the general science journal

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Professor Brainstorm debates 'Time Dilation'

ABSTRACT

Professor Brainstorm has bought a High-Power Laser System (a very expensive; very powerful laser projector) from the Thales Group.
He is hoping to use this piece of equipment to test out the theory of 'Time Dilation' whilst speaking to an inquisitive and enthusiastic audience.

The professor intends to adjust the Laser's controls so that it will turn 'On' for one second, then 'Off' for one second, and to continue delivering that exact modulation of its powerful beam towards various targets.

He has worked out the degree of beam spreading and diffraction involved in long distance projection, knowing that over tens of thousands of kilometres, the beam will spread out massively with the energy per unit area dropping substantially.

KEY WORDS

Brainstorm, Hafele and Keating, Stanford, time dilation, diffraction, laser, watts per square metre, optics, detectors, collector diameter, milliwatts, photon counting, energy, Moon, Mars, modulation, the International Space Station, reciprocity, synchronicity, atomic clocks, critical temperature and pressure restraints, accelerating universe, The Dual Lens, muons, particles, magnetic fields, deceleration radiation, mass, cosmic rays, Field of Influence.

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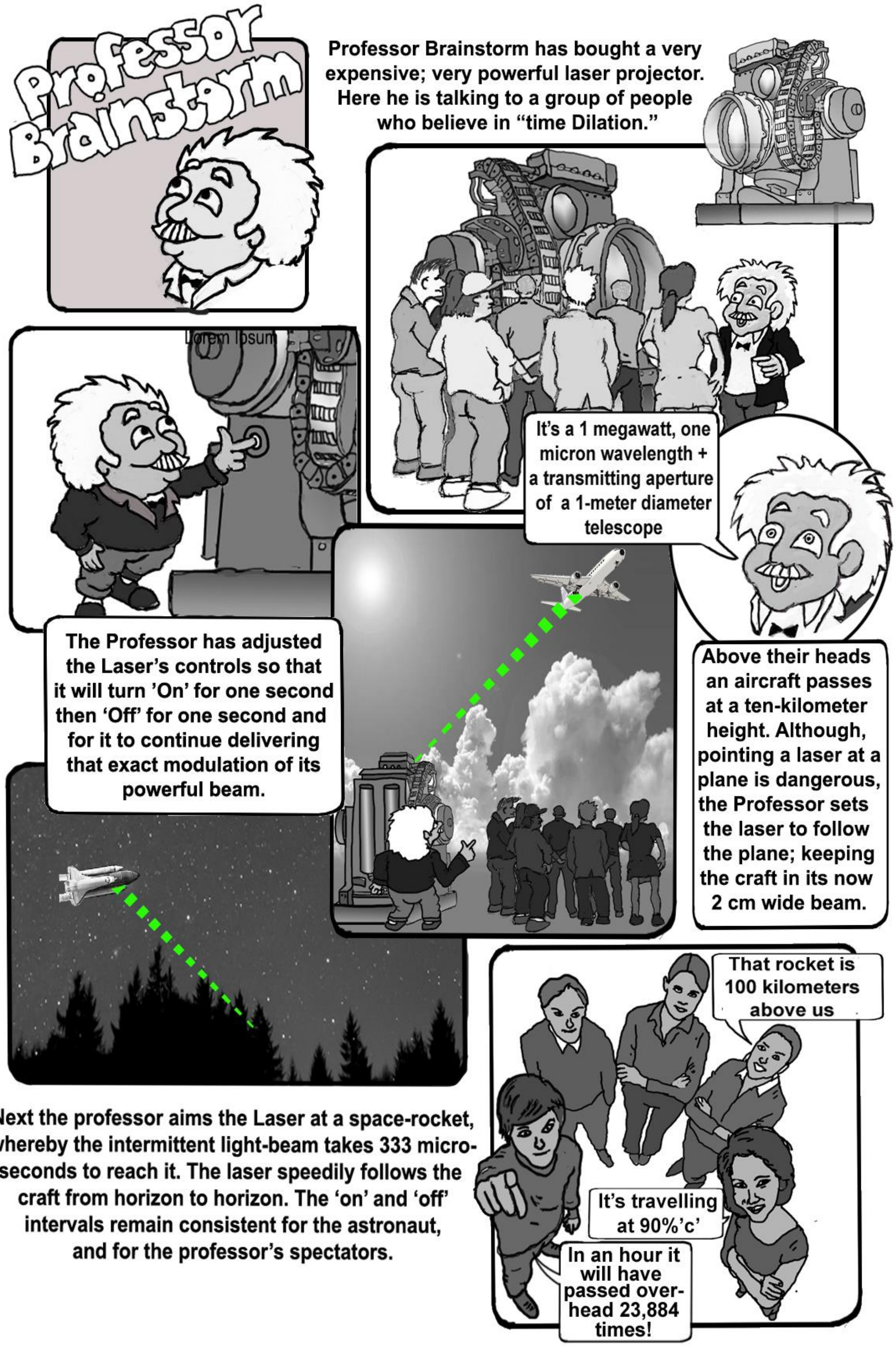
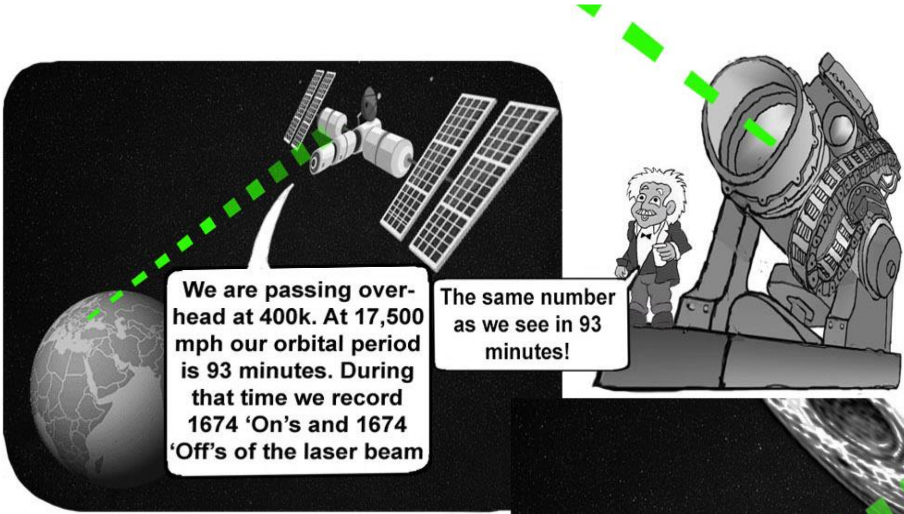
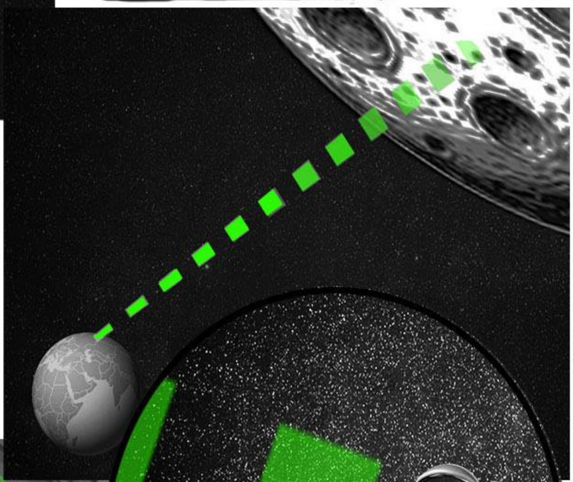
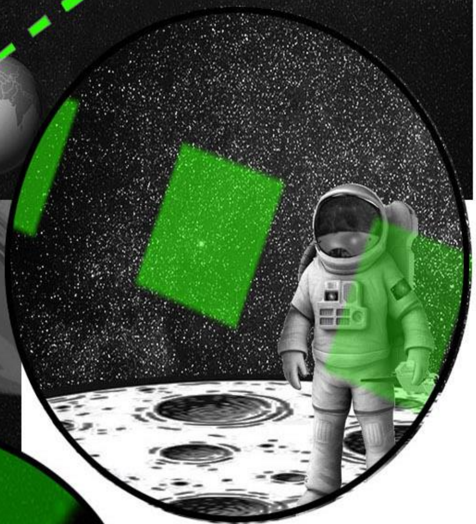


