

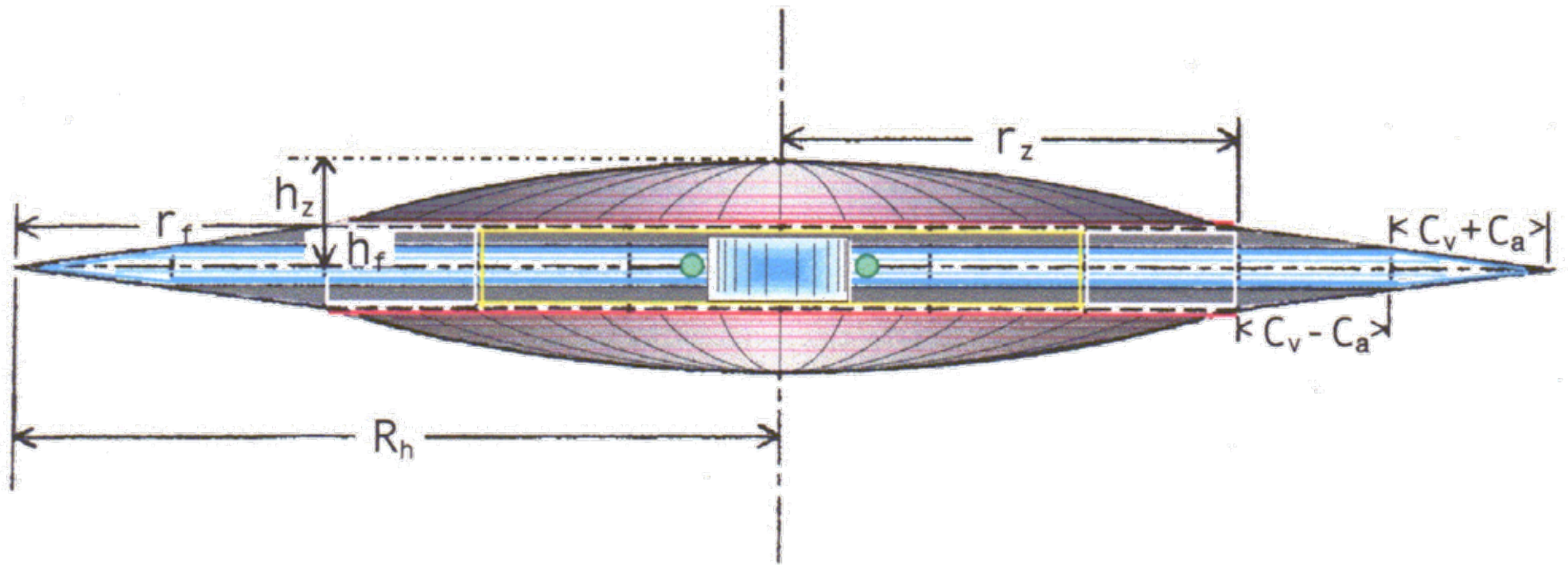
FASTER-THAN-LIGHT



JOHN ASHMEAD

JOHN.ASHMEAD@TIMEANDQUANTUMMECHANICS.COM

PATENT OFFICE



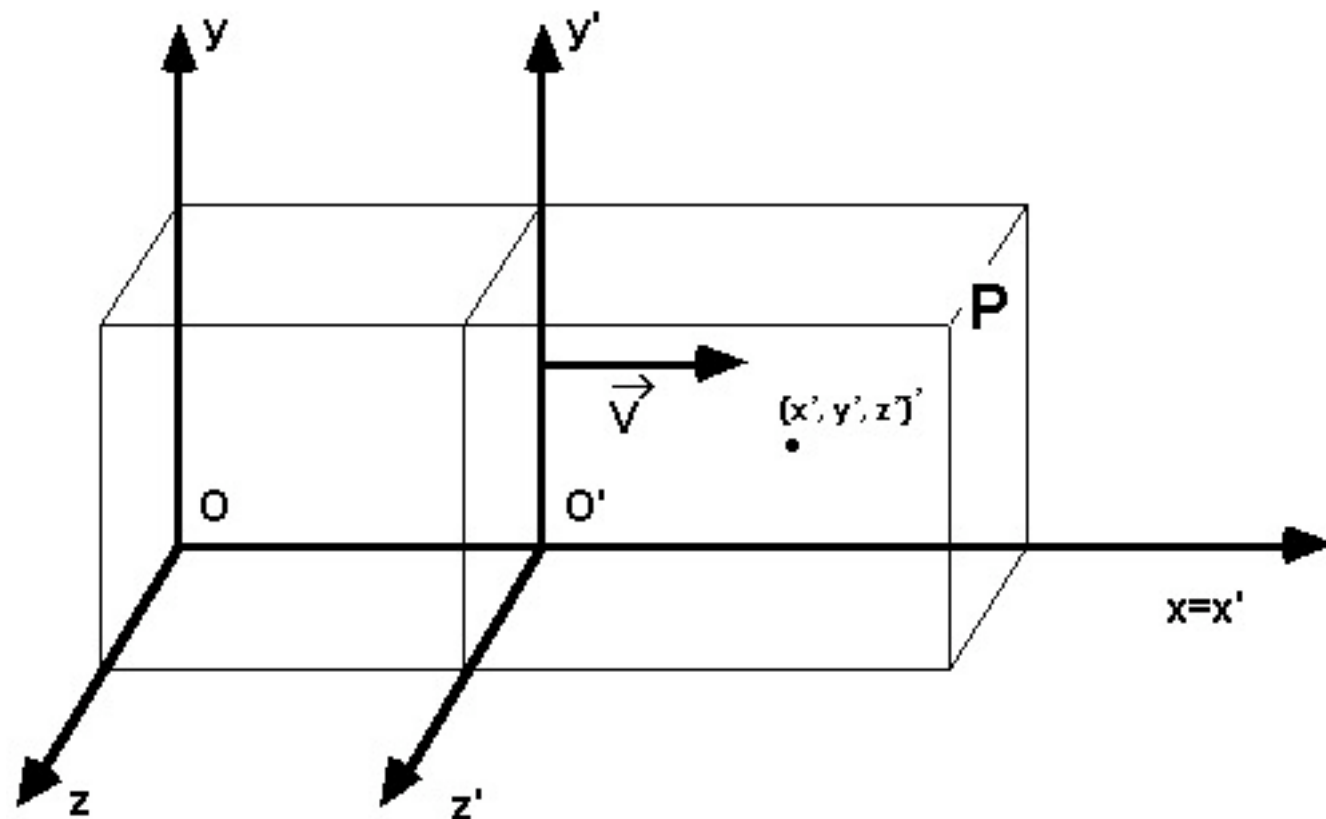
U.S. Patent 6,404,089: "Electrodynamic Field Generator

<http://www.stardrivedevice.com/ch1lex.html>



**BUT I CANNA
CHANGE THE
LAWS OF
PHYSICS,
CAPTAIN!**

GALILEAN LIGHT



**If light is going at speed “c” in the first frame,
how fast is it going in the primed frame?**

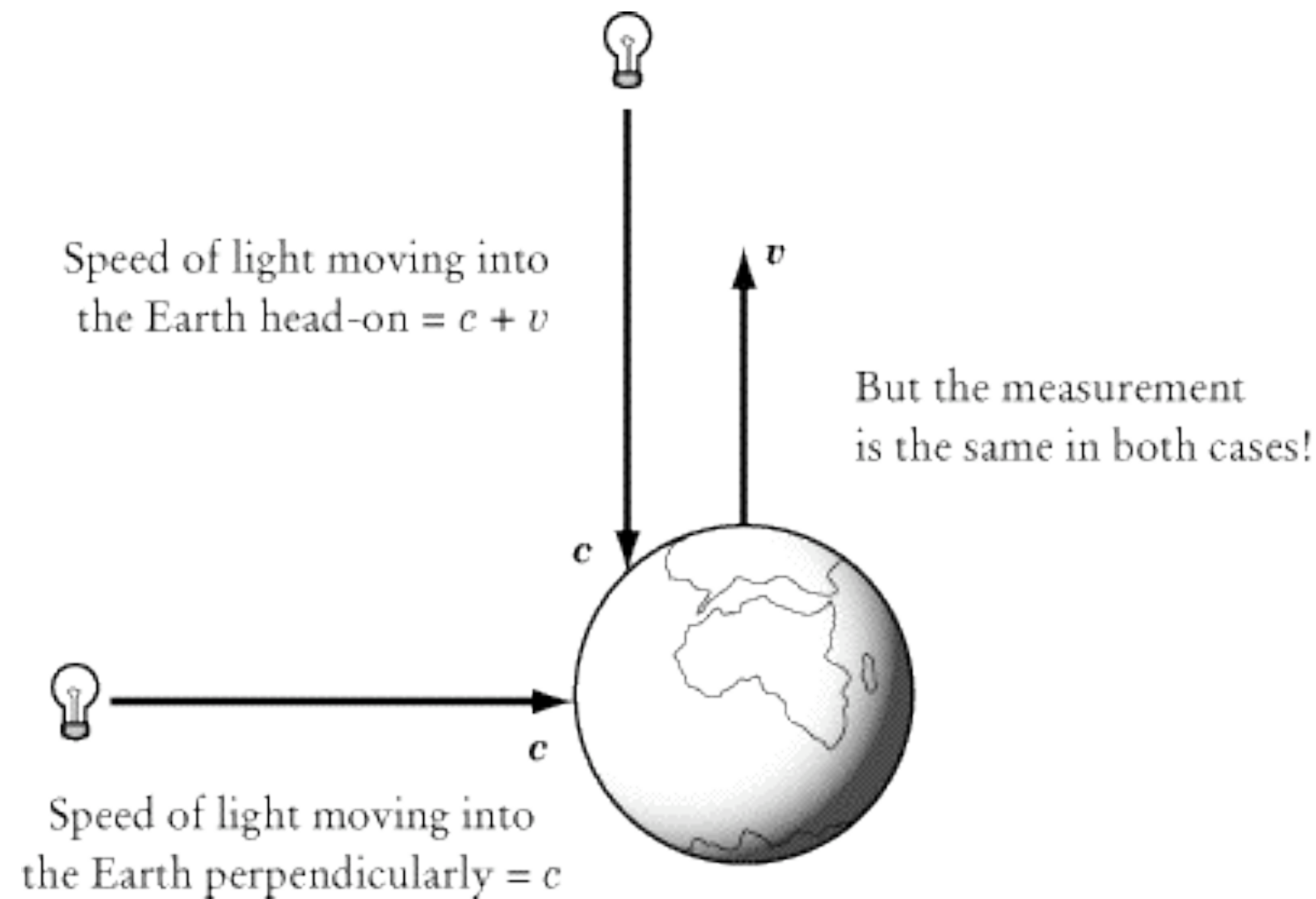
MAXWELL'S EQUATIONS



- ◆ Predicted light
- ◆ Predicted light's speed!



