Report June 4, 2024

Summary:

- **Gamma Ray Spectrometer Measures the Beam**
- **Solar Eclipse, Infrastructure and Allocation of Resources**

Gamma Ray Spectrometer Measures the Beam

Back in February, we reported on a new, extremely economical gamma-ray spectrometer we will use to help measure fusion reactions in our upcoming experiments with hydrogen-boron fuel (pB11). While the main reactions produce NO radioactive material, rare side reactions do produce tiny amounts of the short-lived radioactive isotope carbon-11, which has a half-life of 20 minutes. (It decays away entirely overnight, so produces no radioactive waste.) We showed that the gamma-ray spectrometer had plenty of sensitivity to detect this carbon-11 and thus indirectly measure how much fusion our boron reactions produce once we start running those tests.

In the meantime, we've started our control experiments with tungsten electrodes, which are going well and will be reported when completed. During these tests we decided to try out the gamma ray spectrometer as an additional measurement of the ion beam that our FF-2B produces. The ion beam that the tiny plasmoid accelerates is a measure of how much energy is concentrated in the plasmoid where fusion occurs. In a fusion generator, the ion beam will be the main source of output energy and can be converted directly into electricity in a circuit.

When the ion beam strikes the steel plate at the bottom of the drift tube on our vacuum chamber (the drift tube is there for measuring the ion beam), the ions produce a tiny burst of gamma rays. These come not from any nuclear reactions, but from the deceleration of the ions (positively charged deuterium nuclei) as they hit the electrons in the steel plate. All accelerated charges emit electromagnetic waves and gamma-rays are high-energy electromagnetic waves.

LPPFusion Chief Scientist Eric Lerner did not expect much when he first placed the gamma ray spectrometer next to the bottom steel plate. The gamma ray spectrometer collects data every half second. This was suitable for measuring radioactive decay, but the gamma-ray pulse from the ion beam takes only 100 ns (billionths of a second). It seemed likely it would overwhelm the maximum counting rate of the spectrometer, which counts individual gamma-rays.

However, in fact the spectrometer (a device a third the size of a cell phone) did great, producing detailed spectra from the ion beams. By using standard physics formula, Lerner could calculate from this gamma-ray spectrum the spectrum of the ion beam that produced them (that is the energy in the beam plotted against the energy of each individual ion.) (see images below). This data can be correlated with and checked against four other electrically based instruments that also measure the ion beam, giving us far more accurate and reliable measurements.

This excellent instrument (free endorsement—it's a Radiacode 102 detector) cost less than $300 yet provides the same data as a laboratory gamma-ray spectrometer that costs $25,000 or more. That's because it is a mass-produced consumer item, while the laboratory spectrometers are produced by the dozen, at most.

Why do consumers want gamma-ray spectrometers? A glance at the web shows that people want them to prepare for surviving a nuclear war—searching out pockets of radiation-free food and shelter. As a side-effect of this prepping, fusion researchers get a bargain.

Better yet, LPPFusion's research will go a long way to making the nuclear-war-preppers' worries history. With fusion generators everywhere, all uses for uranium, including both fission energy and nuclear bombs, could be eliminated, uranium mines locked up tight and nuclear weapons destroyed. With fossil fuels gone, a lot of the motivations for war would disappear as well. So, preppers' desires to survive nuclear wars will indirectly help to ensure there never will be one that anyone needs to survive (which in most places would not be possible, spectrometer or no spectrometer.)