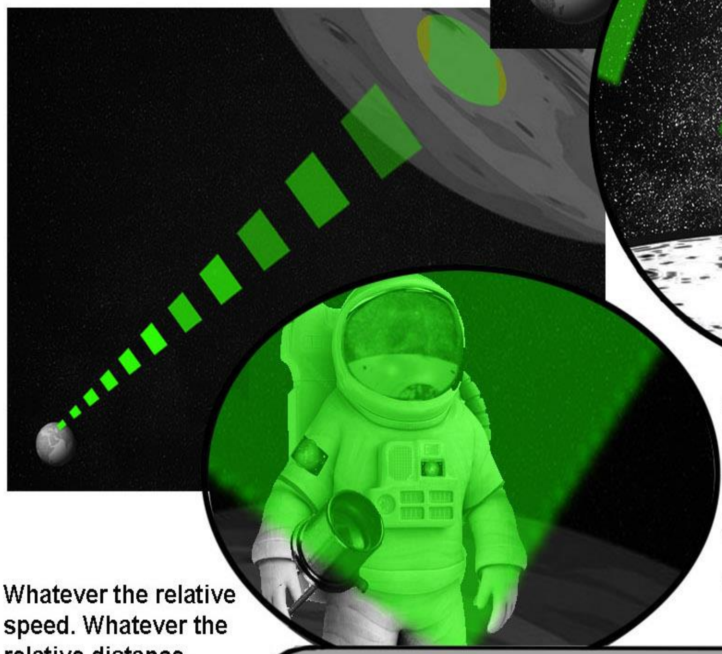
Now it is the International Space Station that has taken the professor’s attention. He sets the laser to follow that.



There is an astronaut on the moon. Currently, he is 384,000 kilometers from the Earth. The laser beam has widened to about 770 meters. The laser keeps the moon, centre screen. He has a "small detector" of 17 milliwatts.

