Special Report

Neutrinos, Press Embargos & Let's Talk about FTL

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Abstract

The Embargo Watch blog has revealed an interesting aspect of how the recent news of faster-than-light neutrinos was released, namely that information had been issued to the main-stream media news outlets before even the rumours started to spread on the blogs. Since the announcement of the OPERA result there have been numerous theory papers written about the Faster Than Light neutrinos and posted to arXiv and even viXra. For October 15, 2011, the CERN theory group have organised a three hour seminar to discuss various theories. The rule of engagement is that nobody is allowed to talk about the result being wrong. They just have to imagine that it has been robustly confirmed and consider how they would explain it.

Key Words: neutrino, press embargo, CERN, OPERA, FTL.

October 7, 2011: Embargoes and Neutrinos

The Embargo Watch blog has revealed an interesting aspect of how the recent news of faster-than-light neutrinos was released, namely that information had been issued to the main-stream media news outlets before even the rumours started to spread on the blogs. Their report includes a statement by the CERN press officer James Gillies detailing how he thinks the news broke but it leaves out some important details. It is interesting to look back at what did happen because news of other discoveries may emerge in a similar way in the future, so for the record here is the timeline as I witnessed it.

12th September – A seminar was scheduled at CERN for 16th September with the title "Seminar DG". I saw it posted on indico and I added it to the viXra event calendar. There was no indication of what it was about, but as we now know CNRS had asked CERN if they could report their results there. CERN does not operate OPERA, it just provides the neutrino beam.

13th September – According to Embargo Watch journalists were briefed about the results at about this time and asked not to publish yet.

15th September – An anonymous commenter reported on Resanaances that a 6.1 sigma effect was about to be reported by CERN but the seminar had been cancelled. I saw the comment and checked my link to the "seminar DG" to find that it had indeed disappeared. I posted a note on an earlier Seminar Watch post and twitter but was not sure if the rumour was genuine.

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16th September – Anonymous posted comments on Resonaances, Not Even Wrong and Vixra to say that the report would be about faster than light neutrinos at OPERA and that the seminar had been rescheduled. I added a link to the new seminar to the Calendar.

19th September – Dorigo posted a report about the findings on Quantum Diaries Survivor. Posts quickly followed on viXra and The Reference Frame and other blogs. Dorigo then withdrew the post under pressure from his emplyer.

22nd September – Another Italian physicist gave an interview about it to an Italian paper. According to Gillies this is when CERN briefed some journalists with the intention that the news should be published the next day. Reuters and some others published immediately.

23rd September - An e-print appeared in arXiv in the morning and the news was widely reported in the media. The seminar was held later that day. The official press release was issued etc.

What do we learn from this? Firstly, a week is too long to contain a rumour about particle physics and if the rumour starts in Italy then it is far too long. If they had stuck to the original schedule the information would have emerged from the seminar as planned. Briefing the press and then delaying the seminar was not good. The original intention was to let the main stream media prepare the story before the blogs, but the result was that the news leaked onto the blogs while the press were under an agreement to stay silent, what a mess.

When Dorigo posted they should not have forced him to remove it. Other bloggers already knew what the news was and by all accounts it was being discussed widely by physicists. I for one was ready to post more at that time anyway.

The CERN press office and the DG give the strong impression that they do not like bloggers that they don't have control over. As freelance bloggers we often get information in advance and contrary to what some people think we don't always post it. They need to stop working against us if they want that to continue.

October 9, 2011: Let's talk about FTL

Since the announcement of the OPERA result there have been numerous theory papers written about the Faster Than Light neutrinos and posted to arXiv and even viXra. For next Friday the CERN theory group have organised a three hour seminar to discuss various theories. The rule of engagement is that nobody is allowed to talk about the result being wrong. They just have to imagine that it has been robustly confirmed and consider how they would explain it. It is a great idea and a pity that they are too shy to webcast it.