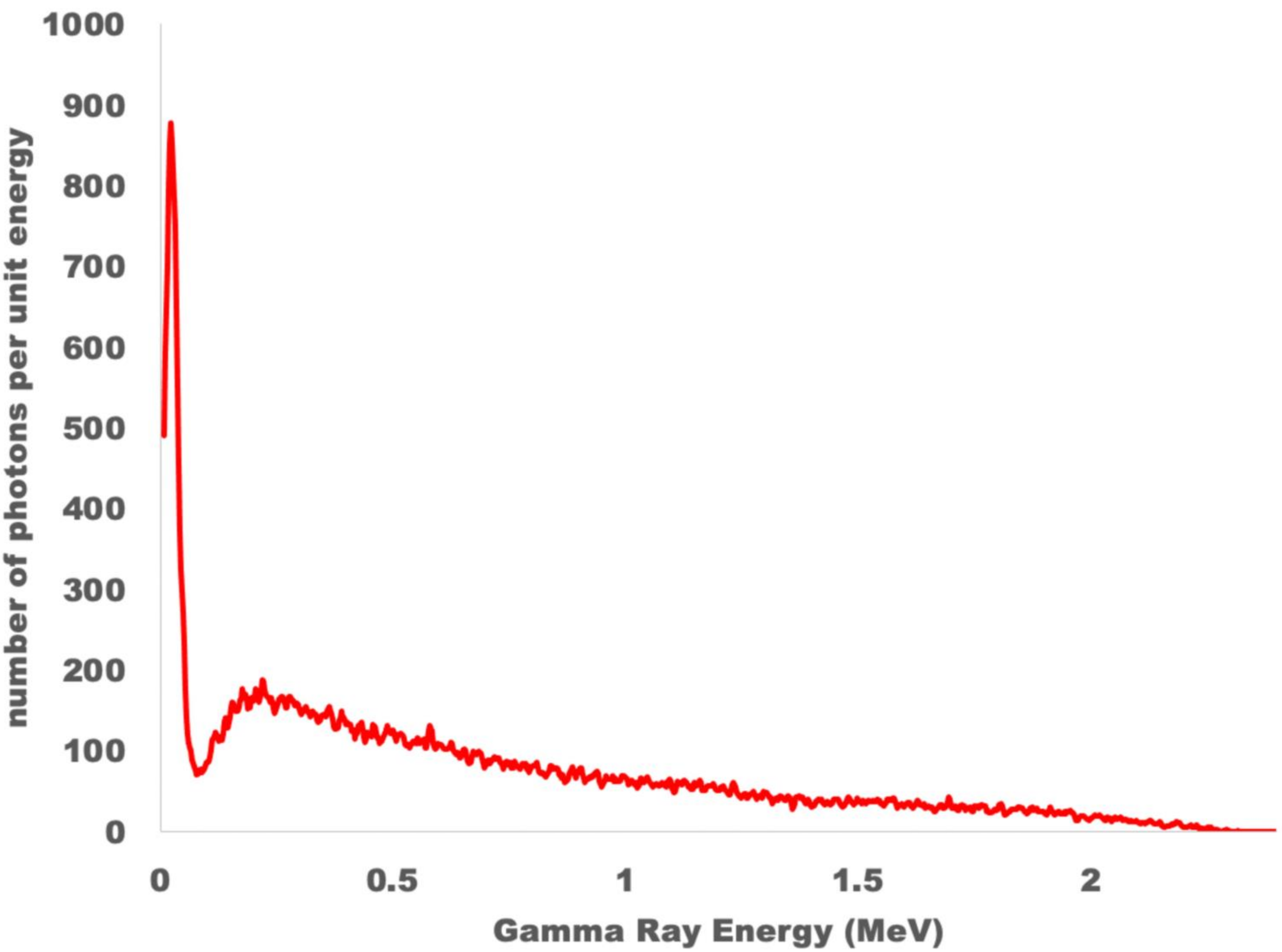

Figure 1. Gamma ray spectrum from ion beam of shot 2, April 12. Most photons are low energy.