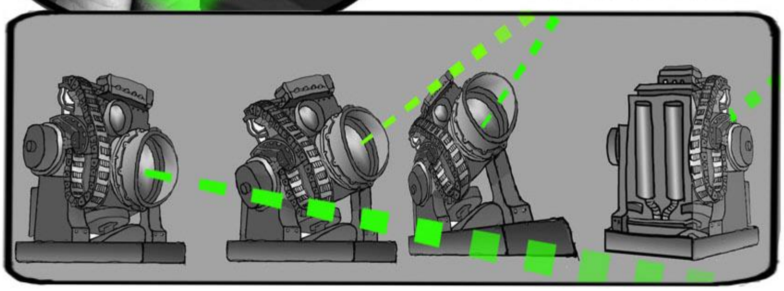


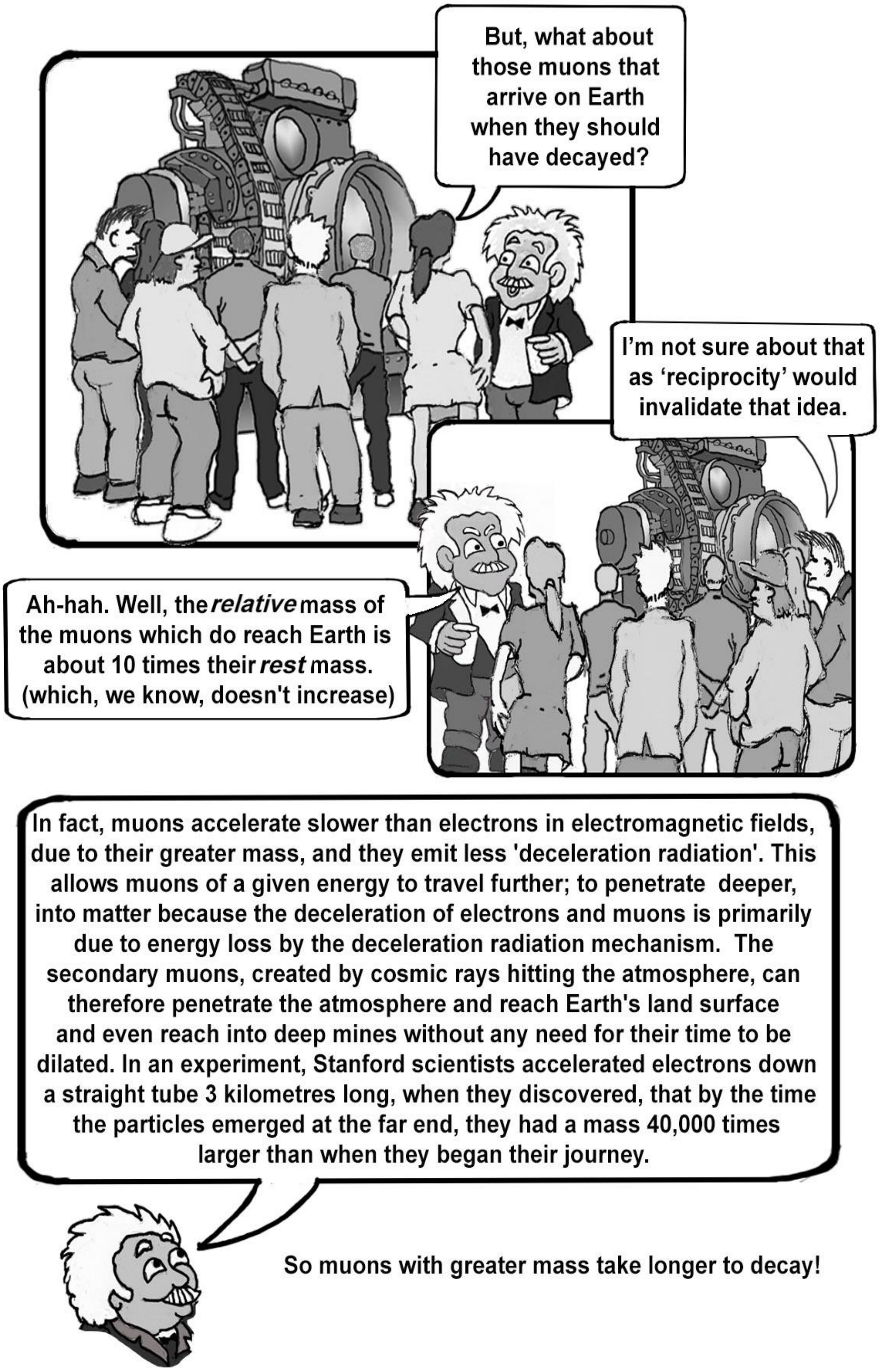


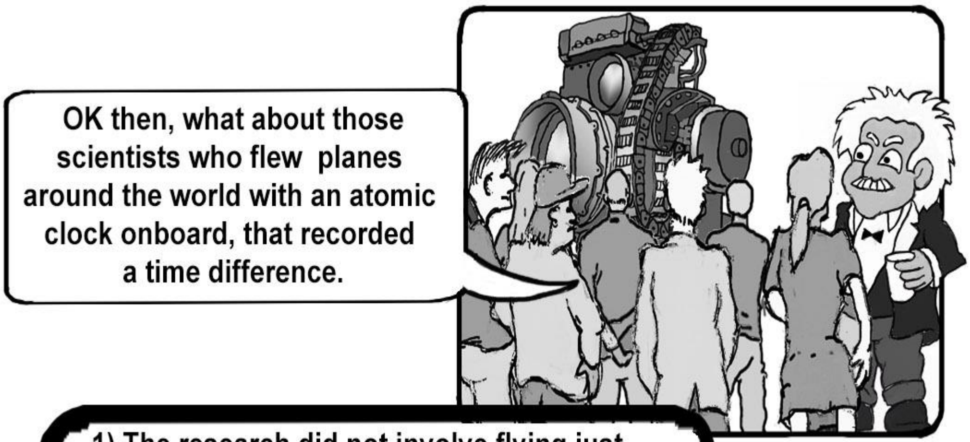


An astronaut on Mars with a photo-detector of 10 cms, at 0.8 microwatts. Mars is 56 Million kilometers from Earth. The 'On' and 'Off' intervals, of laser light take 3 minutes and 7 seconds to arrive.

Whatever the relative speed. Whatever the relative distance. Whatever the relative Gravity. The 'On' and 'Off' intervals have to confirm the same time for everything in their 'field of influence'.




But, what about those muons that arrive on Earth when they should have decayed?
I'm not sure about that as 'reciprocity' would invalidate that idea.
Ah-hah. Well, the *relative* mass of the muons which do reach Earth is about 10 times their *rest* mass. (which, we know, doesn't increase)
In fact, muons accelerate slower than electrons in electromagnetic fields, due to their greater mass, and they emit less 'deceleration radiation'. This allows muons of a given energy to travel further; to penetrate deeper, into matter because the deceleration of electrons and muons is primarily due to energy loss by the deceleration radiation mechanism. The secondary muons, created by cosmic rays hitting the atmosphere, can therefore penetrate the atmosphere and reach Earth's land surface and even reach into deep mines without any need for their time to be dilated. In an experiment, Stanford scientists accelerated electrons down a straight tube 3 kilometres long, when they discovered, that by the time the particles emerged at the far end, they had a mass 40,000 times larger than when they began their journey.
So muons with greater mass take longer to decay!