MICHELSON-MORLEY EXPT



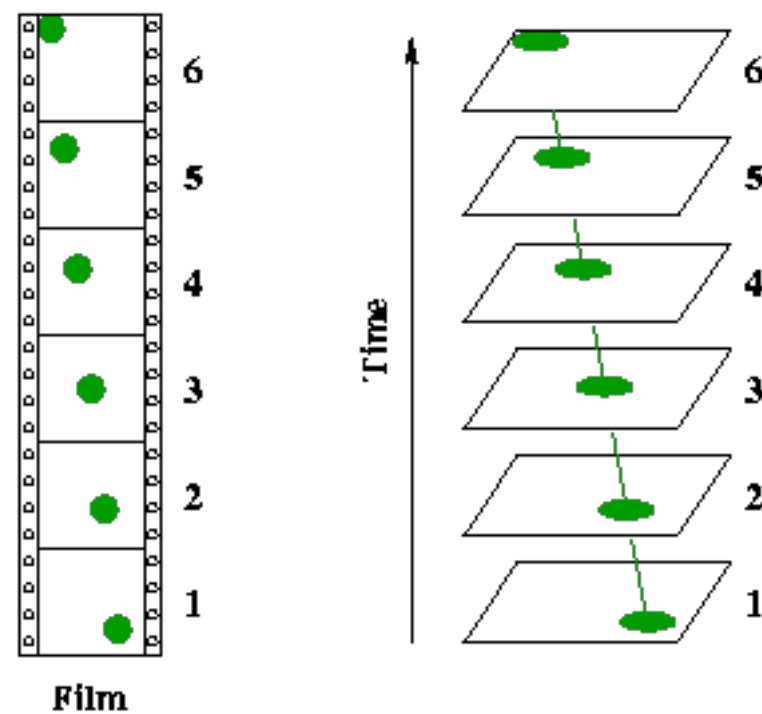
RELATIVITY



- speed of light constant
- laws of physics the same for all observers*

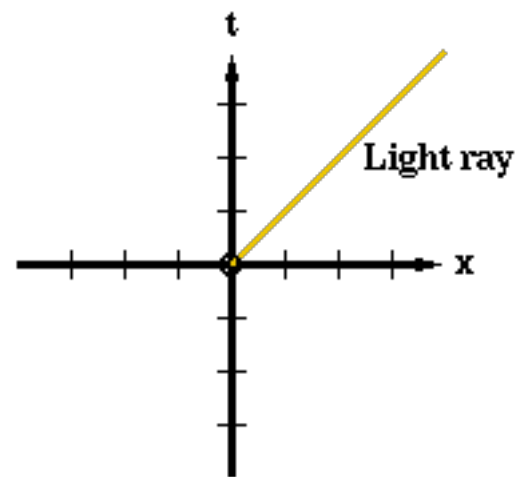
*but definition of simultaneity may differ!

SPACETIME DIAGRAMS

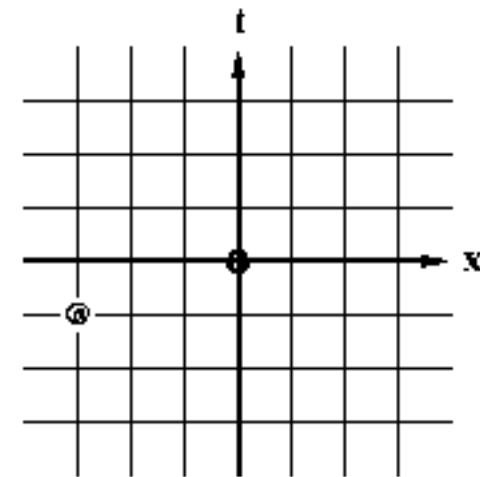
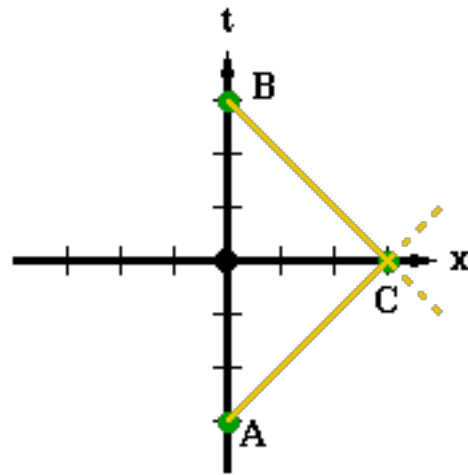


<http://www.physicsguy.com>

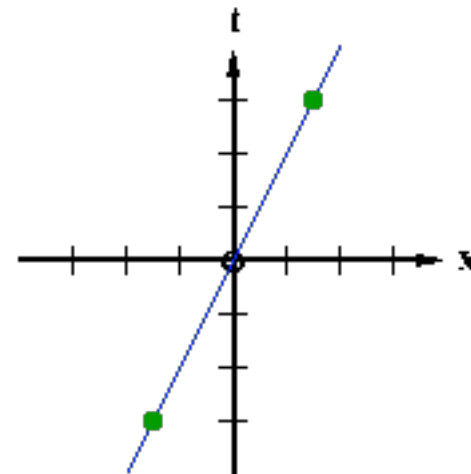
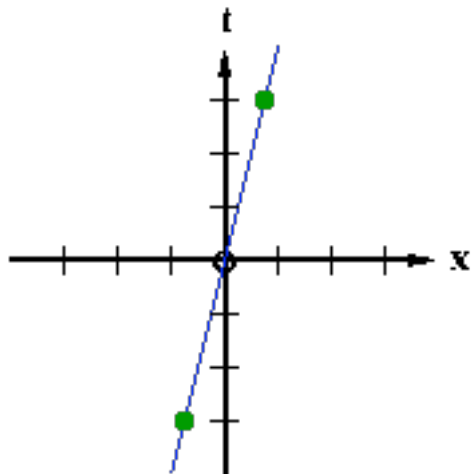
ALICE'S LIGHT



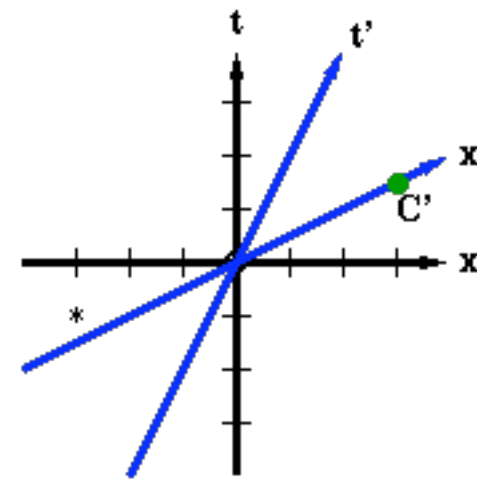
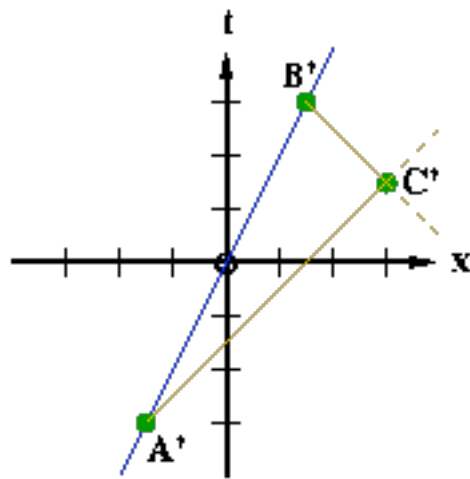
ALICE'S SIMULTANEITY