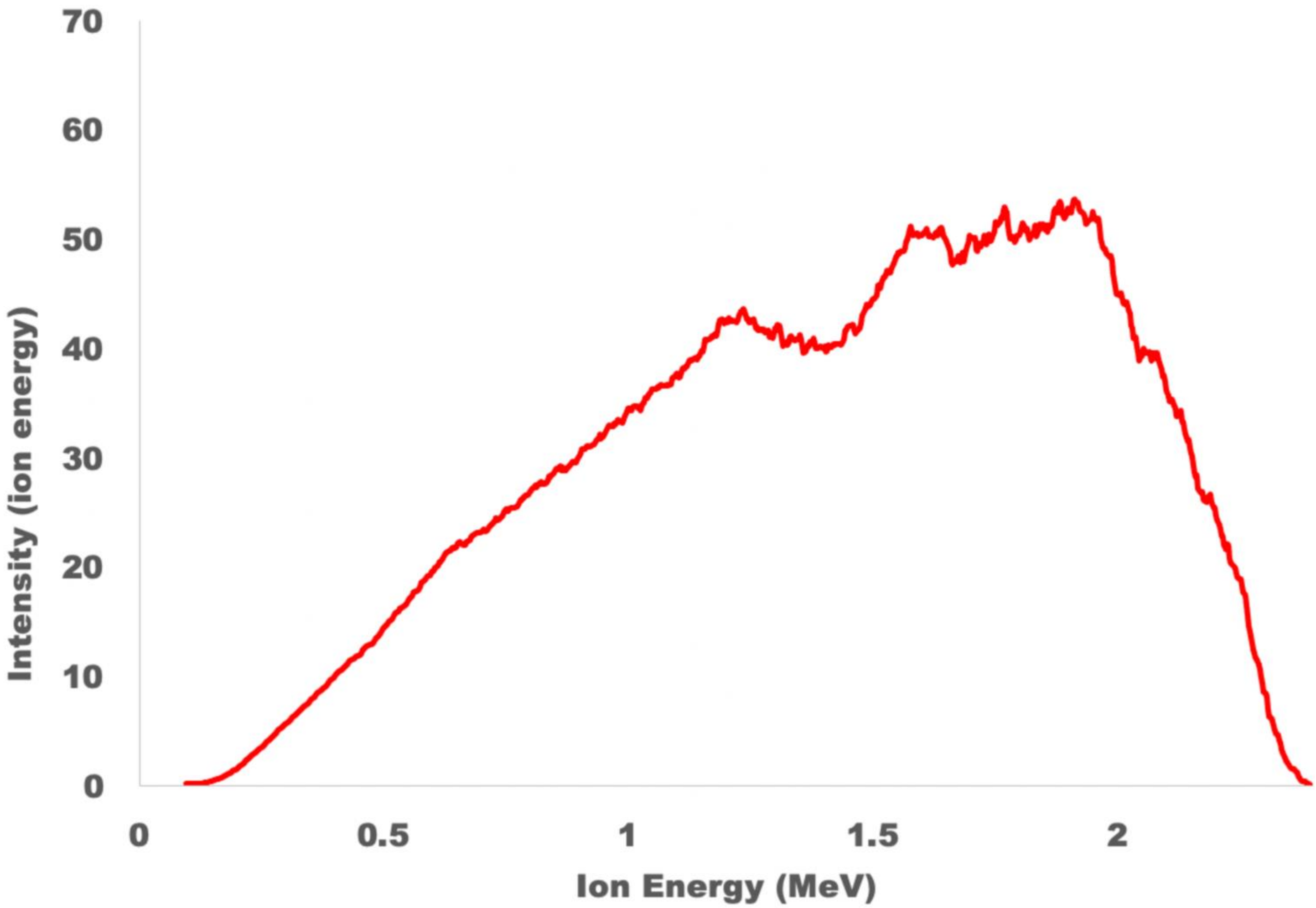

Figure 2. Energy spectrum of ion beam. Most of the energy is above 1 MeV because each ion has more energy. The spectrum looks close to LPPFusion theoretical predictions.

Solar Eclipse, Infrastructure and Allocation of Resources

As we previously reported, LPPFusion Chief Scientist Eric Lerner and CIO and Director of Communication Ivy Karamitsos traveled to Mexico to see the total solar eclipse. Our view of the eclipse was terrific. But our trip getting there and back was…something else. There are some relevant lessons here for fusion energy, so we'll share our (somewhat long but I hope entertaining) travel adventures in this update.

We'd decided to go to Mazatlán Mexico to get the best chance of good weather. The chance of clouds was only 20%, among the lowest chances for the eclipse path. Mazatlán is a big resort town on the Pacific, so accommodation was easy and maybe we could get a dip in the ocean as well. By the time we bought our tickets, months in advance, American Airlines had already jacked up prices sky-high, but that was not surprising.

To make the 6:00 AM flight from Newark to Dallas, we stayed up all night. The plane loaded on time, pulled 100 yards from the gate and stopped. The pilot announced that one of the two generators on board (providing electric power for the plane) was not working. We would have to wait for a gate to open, return, get a mechanic to fix the generator. One would have thought that perhaps such a vital part was checked before loading passengers on the plane, but no. We departed two hours late.

That was enough to miss our connecting flight from Dallas to Mazatlán and no other flight could get us there in time for the eclipse. So, we rerouted to Torreon, some 300 miles from Mazatlán. OK, we could get there by ground. But when we arrived, well, it was almost the eclipse and no rental cars, no trains, no busses could take us to Mazatlán. A brave airport cabbie stepped forward and offered to take us. While Gustavo spoke no English and we almost no Spanish, with Google Translate we got along fine and took off into the Sierra Madres. We admired the terrain as it passed from barren desert to forest.