In any such discussion I think the first thing to remember is that the measurement was a purely classical one so you have to first address the classical (non-quantum) implications. This can go two ways. Either the Lorentz transforms are (locally) valid or not. In the experiment, protons were fired at a fixed target to generate pions and kaons that decay to provide a beam of neutrinos. If we want to keep the principles of special relativity intact in

our explanation then we have to face the fact that the experiment can be transformed to one where a fast-moving target is smashed into stationary protons as seen by someone moving in the reference frame of the protons. This is enough of a Lorentz boost to transform the neutrino worldlines so that they would become anti-neutrinos that began life at the OPERA detector and headed towards CERN to meet the pions. This means they would have to anticipate the experiment so causality is dramatically violated. You can't escape this result if you want to keep the Lorentz transformations. It does not matter whether the neutrinos are acting like classical tachyons with imaginary mass or if they are passing through a stargate buried underground that teleports them closer to the detector. The fact is that if Lorentz invariance holds then you can use the experiment to send information back in time. Some imaginative people may be able to dream up theories in which time-travel is acceptable due to branching timelines or whatever, but you might as well believe in Dr Who.

The second alternative is to consider violations of Lorentz invariance and this is what most theorists would do. It remains true that the size of the violations is large and classical in nature. This is not some subtle quantum gravity effect that only reveals itself at the Plank scale. It has to be something that is only hidden because of the difficulty is detecting neutrinos. Lorentz violation justifies the headlines that "Einstein was wrong" but not just at scales where spacetime structure is expected to break down. This is being seen at velocity scales accessible to a modest particle accelerator.

The measurements tell us that the superluminal velocity of neutrinos does not vary much with energy. They don't seem to approach the speed of light as the energy increases as classical tachyons would. In fact the lack of dispersion observed suggests a fixed speed for neutrinos at least over the range of energies produced in the experiment. Other observations of cosmic neutrinos tells us that much lower energy neutrinos seem to travel at the speed of light. You can consider variations on the possible behavior but I think it is difficult to escape one of two possible conclusions. Either the speed of light a few kilometers underground where the neutrinos passed is faster than the speed of light above ground, or there is a second fixed speed everywhere that high energy neutrinos adhere to.

In the first case you could drill a deep hole and send down an atomic clock, when you bring it back up you will find that time has passed more quickly. This would have to be a much bigger effect than the known GR effects. I can't see how such an effect would not have been seen in some other observation so I wont consider it further.

The remaining possibility is that there are two (or more) constant speeds everywhere in nature. This is not something you can attribute to violations of Lorentz invariance. It simply implies that Lorentz invariance is completely wrong, but wait. Einstein replaced special relativity with general relativity where the spacetime metric is just a dynamical field associated with gravity. In GR the Lorentz transformation is just a subset of a more general transformation that locally preserves the metric. Suppose there were two metric fields that both transform according to the rules of general relativity but one of them is only coupled to neutrinos and other weakly interacting matter. This I think is the best hope for a classical theory that could explain the superluminal neutrinos without causality violations.

However, with two metrics on spacetime you can combine them to define a preferred reference frame. E.g you can multiply one metric by the inverse of the other and construct the

eigenvectors of the result to define vector fields that define a stationary frame. Effectively you have created an aether theory, but at least one where the aether filed is dynamical and nearly invisible. I think this is the least radical way to explain the OPERA result if it stands up.

What about the extra dimensional theories that some people are getting excited about? They don't escape the classical arguments I have given and I suspect that these arguments can be made more robust if someone believes the OPERA result strongly enough to try it. You will either have to accept strong causality violations or an aether field that determines the frame for a second fixed speed. Any such arguments will make assumptions but violating those assumptions would require a paradigm shift to something so radical that we can't really anticipate it.

Of course the much simpler explanation is that the experiment has neglected some systematic error, but that is too boring.

References

1. http://blog.vixra.org/2011/10/07/embargoes-and-neutrinos/

2. http://blog.vixra.org/2011/10/09/lets-talk-about-ftl/