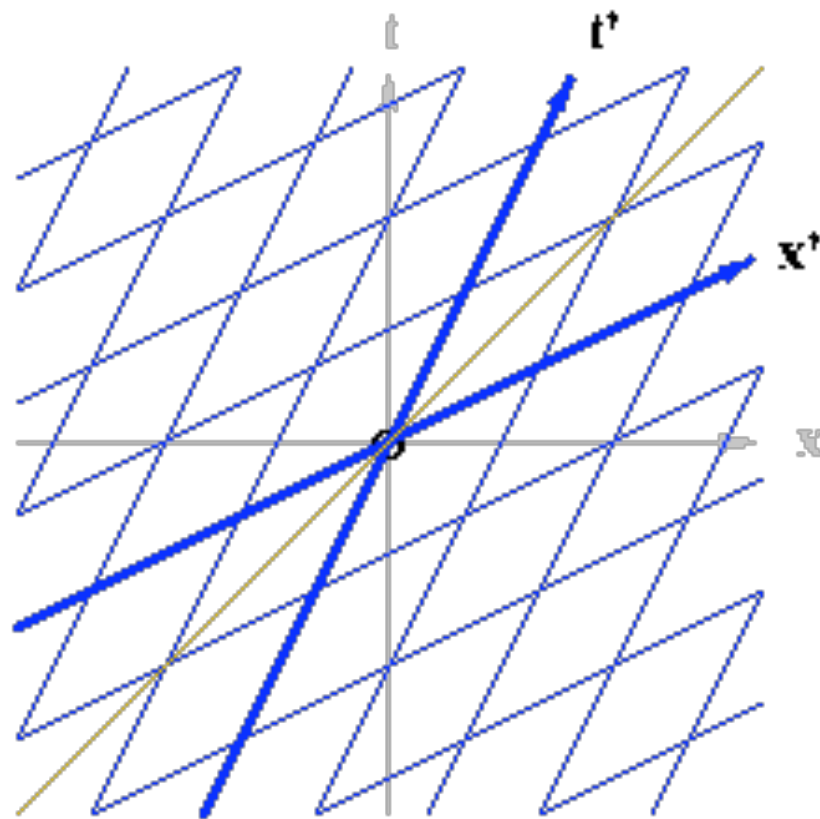
BOB JETS BY



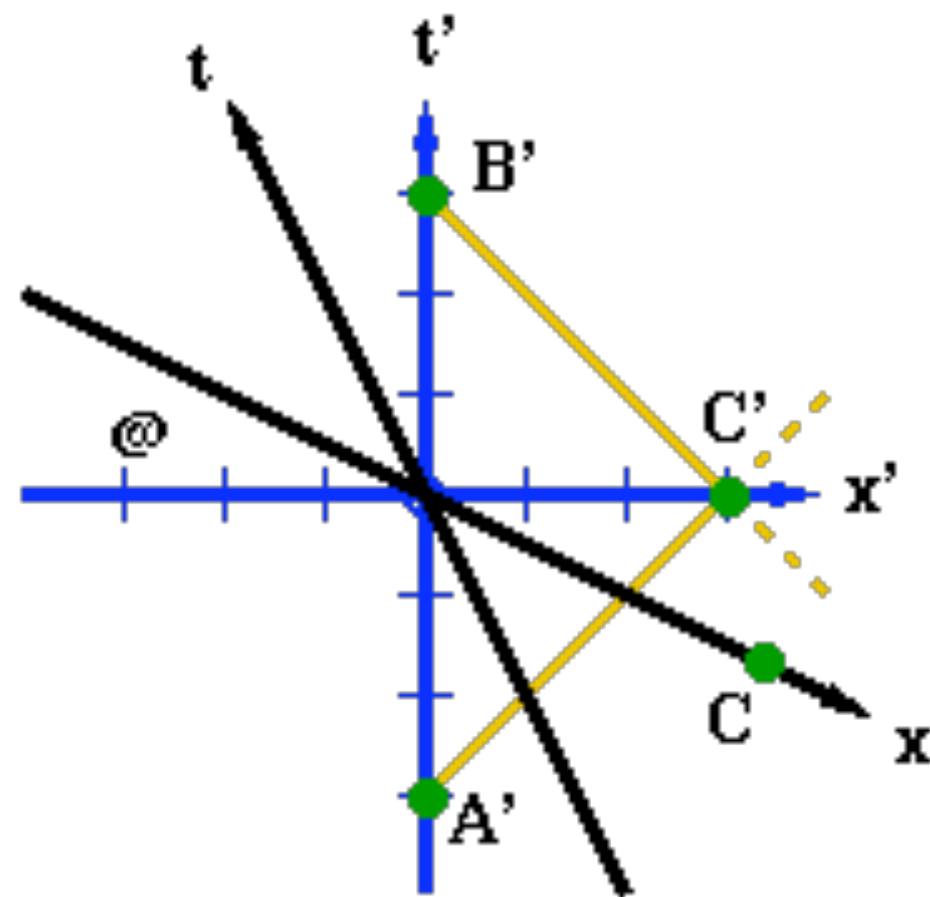
BOB'S SIMULTANEITY



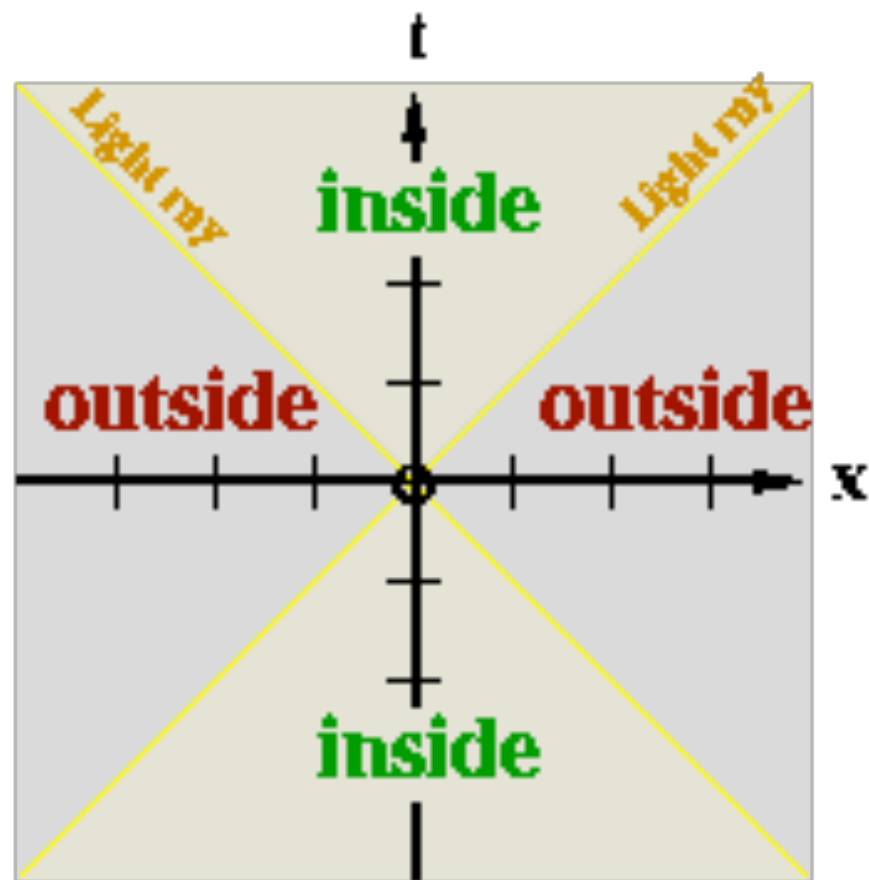
ALICE & BOB



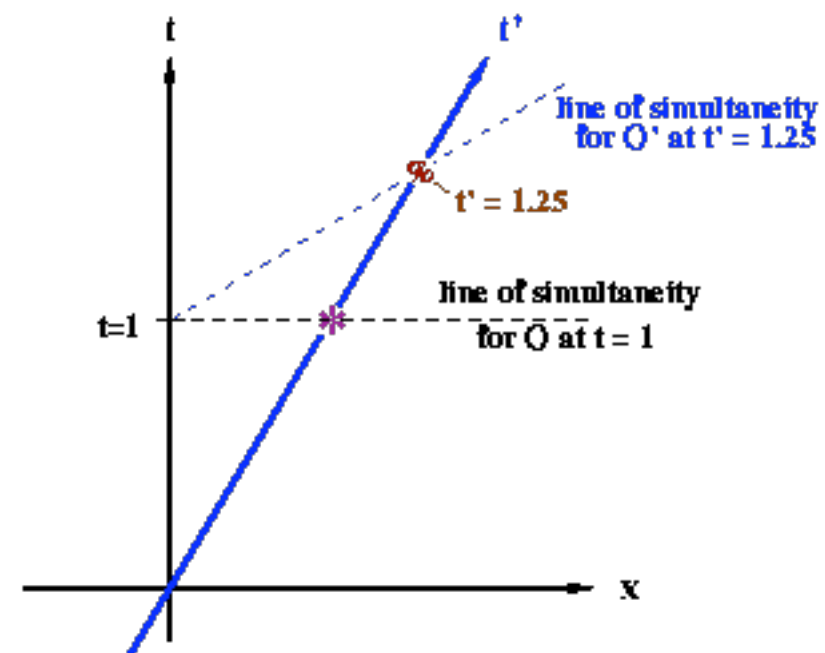
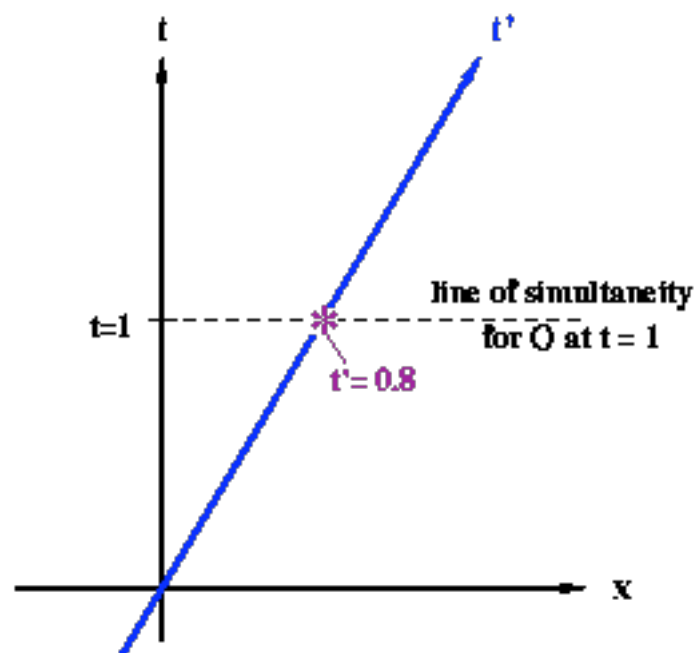
BOB & ALICE



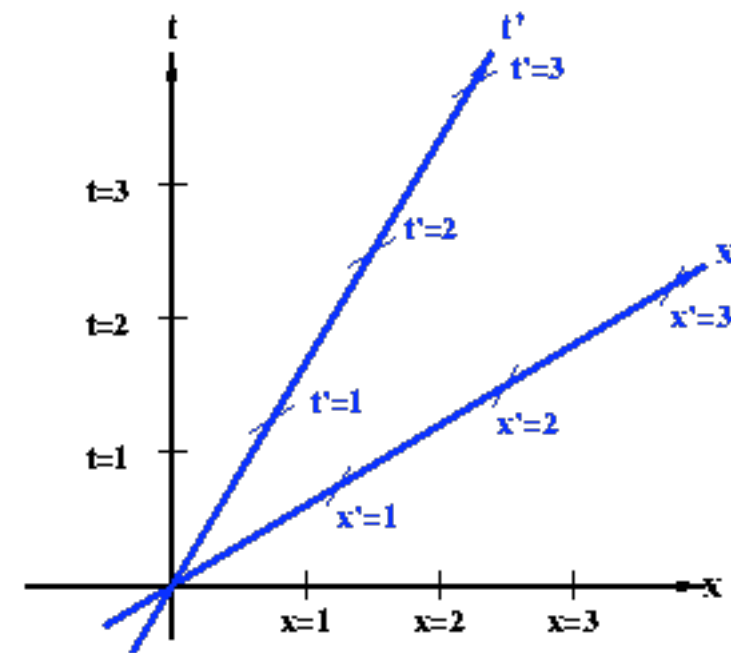
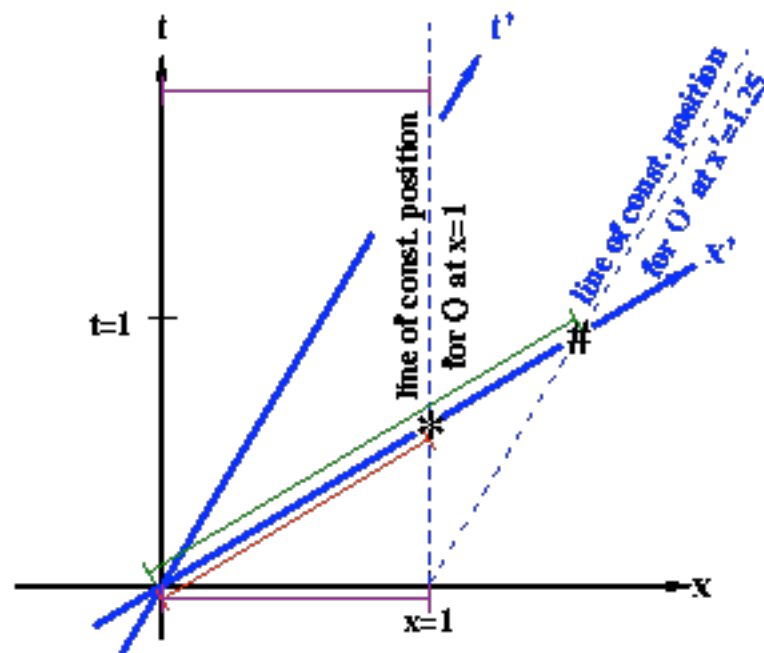
LIGHT CONE



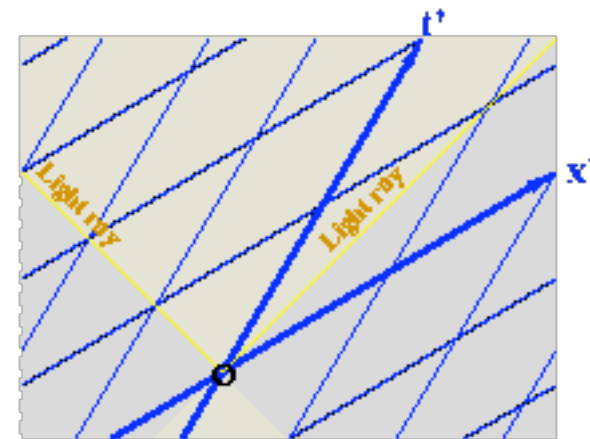
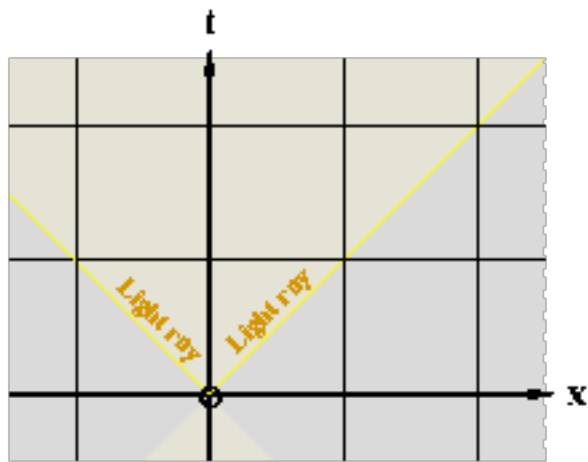
LINES OF SIMULTANEITY



