

# A null experiment shows that superluminal group velocity is not sensitive to Earth's absolute motion

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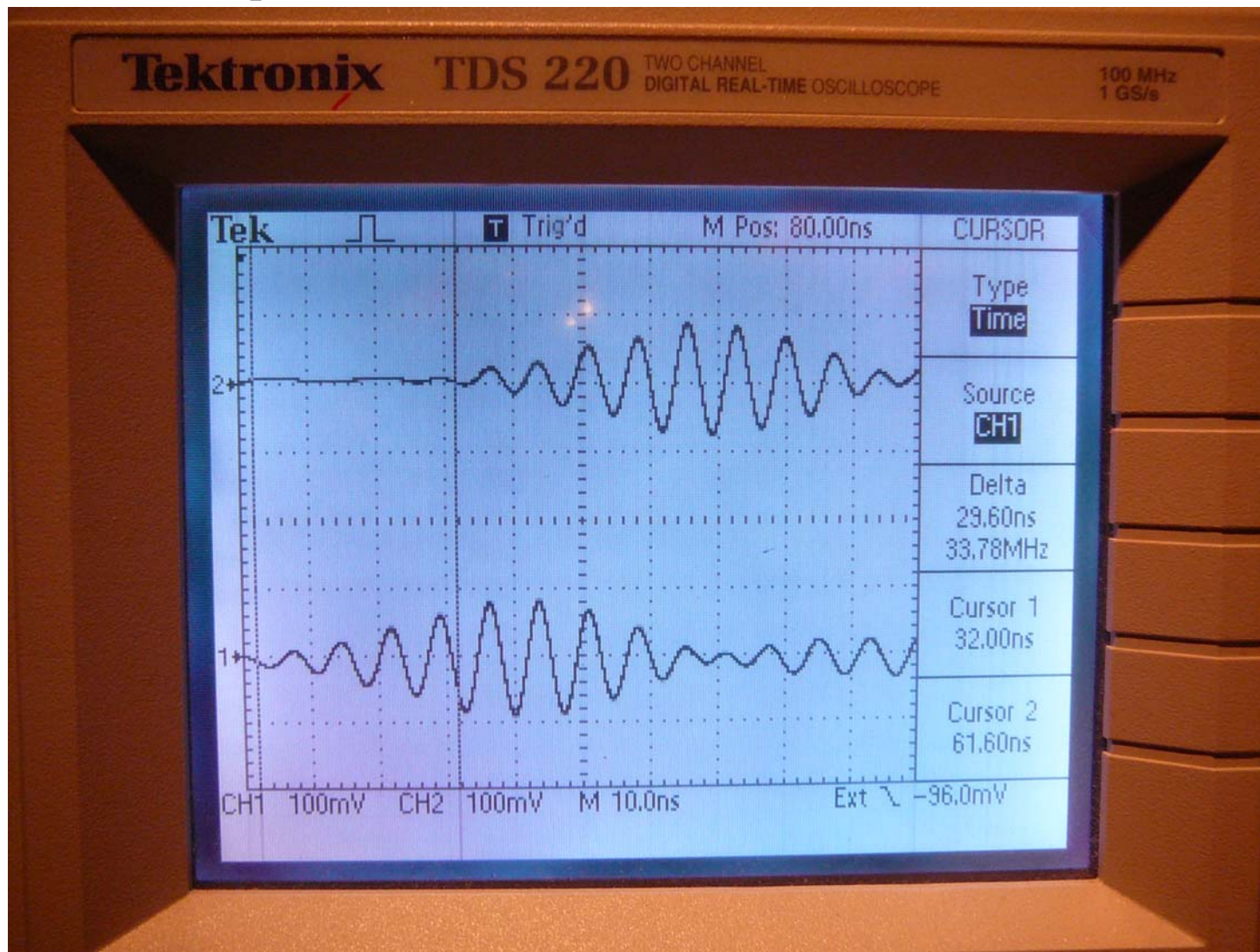
- A possible method for testing if superluminal group velocity associated with tunneling photons is a real superluminal energy flow is to measure its preferred frame effects. We test one-way superluminal velocity defined by coordinate time rescaling\* caused by a ghost condensate [1].
- Our null measurements show that preferred frame effects do not exist down to an absolute Earth velocity of  $62 \pm 426$  km/s and  $0 \pm 135$  km/s relative to a CMB velocity of 369 km/s.
- In Lorentz invariant theories, causal superluminal propagation in one reference frame is acausal in other frames.
- But Lorentz-violating theories have a preferred frame in which causal evolution is defined and superluminal propagation becomes causal in all reference frames.
- Our two-channel experiment uses two-meter wavelength photons tunneling through two water-tank barriers in each channel. Our measured timing resolution is about 3 ps.