Four hours later, with our trip nearly done, traffic came to a stop. The news told Gustavo that in the one-tube tunnel up ahead a tanker truck had had a collision and exploded. We were on the only highway to Mazatlán. The only alternative was a narrow road, nicknamed, “Path of the Devil” which hairpin-turned every 100 yards through the mountains with a cliff on the roadside. Gustavo vetoed this as “peligroso” and we hardily agreed.

A glance at the weather map showed that we were near the clearest skies in the area for the eclipse the next day, and the centerline of the totality ran by coincidence along the road. So, resigned to spending the night in the cab, we expected to view the event from the highway come morning. None of us recommend this form of accommodation, which provided a second sleepless night, and gave us renewed empathy for the 150,000 Americans who live in their cars. However, the night sky was very dark and splattered with a thousand times as many stars as are visible from home in NJ. Gustavo's unshakeable good humor also helped.

The next morning, we decided to look for breakfast. We left the highway and resourceful Gustavo quickly found a group of eclipse observers, a few families of friends living both in the US and Mexico and, fortunately for us, all bilingual. After admiring their hilltop spot for observing, we ended up at their beautiful weekend home in the valley where they set a few more plates for us for a great breakfast. Seeing the surroundings, we decided to stay and observe the eclipse from there. It was as awe-inspiring as expected (I, Eric, had seen this eclipse's cyclical counterpart 54 years earlier and this was Ivy’s first totality) It was also great fun to see among new-found friends.

Figure 3. The eastern sky darkens as totality approaches over the Sierra Madres ringing the valley.

Figure 4. As totality ends and the sun's bright photosphere blazes through a lunar valley, huge pink prominences soar into the pearly white corona. (Image with 600mm telephoto lens by Lerner.) This is close to what we viewed through binoculars--except that they were safely downed before totality ended.

We soon had to hit the road again to get to our reservation in Mazatlán (and our flight the next day from there back home.) But, after a few minutes on the road, the trip went into re-runs—traffic stopped, another tunnel blocked by another accident. None of us had any desire to spend hours more in the cab, so Gustavo contacted a friend at the Torreon airport, Alex, who rapidly found us a flight from there back to Dallas and a later connection to Newark. Gustavo turned the car around in a flash, while Ivy located accommodations for us back in Torreon to finally sleep before the next day's flight.

After all three of us got refreshing sleeps in real beds, Gustavo got us to the airport and we said hearty farewells. And went back into re-runs. After we boarded the American Airlines aircraft, but before we pulled from the gate, the pilot announced that the plane had a blown tire and we should await repairs back in the airport. Unfortunately, the airport lacked such an "unexpected" item as a spare tire and given the delays in getting one from another airport by ground transport, our flight was postponed to the next morning. Alex again rescheduled us, Ivy found another place to stay and a day later, we flew back to Dallas and from there to Newark without further incident.

Figure 5. The three eclipseateers--Eric, Ivy and superhero cabbie Gustavo, at Torreon airport.

So, we saw an awe-inspiring total eclipse of the sun from Mexico, but getting there and back involved 50% delayed flights, two blocked tunnels and a night in a taxicab. **Why did this happen and what does this have to do with fusion energy anyway?**

The simple fact that the generator failure on our first flight from Newark was not discovered until the pilots tested it after the plane had taxied from the gate was a big indicator that American Airlines was not allowing enough time for routine maintenance—which would have caught the failure before the plane was OK'd for boarding. Similarly, American Airline's lack of a single spare tire at the Torreon airport indicated not enough inventory was being kept on hand.

Sure enough, three days after our return on April 10, the Allied Pilots Association, the pilot's union at American Airlines, emailed members voicing alarm over "fewer routine aircraft inspections and shorter test flights on planes following major maintenance work, a significant spike in safety- and maintenance-related problems…and that the airline has increased the time between routine inspections and ended overnight maintenance checks." So, our flight delays were not our bad luck, but a consequence of American Airline's cutting back maintenance system-wide.

Nor was this perilous re-allocation of resources limited to American. Three weeks earlier, the Federal Aviation Administration announced that it "is increasing oversight of United Airlines to ensure the carrier's compliance with safety regulations, following a series of safety incidents." These in-air incidents included a flaming engine, a fuel leak and a tire falling off. Unlike our American incidents they were not even caught before take-off, possibly indicating that the pilots too were under management pressure to cut corners on time devoted to safety checks.