1) The research did not involve flying just "one atomic clock". Four caesium atomic clocks were flown, apparently to "even out any discrepancies between them". If H and K accepted that there might be differences between the readings of the flown clocks, then they too should have accepted that there could be a similar discrepancy between those four -and the ground based clock at the US Naval Observatory, that would have had nothing to do with the 'moving clock running slow'.

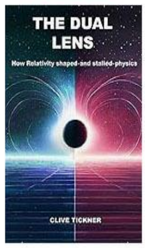
2) Hafele and Keating's published results required all the atomic clocks to be precise to one, three and a half trillion, trillionths of a second, which, at that time, no caesium atomic clocks could manage.

3) The scientists also stated that they had proved a difference between flying east and flying west. There should never be different results- due to the unknown 'direction' of the expanding (and accelerating) Universe.

4) The ground based clock was subjected to critical temperature and pressure constraints. The flown clocks experienced both temperature and pressure changes.

5) Possibly, most importantly; we know that in any given circumstance it is impossible to say 'who is moving'. H&K did not allow for this. Reciprocity, or synchronicity, should equally show that the ('universally moving') clock at the US Naval Observatory had recorded 'marginally less time' than the four clocks flown.

For those interested, I recommend the Amazon publication; "The Dual Lens-How Relativity Shaped -and Stalled- Physics"; Chapter 6; where 28 well-known 'Time Dilation' experiments are discussed. You can question the procedures and make up your own minds about the results.



THE PHYSICS

Professor Brainstorm has bought a High-Power Laser Systems (a very expensive; very powerful laser projector) from the Thales Group. Here he is talking to a group of people who believe in “Time Dilation.”

The professor has adjusted the Laser’s controls so that it will turn ‘On’ for one second then ‘Off’ for one second, and to continue delivering that exact modulation of its powerful beam.

He has worked out the beam’ spreading’ and ‘diffraction’ involved in long distance projection, as even the best laser diverges by a small amount. Over tens of thousands of kilometres, the beam broadens immensely, so the energy per unit area drops similarly. There’s no such thing as a perfect pencil of light.

The professor admits that Relativity predicts that different observers may disagree on simultaneity, and moving observers may measure Doppler-shifted intervals, and that gravitational fields may cause redshift, however the interval encoded at the laser’s emission will remain encoded and the emitted time interval will be faithfully conveyed to distant observers.

He gives his audience the maths;
Beam diameter grows roughly as $\theta \approx \lambda / D$
Where: λ is wavelength; D is aperture size

Meanwhile, above their heads an aircraft is passing at a ten-kilometer height. Although the professor knows that pointing a laser at a plane is dangerous, he sets the beam to follow the plane. Here, the professor has worked out that the beam has diffracted to a 2 cm diameter.

The plane is travelling at 500 miles per hour. The tracking laser follows its path for an hour, during which time *both* his Earthbound audience and the plane’s passengers must see 1800 ‘On’ periods of the laser’s beam, and 1800 ‘Off’ periods of that beam.
(3600 ‘On’ and ‘Off’s, equals one hour for both the Professor’s crew and the passengers in the aircraft).

No ‘Time Dilation’ here then.

Later, at 100 kilometers above them, a space-rocket is passing on an earth-orbit. The craft is travelling at 90% the speed of light. Therefore, in one hour, it will pass above the Professor and his audience 23,884 times.

The laser is set to track the rocket from horizon to horizon. The intermittent beams of laser light take 333 microseconds to arrive at the craft. Nevertheless, the *interval* between ‘On’ and ‘Off’ will remain consistent for the watching astronaut, and also for the Professor’s spectators. There is no reason, in physics, for the interval to alter, no matter the distance the signal has to travel. So, no ‘Time Dilation’ exhibited here either.

Next, the International Space Station passes overhead, at a height of 400 kilometers. At 17,500 mph its orbital period is about 93 minutes. The astronauts aboard will record 1674 ‘On’s and 1674 ‘Off’s of the laser beam, (now at a 0.8-meter circumference) before the ISS is out of the laser’s range. The professor and his team, in that same 93 minutes, *have to see* exactly the same number of ‘On’s and ‘Off’s as each other, as no physical process can have interceded or interrupted, the laser beam’s *regular* intervals.
Once again it is not possible to spot any ‘Time Dilation’.