[1] D. E. Kaplan and R. Sundrum, "A Symmetry for the Cosmological Constant",  
[http://arxiv.org/PS\\_cache/hep-th/pdf/0505/0505265v2.pdf](http://arxiv.org/PS_cache/hep-th/pdf/0505/0505265v2.pdf)

\* Integrated Detector Systems, <http://www.integrateddetectors.com>

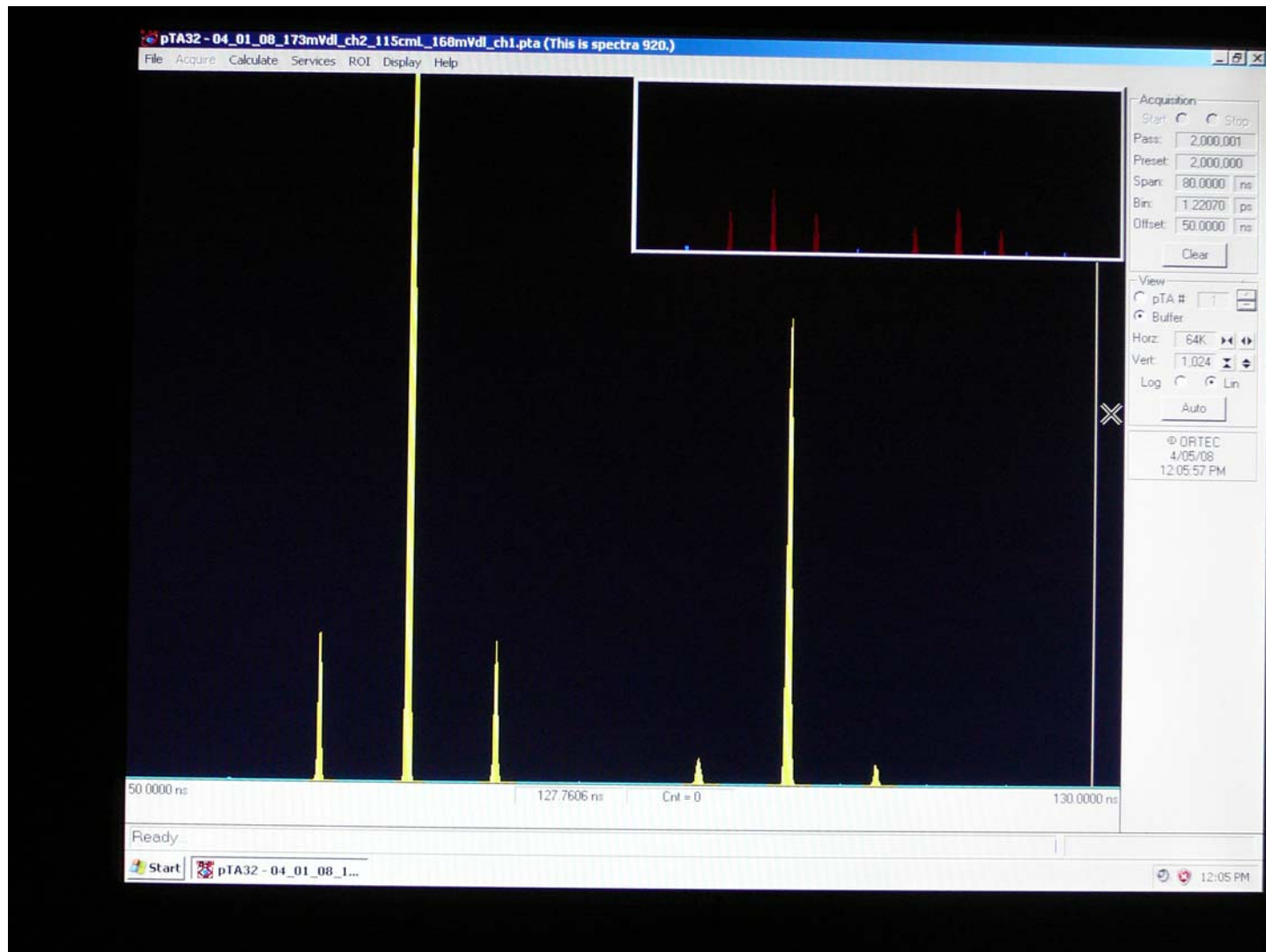


# Null Ghost Experiment



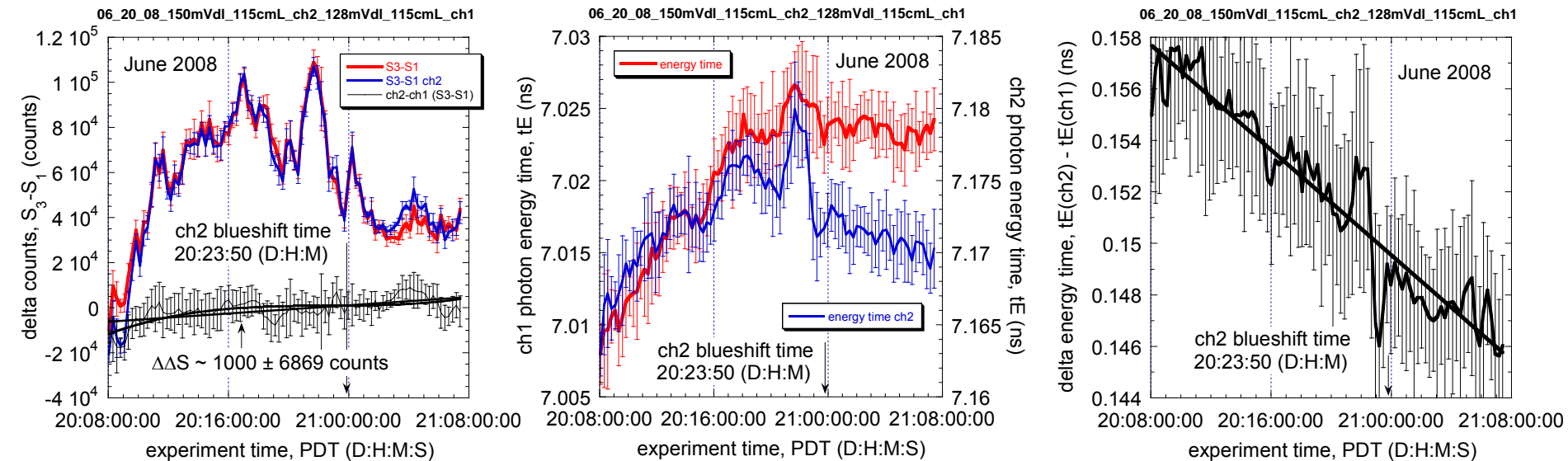
- The channel-1 wavepacket proceeds the channel-2 wavepacket by 29.6 ns.
- The channel-1 water tanks have been removed to verify channel-2 wavepacket reflection.

# Null Ghost Experiment



- For a 2 April 2008 spectrum, channel-1 contains 947K counts out of 2M start counts.
- The channel-2 spectrum contains 199K counts because most wavepackets are reflected.

# Null Ghost Experiment



- Delta counts ( $S_3 - S_1$ ) have a smaller standard deviation than wavepacket peaking time due to the large number of counts ( $S_2$ ) in the central peak in each wavepacket.
- Delta counts is calibrated in both channels to a wavepacket peaking time of 120 counts/ps.
- 1000 Delta delta-counts represents an 8.3 ps positive oscillation in wavepacket peaking time.
- An 8.3 ps positive oscillation in the one-way group velocity of light restricts Earth's absolute velocity to  $62 \pm 426$  km/s assuming a 40 ns average wavepacket peaking time.
- The measured one-way velocity direction does not line up with the channel-2 blueshift time.
- The delta energy time [ $tE(\text{ch2}) - tE(\text{ch1})$ ] standard deviation 24 hr mean value is 3.14 ps.
- This gives an absolute Earth velocity of  $0 \pm 135$  km/s where  $(3.14/8.6)(369) = 135$ .
- An absolute velocity of 369 km/s would cause an +8.6 ps oscillation in delta energy time.

# Null Ghost Experiment

- A ghost-condensate could produce a Higgs effect and define a preferred time everywhere in space and the required causal evolution in all reference frames [2].
- Direct coupling of a ghost-condensate to photons is prevented by Lorentz-violation experiments, especially those using Ultra High Energy Cosmic Rays (UHECRs) [3].
- So the only way to generate the preferred frame effects is to try to use gravity,

for AdS superluminal action,  $S(\text{superluminal}) = -\int(\epsilon_R/4)dt \int d^3y\dots$  [2].