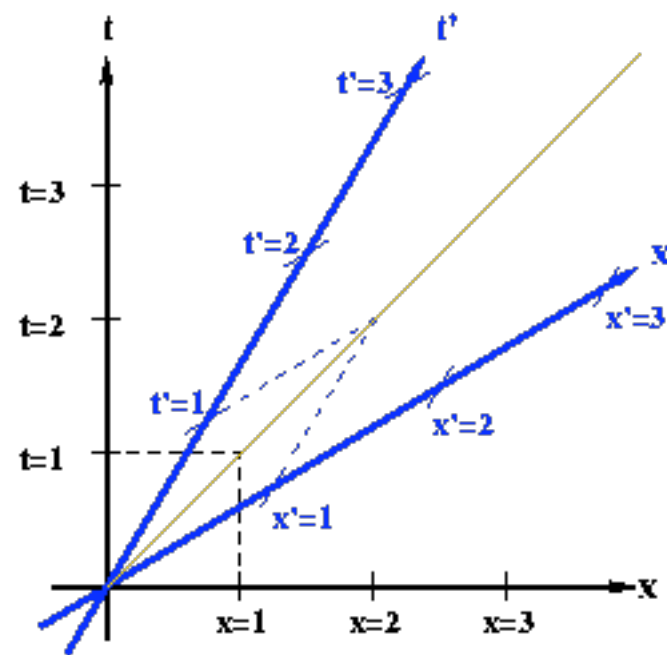
ALICE & BOB COMPARE LENGTHS



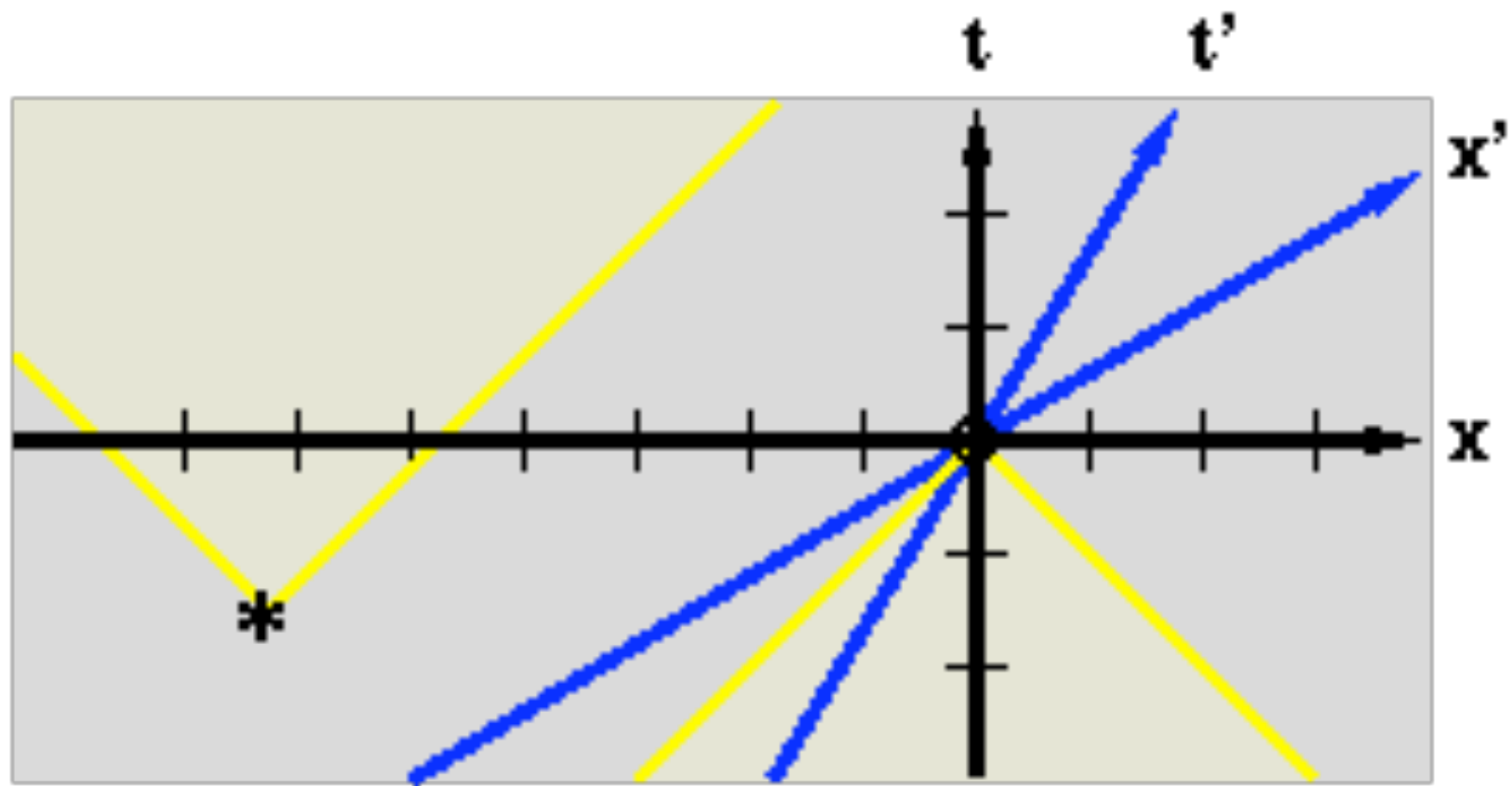
LIGHT CONE



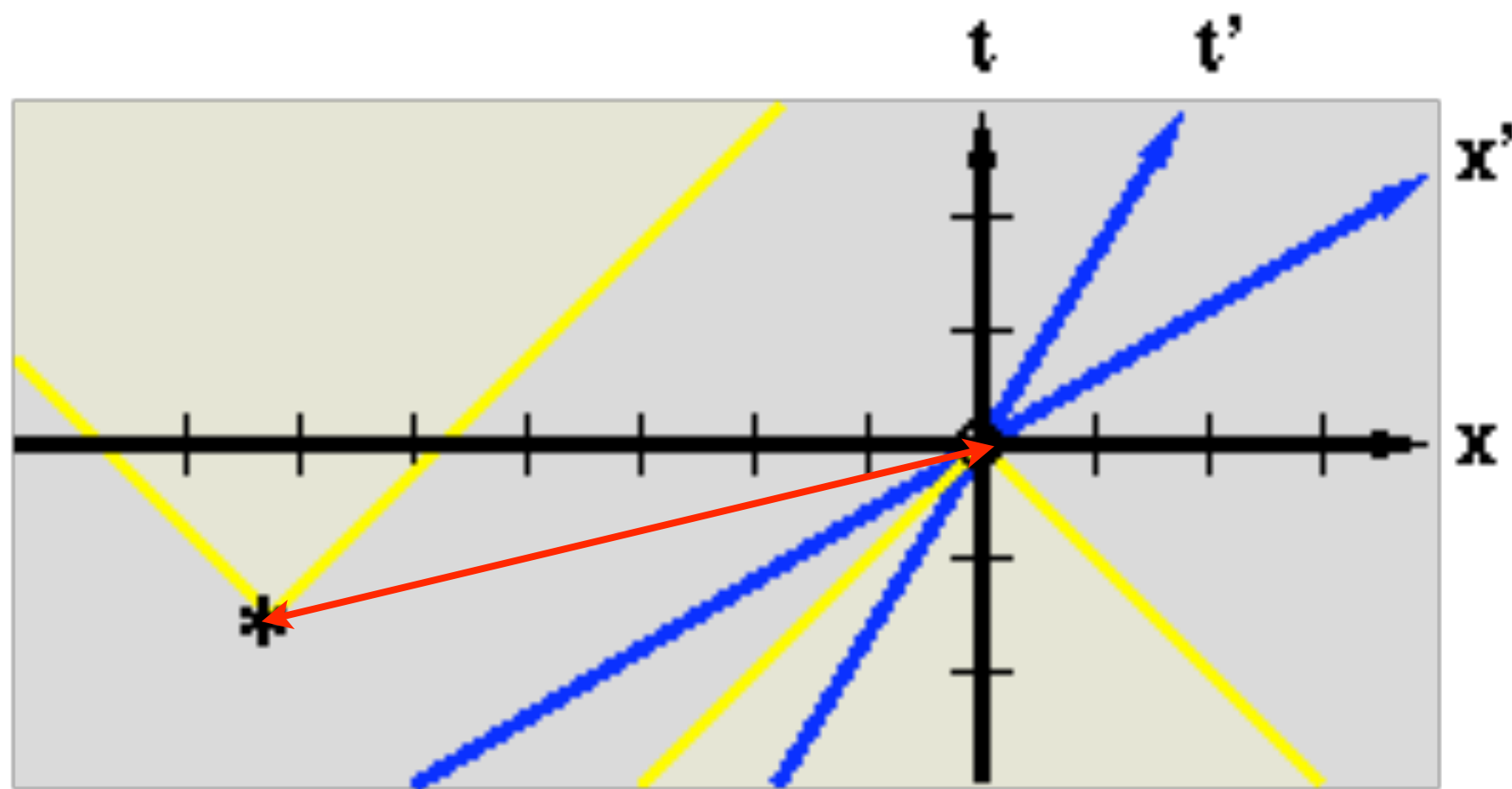
LIGHT CONE (2)



AFTER & BEFORE



**AFTER & BEFORE?
BEFORE & AFTER?**



GRANDFATHER PARADOX

“Why pick on grandfather? It seems that the only way to prove that time travel is impossible is to cite a case of killing one's own grandfather. This incessant murdering of harmless ancestors must stop. Let's see some wide-awake fan make up some other method of disproving the theory.”

- Letter to editor at Astounding Stories (January 1933) as quoted in Nahin (Nahin 1999)

PARADOXES

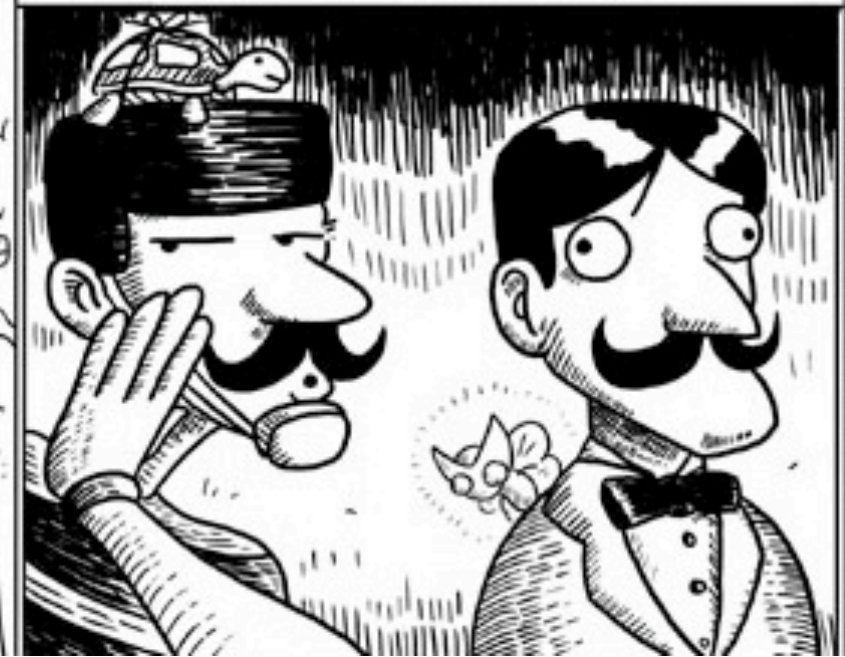
Once the superluminal has been achieved, it is important to remember that you will reach your destination before anyone will see you arrive, which may lead to existential scheduling complications.



This can become troublesome at dinner parties, as the host will feel obligated to set additional places for your numerous light echoes and disturb his seating arrangements.



However, as such velocities reverse the time stream, you may go back and tell yourself where you are going to be before you arrive. Simply be sure to inform the host that you are not an additional guest but a herald from the future, and thus have already eaten.



