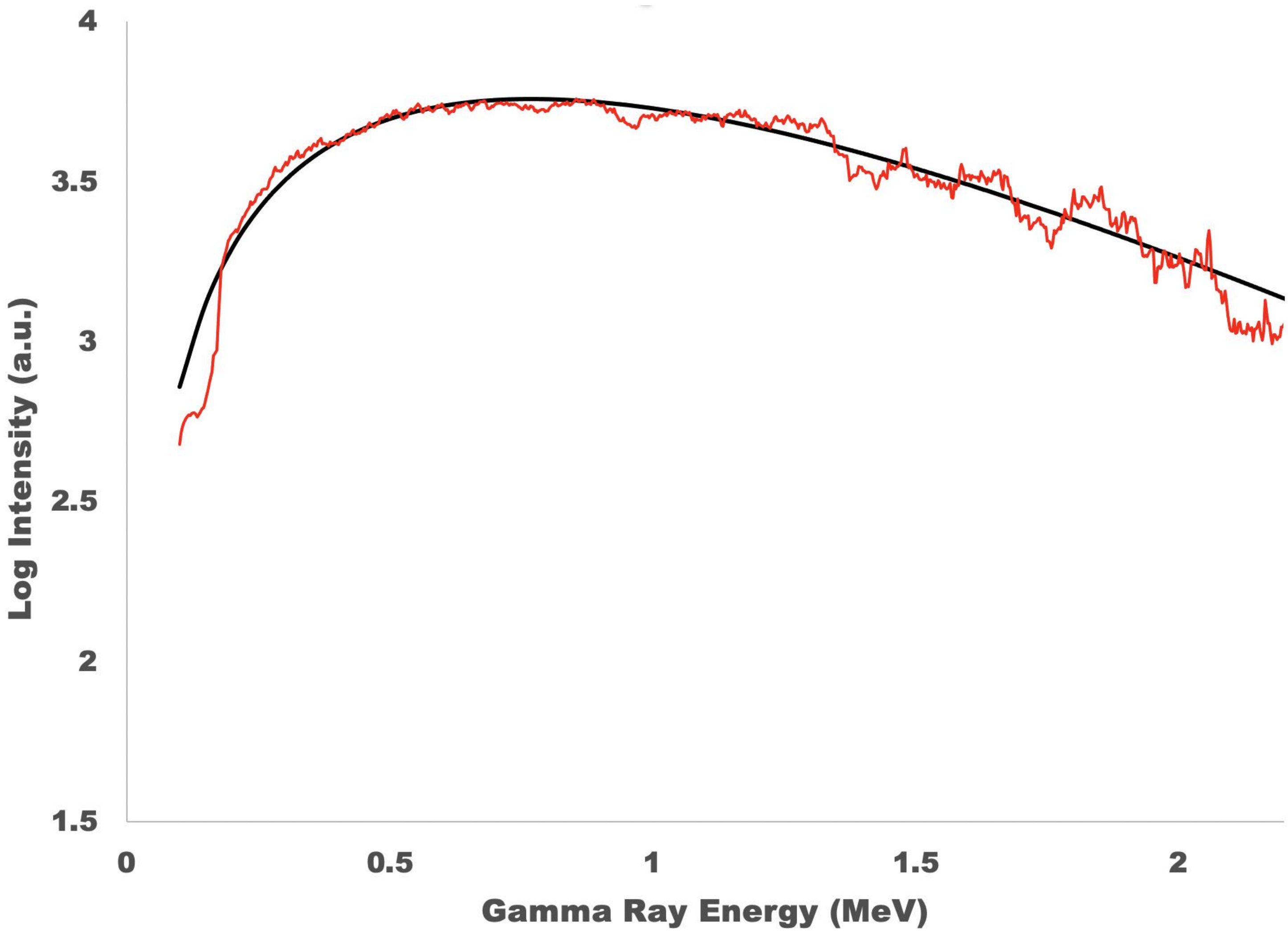


Figure 1. top) Gamma ray spectrum from the two shots we reported on to the ITER confence. The red line is the data averaged over 100 keV and the black line is the spectrum predicted from a 420 keV(4.6 billion K) Maxwellian (random) plasma. The black line is a good fit to the data. Bottom) The gamma rays from June 14th shot 4. Again the black line is the best fit to a Maxwellian plasma. This is not just a good fit, but a great fit! The slight deviation at the low energy end on the left is entirely acounted for by a small amount of absorption as the x-rays pass through our quartz window on the vaccum chamber.