Why this epidemic of gross corporate irresponsibility at the two largest (by number of flights) airlines in the United States? **Why are both airlines cutting the time and money devoted to maintaining the aircraft on which so many lives depend?** It does not take the skills of Sherlock Holmes or even Inspector Clouseau to solve this mystery.

These airlines are not paying for essential maintenance because they are spending their money on another big item—debt payments. American owes banks over $25 billion and pays $1.5 billion a year just in interest. That is half of the airline's operating income and would cover a lot of maintenance! And why does American Airline have $25 billion in debt despite getting a big piece of the $54 billion US government bailout of the airlines in 2020? Why did it and the other airlines even need the bailout and not have reserves to cover unexpected emergencies, like people and businesses are supposed to have?

The answer here is that American, United and the other airlines paid $45 billion to their shareholders in the preceding decade in buy-backs of their own stock and dividends—96% of all the cash they accumulated that profitable decade. Saving for a rainy (or sick) day was not for them. Over half this windfall flowed to the richest 1% of Americans, who own the majority of all stocks, including the airlines', and more than $7 billion flowed to just a few hundred billionaires, who now own about 1/6 of the stock market.

So, the money the airlines should have kept in reserve had gone to the rich. The money they should be spending on maintenance now goes to interest payments, which are rapidly rising with higher interest rates. The debt service swells the profits of international banks, whose soaring stocks again are majority-owned by less than 1% of the population. That's why our planes were late.

The story is just the same as to why we hit two blocked tunnels out of two tries to get to Mazatlán. According to a recent report, Mexico spends **less than half what it needs to on infrastructure.** For one thing, it has not built the water purification plants needed to make its drinking water safe—tourists and residents alike are warned against tap water. But the biggest short fall is on the roads, where spending is only 25% of needs, a gap of some $20 billion a year. No wonder a major supply artery (almost all the traffic on the road with us to Mazatlán was trucks) has only single-tube tunnels that can be shut down with no re-routing possible.

Again, where is that money going? Mexico spends $80 billion a year on debt service, more than enough to make up for the entire infrastructure deficit. In Mexico's case the debt was incurred mainly to build up the countries' increasingly expensive production of petroleum. While petroleum now represents only 7% of Mexico's exports, it provides almost 80% of government revenues. Like the US, Mexico imposes only very light taxes on its wealthy.

So, our trip—and those of hundreds of thousands or millions of others—became a series of delays, detours, and, potentially, hazards, because of the way resources were allocated away from the construction and maintenance of infrastructure and towards welfare for the wealthiest. Decisions made on the one hand, by the successive top managements of major private airlines, and on the other, by successive governments of Mexico, both resulted in **tens of billions of dollars NOT being spent on the safety of and convenience of the many, but on the incomes of the few.**

In a near-future update, we'll report on ideas that others have proposed to change some of these big allocation decisions and how that can speed the transition toward fusion energy. But right now, I'm connecting these big allocations of resources with the small allocations of resources that you do yourself. When you decide how to allocate whatever money you've put aside for investment you make a decision in part on the probability that you will get more money back than you put in. That's easy to understand. But how resources are allocated, as our trip example shows, have real-world consequences way beyond the immediate money-in, money-out calculation.

So, if you decide, to take an example, that Bitcoin is on a tear and you can make some quick money, there's one real world result, and maybe you'll be right. But if you take that same money here to Wefunder and put it into LPPFusion, there's a different outcome. You may not get money back as quickly, but **you'll be bringing closer the day when you—and billions of others—are saving tens of thousands of dollars a year in energy costs, and the day we have a cleaner and safer fusion-powered world.**

We've had some extra expenses lately—$20,000 for our two new anodes (one spare)—so we need more money coming in to keep up our pace in the lab. If you're having any doubt about where to allocate your next investment, I hope you'll think hard about allocating it here.

If you are in a position to allocate a lot, we have a special perk. **The first person to invest $10,000 or more can have the anode that we use named after them**—and that's how we'll refer to it publicly. If two people give $5,000 or more each before that, then they'll have the anode named after them jointly, like the AmyJack anode..or really, anything you mutually choose as a name. Let's see how fast we can name that anode!