FTL $\hat{=}$ TIME TRAVEL

- **If you have an FTL drive, you have a time machine**
- **If you have a time machine, you have an FTL drive**

JUMPERS



CONSISTENCY PRINCIPLES

- ◆ **Blinovitch Limitation Effect**
- ◆ **Hawking's Chronology Protection Conjecture**
- ◆ **Novikov's Consistency Principle**

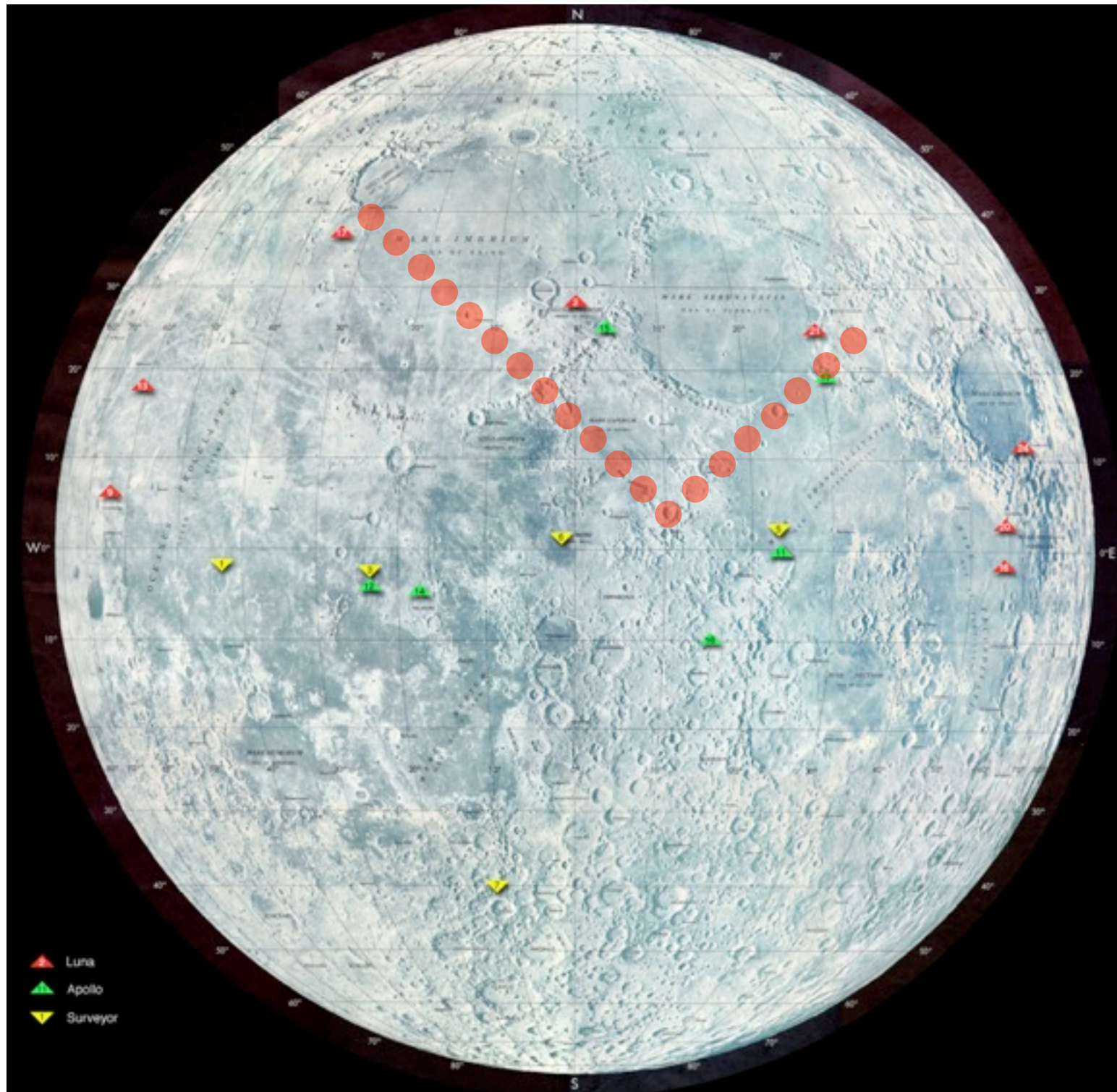
CAUSE & EFFECT

- Multiple worlds: parallel universes, multiple worlds interpretation of quantum mechanics, ...
- Self-consistency principles: Novikov, Hawking
- Restricted regions: here there be paradoxes
- Preferred frame: e.g. all GPS satellites use a Terran reference frame

TYPES OF TACHYONS

- pseudo-tachyons
- tachyon particles
- “real” tachyons

MOON SHADOWS



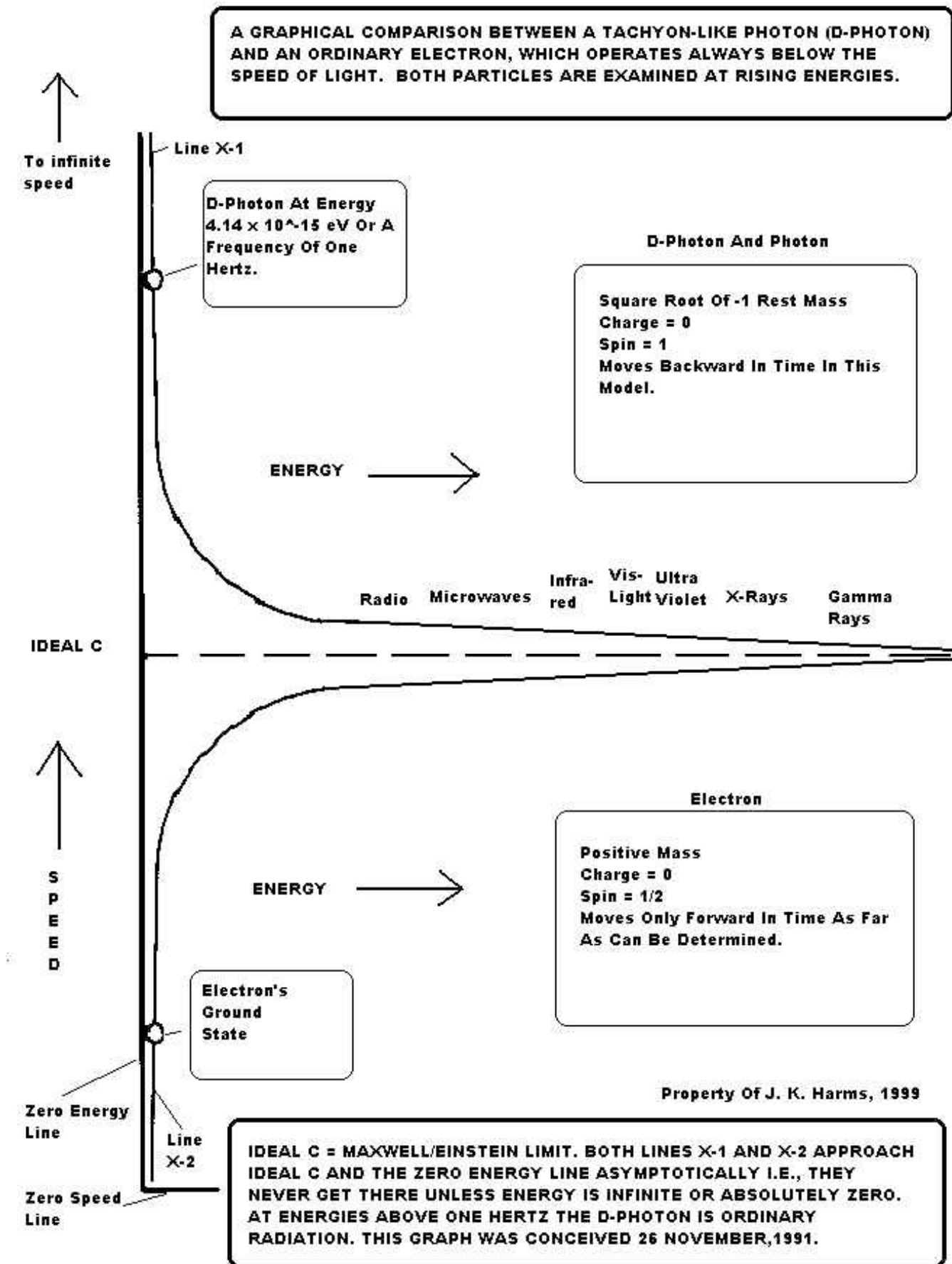
- shadow can move faster than light
- but the wiggle still only gets to the moon at light speed

TACHYON PARTICLES



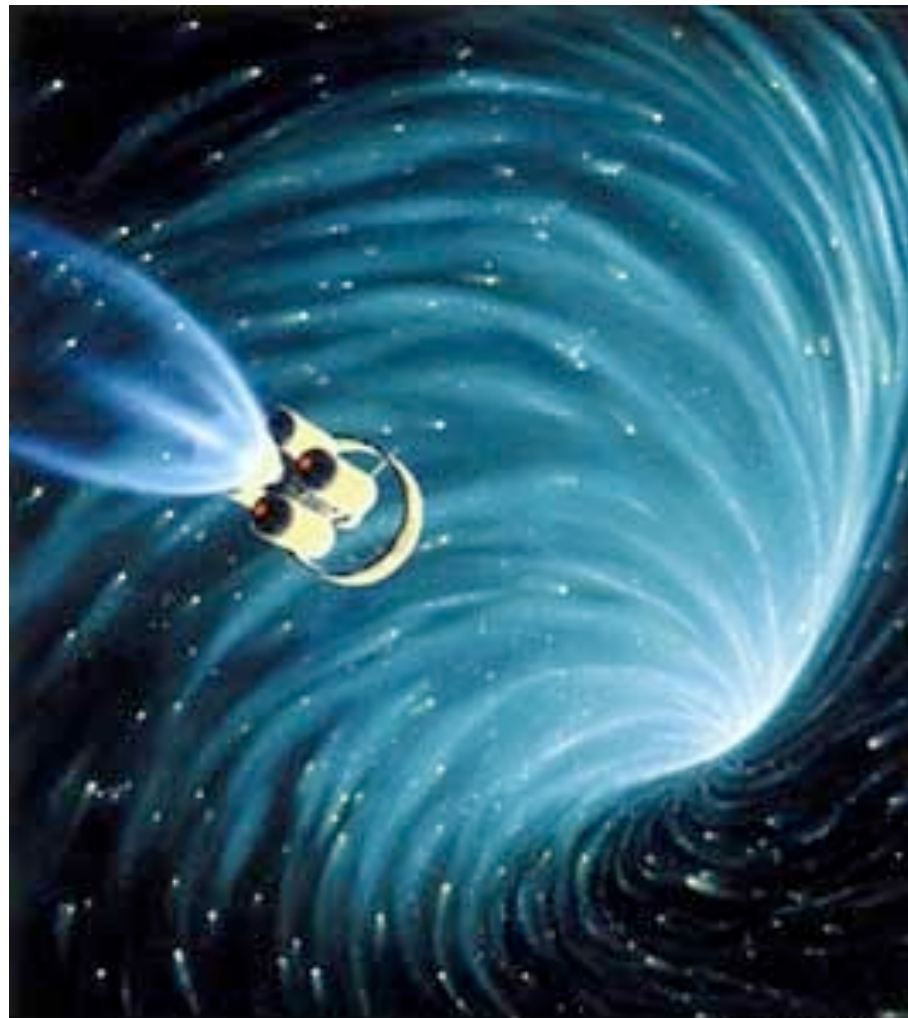
- takes energy to slow them down!
- takes infinite energy to get *down* to light speed