Now there is an astronaut on the moon. Currently, she is 384,000 kilometers from the Earth. At this distance the laser beam has widened to about 770 meters. The laser tracker keeps the moon, (which, of course, is moving relative to the earth), centre screen.
The astronaut has a small hand-held detector of 17 milliwatts. Both the astronaut and the professor’s crew must, therefore, note that the earth-based laser is still ‘On’ for one second then ‘Off’ for one second, with that interval still remaining constant.
As the number of ‘On’s’ and ‘Off’s absolutely *have to coincide* for all, then, no matter what any ’Time Dilation’ equation tells us, no disparity is occurring.

Now we are considering an astronaut on Mars. Currently 56 million kilometers from Earth. Mars too, moves relative to the Earth. The focussed laser beam, (aimed at where Mars will be in about 4 minutes) much weaker now, spreads over about 112 kilometers, its light, today, taking 3 minutes and 7 seconds to arrive from earth. (This time can vary up to 24 minutes, with an average of 12.5 minutes).

Fortunately, this astronaut also has a photo-detector, this of 10 cms at 0.8 microwatts- which, even now, accurately records the regular ‘On’ and ‘Off’ intervals which, of course, for all, have to remain the same.

I think that we can now claim that anything falling within the ‘field of influence’ of that laser’s beam will be experiencing exactly the same time as on earth; living through *identical hours*. (Even although clocks will differ by the signal delay period)

Therefore;
Regardless of what particular mathematical formalisms predict, or what interpretations are drawn from other experimental arrangements, the result presented here is a direct visual demonstration. Within the limits of observation, it shows no evidence at all of time dilation.

THE MATHEMATICS

For physicists; here are the requirements for seeing the 1 second ON, one second OFF intervals for distances as far as Mars.

With a serious Earth-based laser
Power: 1 megawatt (10^6 W), continuous.
Wavelength: 1 micron (near-infrared, very common for high-power lasers)
Transmitting aperture: 1 metre diameter telescope.
1 second ON / 1 second OFF modulation

Observers only have a small optical collector, not a giant telescope.

Location	Distance	Beam diameter
Plane (10 km)	1×10^4 m	2 cms
Rocket (100 km)	1×10^5 m	20 cms
ISS (400 km)	4×10^5 m	0.8 m
Moon	3.84×10^8 m	~770 m
Mars	5.6×10^{10} m	~112 km

Power density at the observer on the ISS, on the Moon, on Mars

International Space Station

At ISS distance, beam diameter is under 1 m.
But Power density is still thousands of watts per square metre.
Even without optics, detectors would saturate. With optics, attenuation required. (ISS / rockets / planes: all visible)

Moon;

Very bright by astronomical standards.
Observer with a “small detector”;
Collector diameter: 10 cm; Area ≈ 0.008 m^2
Power collected on the Moon; 17 milliwatts
That is enormous for an optical detector.
Photon counting (to prove visibility)
Energy per photon at 1 μm:
That’s astronomically above detection threshold.
Even a cheap photodiode sees this instantly.
The 1-second on / 1-second off modulation would be unmistakable.
Moon: rock-solid detection.

Mars

The closest approach beam diameter ≈ 112 km
Radius ≈ 56 km; Area ≈ 10^{10} m^2
Power density: 0.1 milliwatts per square metre.
Collected by 10 cm detector: 0.8 microwatts.
Photon rate: ~4×1012 photons/s
The 1-second modulation is still clean; still easily detectable with modern photodetectors.

CONCLUSION

Pulses, separated by 1 second of the emitter's proper time, are encoded in the beam and cannot alter. This is because light does not stretch its internal timing pattern just because it travels far -and photons do not "age" or blur in transit. In effect, the signal carries a time stamp.

Therefore, a laser beam modulated at one-second intervals preserves that temporal structure over any distance. While the signal arrives delayed by light-travel time, the interval itself remains unchanged, allowing distant observers to recover the timing of the emission without distortion.

In doing so, an hour passing for the laser *must* equate to an hour (not THE SAME hour) passing at the pulse's destination, thus denying any time dilation.

CT 21/02/2026