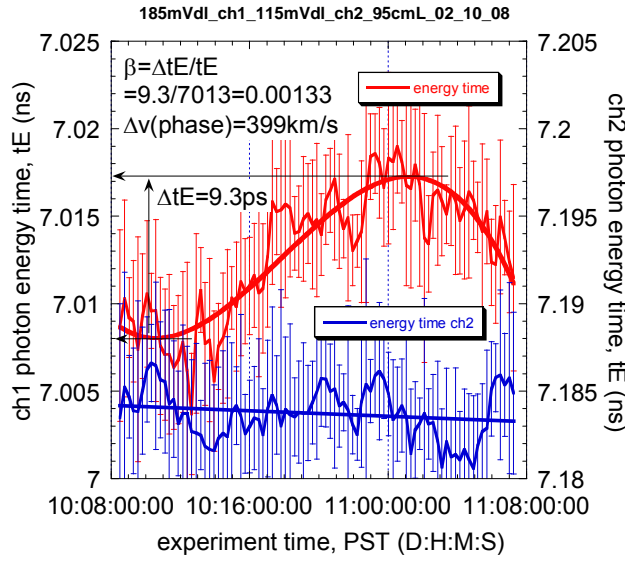
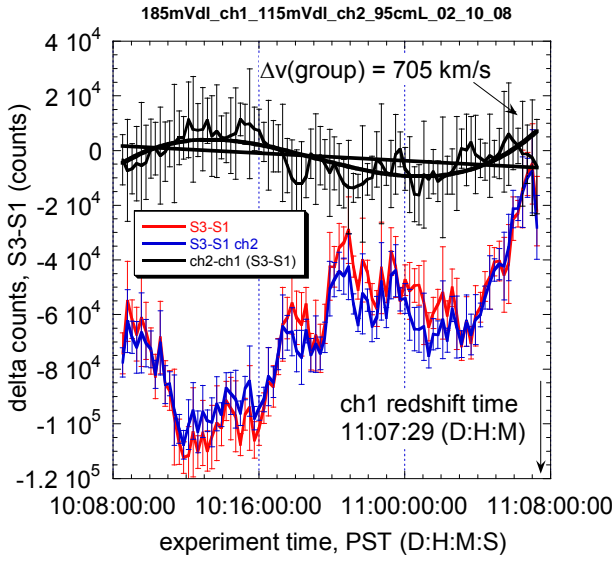
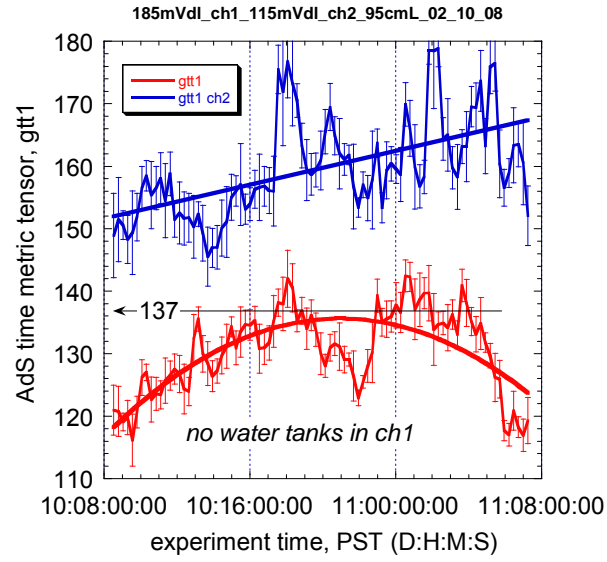
...“Now we can choose  $\epsilon$ (renormalized) so weak as to not lead to catastrophic vacuum decay. This also suppresses the probability of superluminal propagation,...” Sundrum [2].

- This probability precludes superluminal energy flow in our photon tunneling experiment by several orders of magnitude. So trying to use gravity does not work anyway.
- Standard model ghosts might screen an AdS collapsed object mass by “energy-parity” [1]?

[2] R. Sundrum, “Gravitational Lorentz Violation and Superluminality via AdS/CFT Duality”,  
[http://arxiv.org/PS\\_cache/arxiv/pdf/0708/0708.1871v2.pdf](http://arxiv.org/PS_cache/arxiv/pdf/0708/0708.1871v2.pdf)

[3] F. R. Klinkhamer, “UHCER Bounds on Lorentz Violation in the Photon Sector”,  
[http://arxiv.org/PS\\_cache/arxiv/pdf/0807/0807.2147v4.pdf](http://arxiv.org/PS_cache/arxiv/pdf/0807/0807.2147v4.pdf)

# Diurnal oscillations and AdS time rescaling



● Morse function critical points as magnetic charge = 137 in an AdS time metric tensor gtt1 can still be produced by fine-tuning this experiment.\* These critical points cause oscillations.

- *There are no water tanks in channel one and therefore no tunneling.*
- *Group and phase velocity oscillations don't line up with the CMB dipole.*
- *Oscillations in the group and phase velocities have an absolute Earth velocity of 705 km/s and 399 km/s respectively and are large relative to 369 km/s.*

- The 6-20-08 data shown on the previous slide is de-tuned away from gtt1 = 137 like ch2.
- Standard model ghosts would screen the collapsed object at 137 through “energy-parity”[1].