INFINITE MASS



- As you get closer to the speed of light, your mass goes to infinity.
- This creates fuel issues
- Tachyons need infinite energy to slow to the speed of light

"REAL" TACHYONS



Manchu

- communicators (ansibles)
- warp drives, hyperdrives, superluminal drives,...
- teleportation: jumpgates, stargates, et cetera

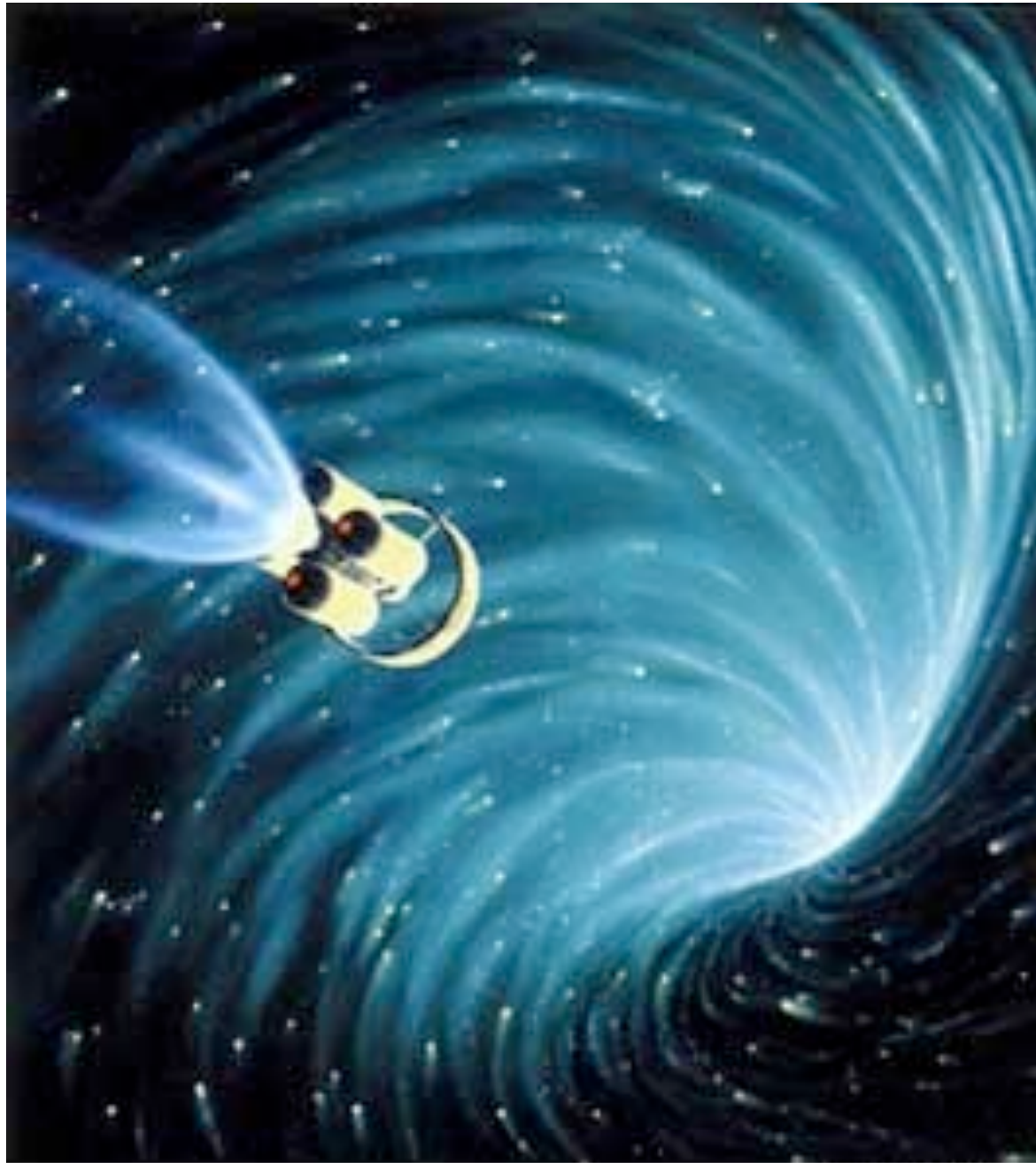
ANSIBLES



He said in his shrill harsh voice, 'What's that?' — pointing to the ansible. 'The ansible communicator, sir. A radio?' 'It doesn't involve radio waves, or any form of energy ... What it does, sir, is produce a message at any two points simultaneously. Anywhere.'

-- Left Hand of Darkness

WARP DRIVES



Manchu

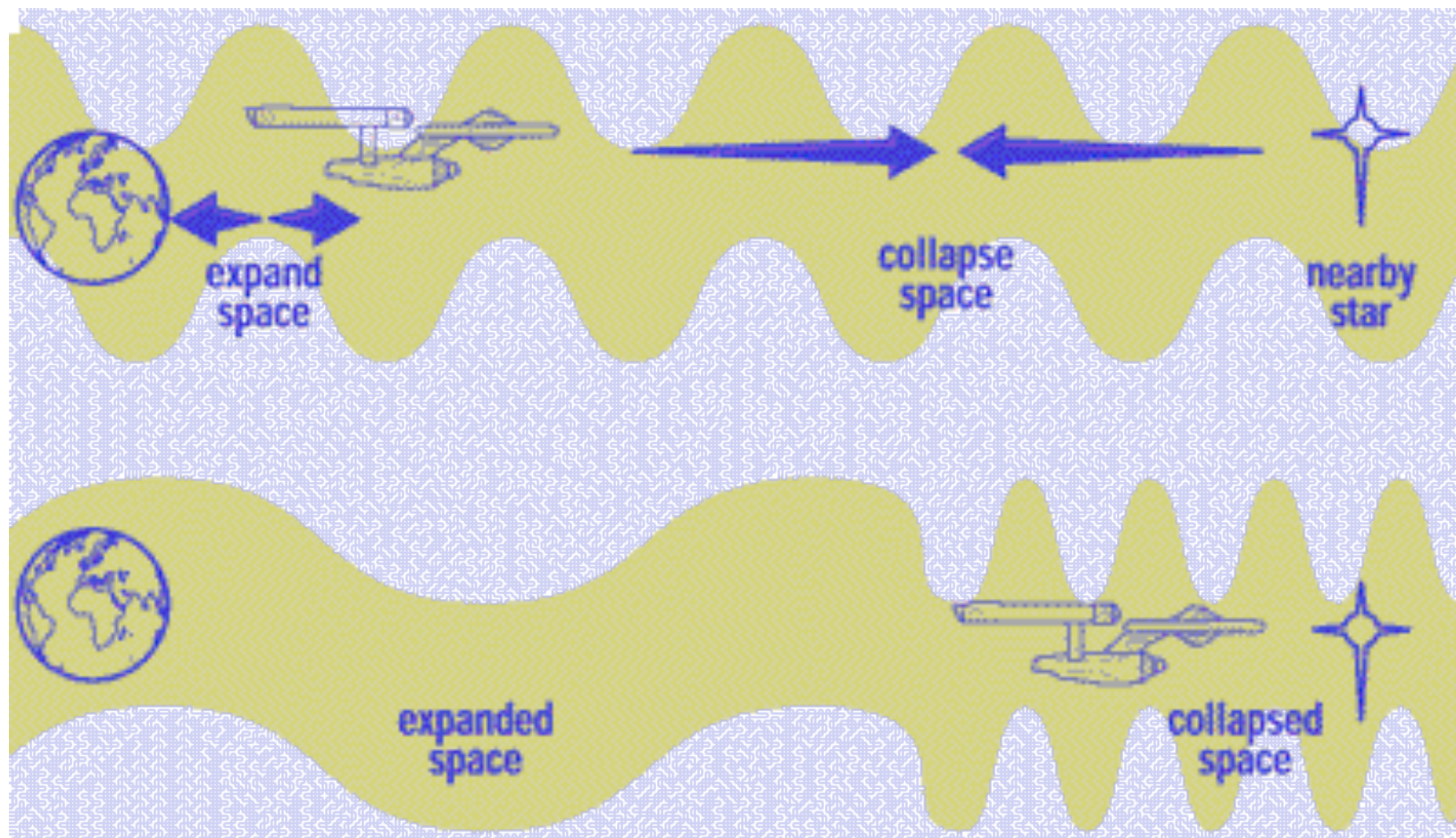
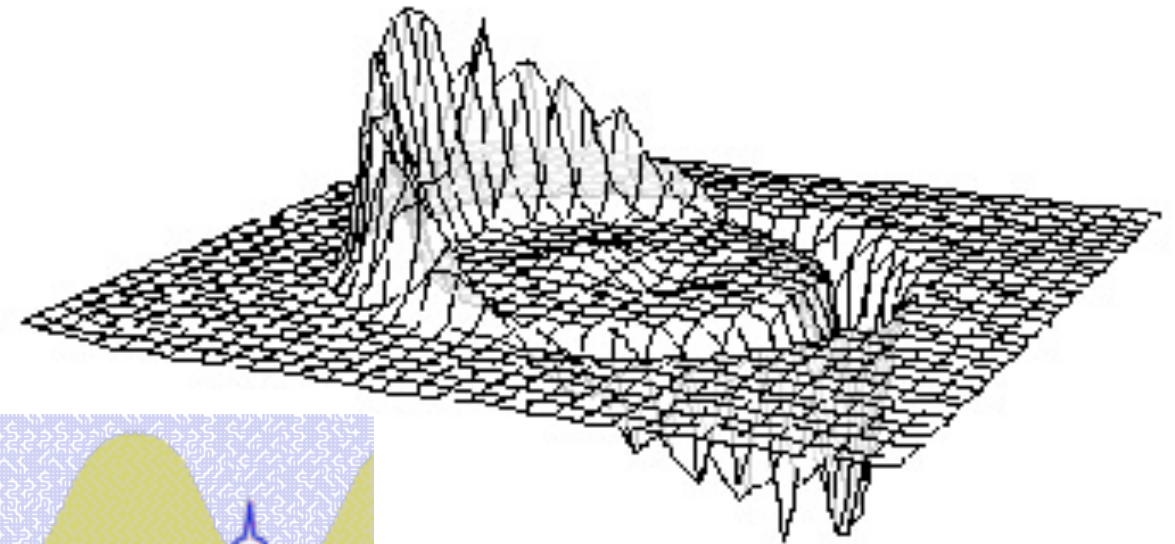
Text

- hyperdrive: enter parallel space
- warp drive: bubble of space
- jump drive: or hop drive or skip drive...
- fake drive -- throw out the rules

Merely corroborative detail, intended to give artistic verisimilitude to an otherwise bald and unconvincing narrative. -- Lord High Everything Else

MIGUEL ALCUBIERRE

THE WARP DRIVE: HYPER-FAST TRAVEL WITHIN GENERAL RELATIVITY



KRASNIKOV TUBE

If the Alcubierre space warp moves faster than the velocity of light, it cannot be controlled from inside. Per Krasnikov, at superluminal speeds the interior of the bubble is causally isolated from its surface and exterior. Photons cannot pass from the inside to the outside. Therefore, there would be no way of controlling the space warp—of stopping, starting or steering.

Krasnikov's alternative is to create a space warp behind the space ship as it travels at near lightspeed to some distant star system, and then use the "tube" thus created for the return trip. This distortion of space has an interesting property for the return trip: it gets you back home shortly after you left, no matter how far you go.

WARP DRIVE: A NEW APPROACH

Richard K Obousy and Gerald Cleaver*

Baylor University, Waco, Texas, 76706, USA

(Dated: February 11, 2008)

Certain classes of higher dimensional models suggest that the Casimir effect is a candidate for the cosmological constant. In this paper we demonstrate that a sufficiently advanced civilization could, in principal, manipulate the radius of the extra dimension to locally adjust the value of the cosmological constant. This adjustment could be tuned to generate an expansion/contraction of spacetime around a spacecraft creating an exotic form of field-propulsion. Due to the fact that spacetime expansion itself is not restricted by relativity, a faster-than-light 'warp drive' could be created. Calculations of the energy requirements of such a drive are performed and an 'ultimate' speed limit, based on the Planckian limits on the size of the extra dimensions is found.

PROBLEMS

- Huge quantities of negative energy required
- Negative energy may itself imply time travel

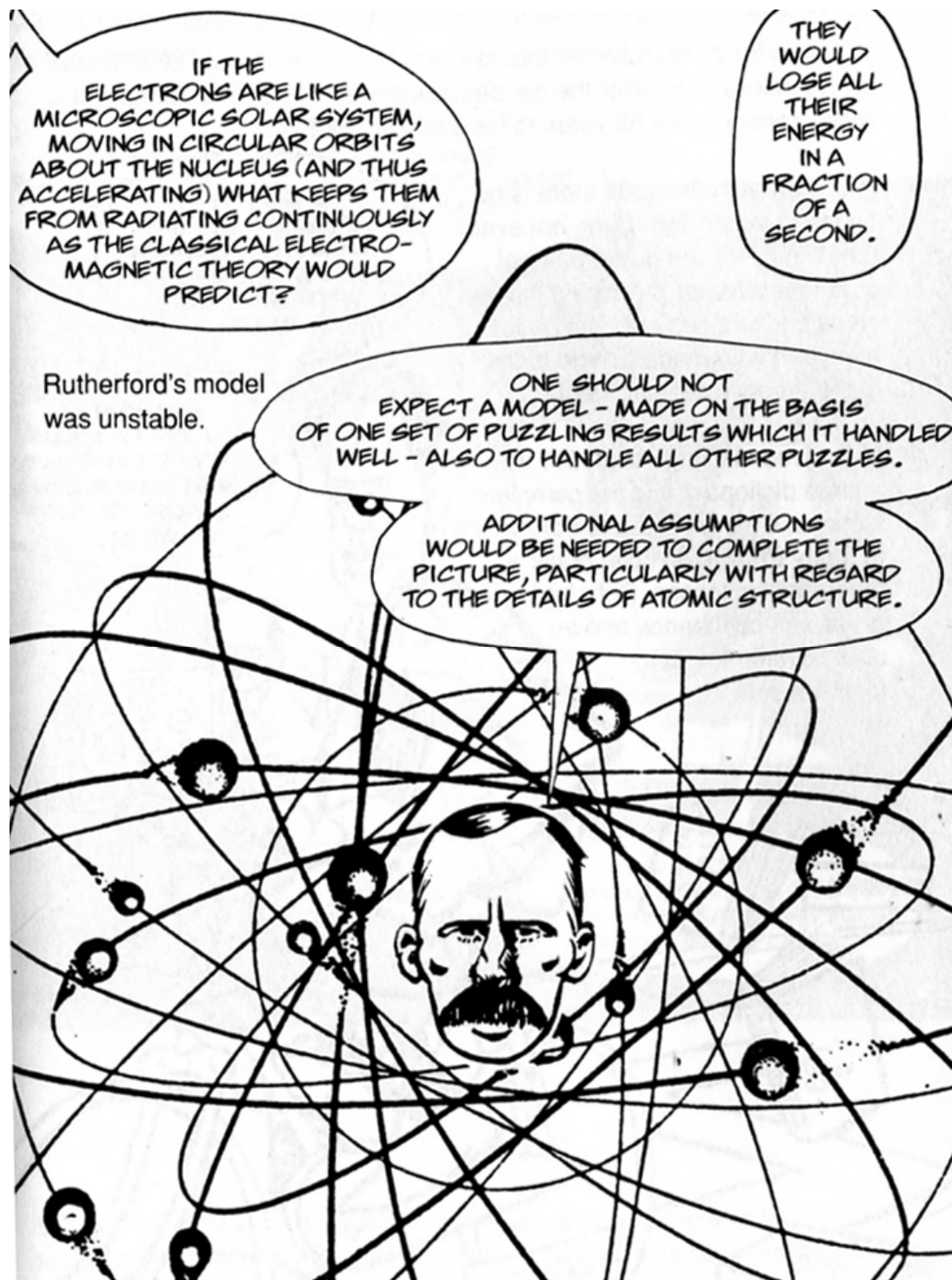
BENEFITS

"Warp drive" spacetimes are useful as "gedanken-experiments" that force us to confront the foundations of general relativity, and among other things, to precisely formulate the notion of "superluminal" communication.

-- Fundamental limitations on "warp drive" spacetimes, Francisco S. N. Lobo, Matt Visser

QUANTUM MECHANICS

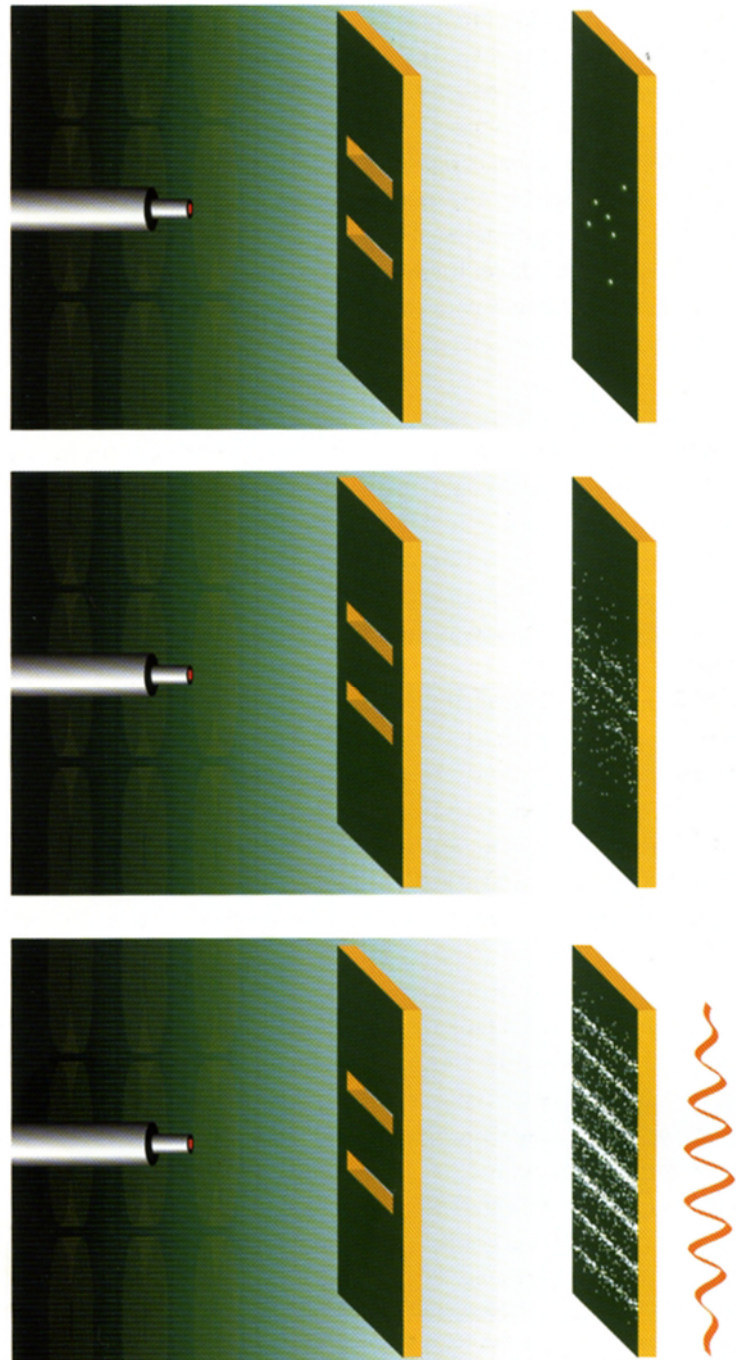
- ◆ **Everything is waves**
- ◆ **That interfere with each other to create reality**



WITHOUT QUANTUM MECHANICS, ATOMS DON'T EXIST!

Introducing Quantum Theory
McEvoy & Zarate

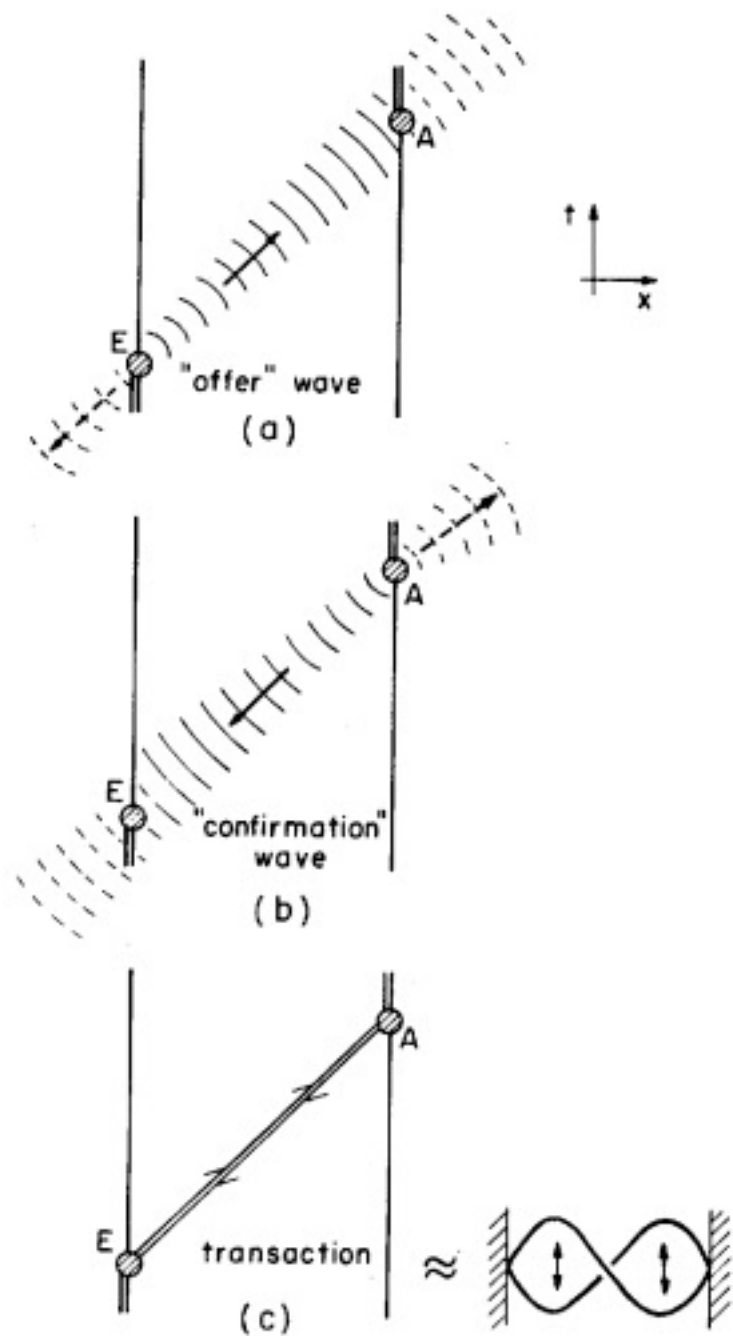
DOUBLE SLIT



We choose to examine a phenomenon which is impossible, absolutely impossible, to explain in any classical way, and which has in it the heart of quantum mechanics. In reality, it contains the only mystery. We cannot make the mystery go away by 'explaining' how it works. We will just tell you how it works. In telling you how it works we will have told you about the basic peculiarities of all quantum mechanics. - - Feynman

Quantum: A guide for the perplexed -- Al-Khalili

TRANSACTIONAL INTERPRETATION



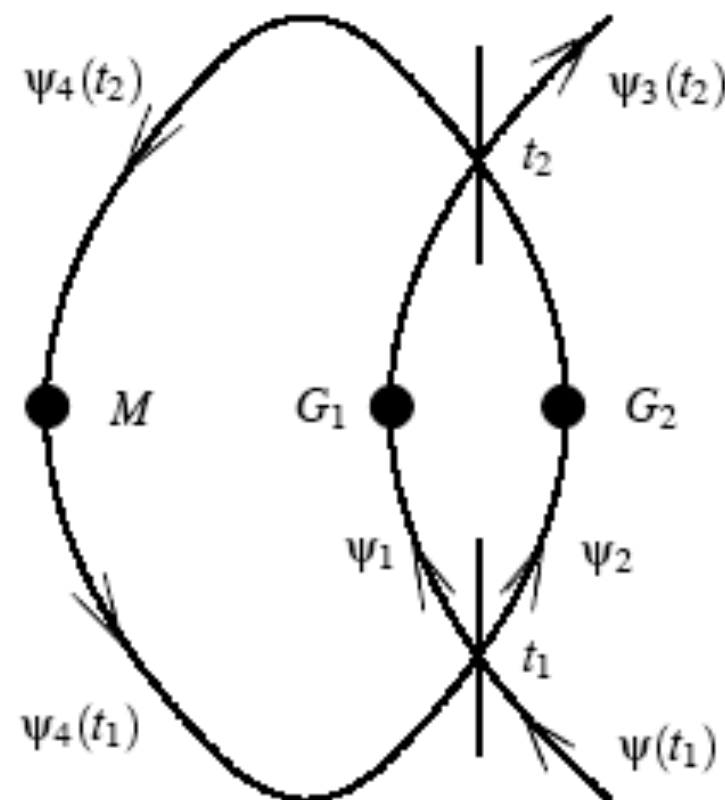
- ◆ Forwards in time
- ◆ Backwards in time
- ◆ Together create a standing wave

-- John Cramer

<http://www.npl.washington.edu/TI/>

QUANTUM INTERFERENCE

www.arxiv.org/pdf/quant-ph/0506027



**Quantum
mechanics looks at
time travel
-- Greenberger &
Svozil, 2005**

FIG. 3: A quantum time evolution scheme with feedback. With no feedback, $\psi(t_1)$ would evolve through G_1 into $\psi_3(t_2)$. There is another evolution channel G_2 and a feedback channel M that alter the output at time t_2 .

GREENBERGER & SVOVIL:



**“Paradox is
useless”**

According to our model, if you travel into the past quantum mechanically, you would only see those alternatives consistent with the world you left behind you. In other words, while you are aware of the past, you cannot change it. No matter how unlikely the events are that could have led to your present circumstances, once they have actually occurred, they cannot be changed. Your trip would set up resonances that are consistent with the future that has already unfolded.

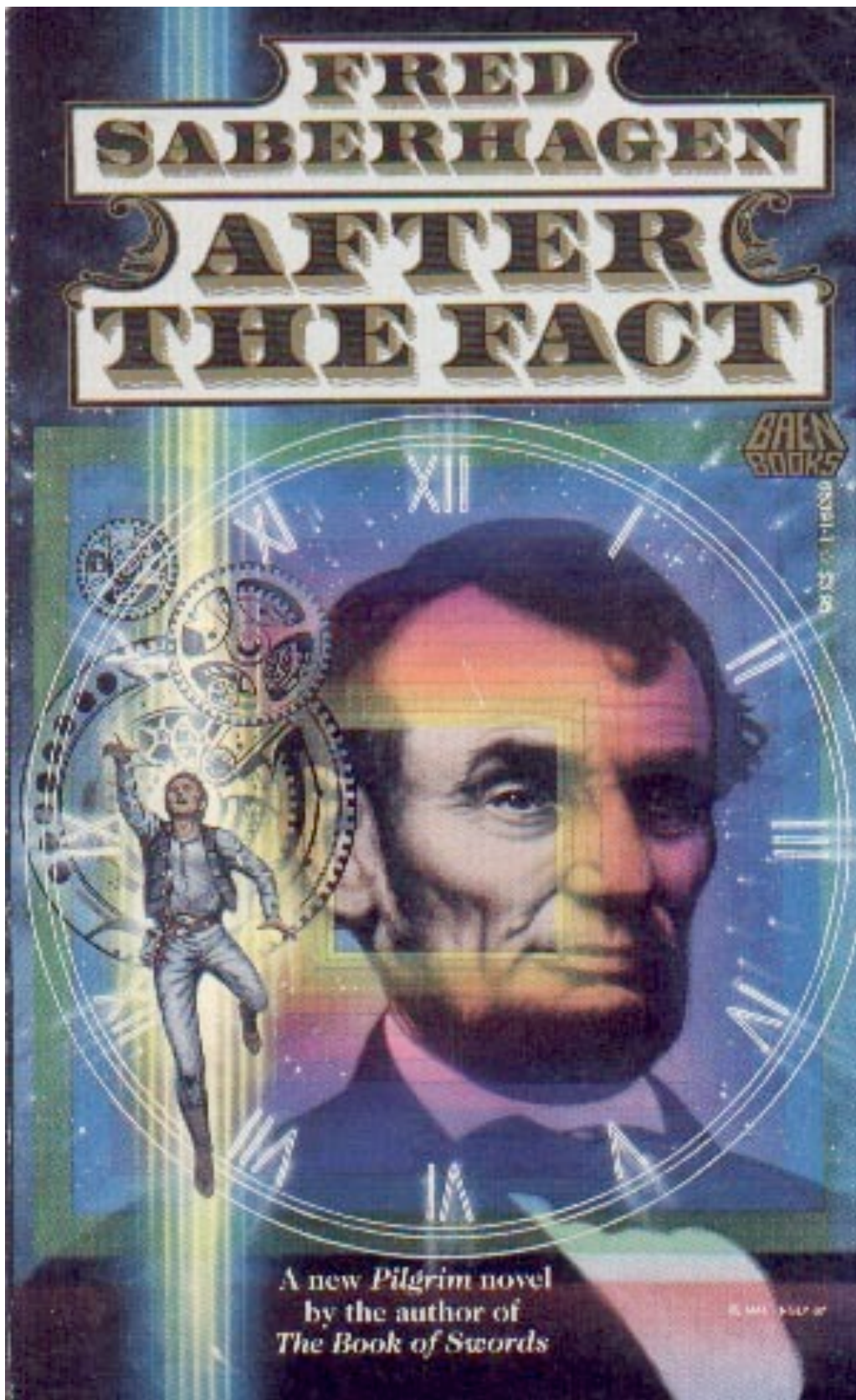
PARADOX NOISE

*"YOUR ONLY CHANCE LIES IN
PREVENTING THE ASSASSINATION
OF PRESIDENT ABRAHAM
LINCOLN ..."*

"What?"

A burst of audio and visual static
reduced reception to
unintelligible noise. Then the
paradox-generated interference
was gone again, as suddenly as it
had come.

*"... Fourteenth of April at Ford's
Theater --" blast, crackle.*



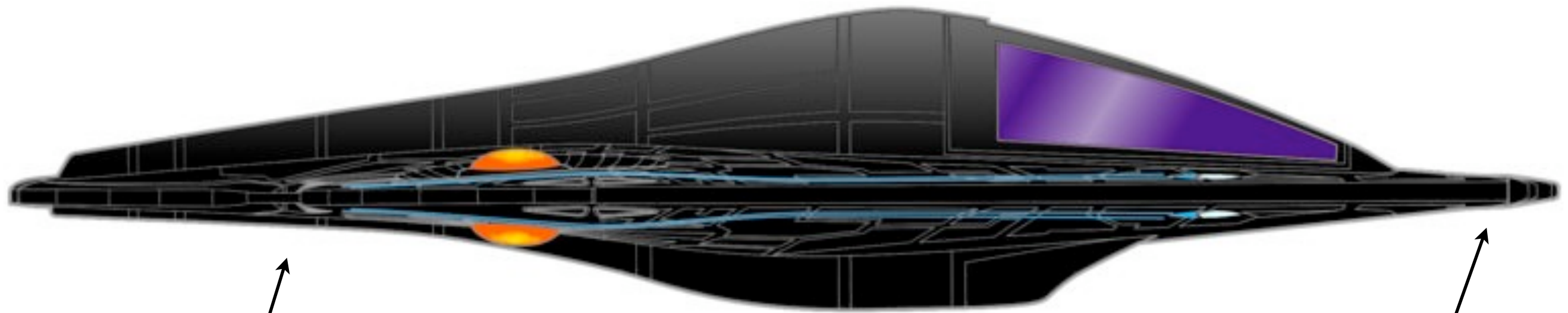
EXULTANT/BAKTER

In this war it wasn't remarkable to have dinged-up ships limping home from an engagement that hadn't happened yet; at Arches Base that occurred every day. And it wasn't unusual to have news from the future. In fact, sending messages to command posts back in the past was a deliberate combat tactic. The flow of information from future to past wasn't perfect; it all depended on complicated geometries of trajectories and FTL leaps.

FASTER THAN LIGHT

**There was a young lady named Bright,
who travelled much faster than light.
She departed one day,
In a relative way,
And returned on the previous night!**

GENERAL RELATIVITY & QUANTUM MECHANICS



SMOOTH

SMALL OVERALL SIZE

**SINGULARITY
GENERATOR**

Branson and Rutan Form "TransLight InterGalactic Spacecraft Company"



[Email this story](#)



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Written by [Felix Minderbinder](#)

Story written: 28 July 2005

LONDON (Reuters)--Billionaire entrepreneur Richard Branson has teamed up with aerospace designer Burt Rutan of Mojave-based Scaled Composites to form a new aerospace [production company](#) which will build a fleet of commercial faster-than-light spaceships using a tachyon-based warp drive.



Branson holds model of his new faster-than-light [spacecraft](#)

Called "The TransLight InterGalactic Spaceship Company" the new [enterprise](#) will manufacture various spacecraft and market them to spaceliner operators. The main client would be Virgin InterGalactic, formed by Branson to handle trans-solar system and intergalactic space tourist flights.

"We'll quickly achieve faster-than-light speed with the new warp drive and be able to take paying passengers out to Pluto and back to Earth in under an hour," Branson enthused.

At present, seats onboard Virgin InterGalactic spaceships are price tagged at \$200,000 each for voyages to the edge of our [solar system](#), but Branson hopes that this seat price will drop over time.

FASTER-THAN-LIGHT



**Wind, flag, mind moves.
The same understanding.
When the mouth opens
All are wrong.**

THE JOURNEY BEGINS..

- **www.arxiv.org** -- physics preprints, basic starting point
- **NASA -- www.grc.nasa.gov/WWW/bpp/**
- **wikipedia -- warp drive, faster-than-light,...**
- **www.physicsguy.com/ftl** -- good on special relativity
- **www.projectrho.com** -- mindful fun
- **John Cramer's Alternate View column for Analog**
- **Faster Than Light -- Nick Herbert**
- **Time Machines -- Paul J. Nahin**

Faster than Light

john.ashmead@timeandquantummechanics.com