

# Missing Pieces for Quantum Mechanics

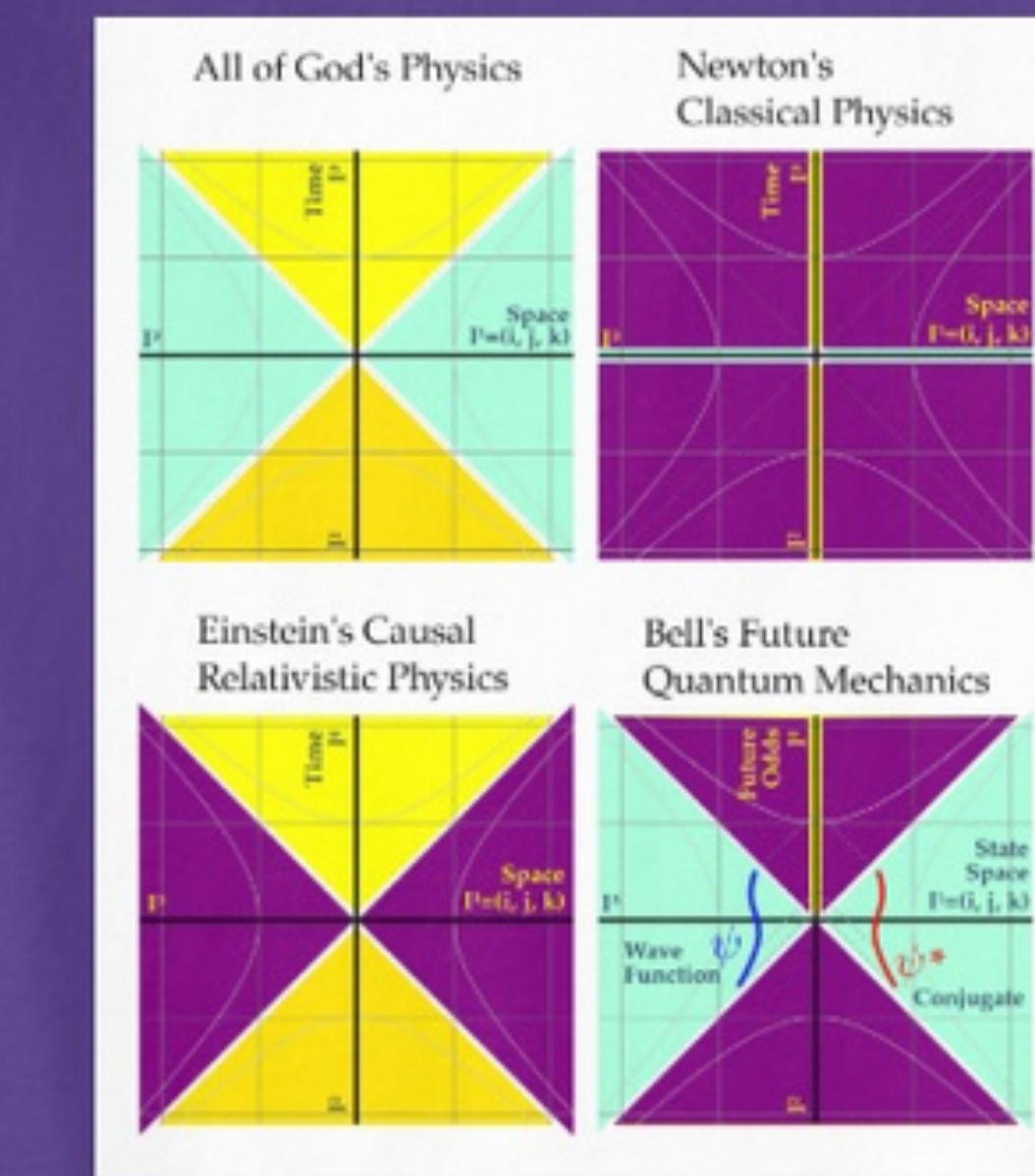
The forth Spiritual Physics Research Series Discussions

Final Friday, April 30, 2021

First Church Unitarian of Littleton, MA

Spiritual framing by Rev. Lara Hoke

Physics research slide presentation by  
Doug Sweetser  
Slide design by Elle Sweetser



A puzzle cannot be solved  
when pieces are missing

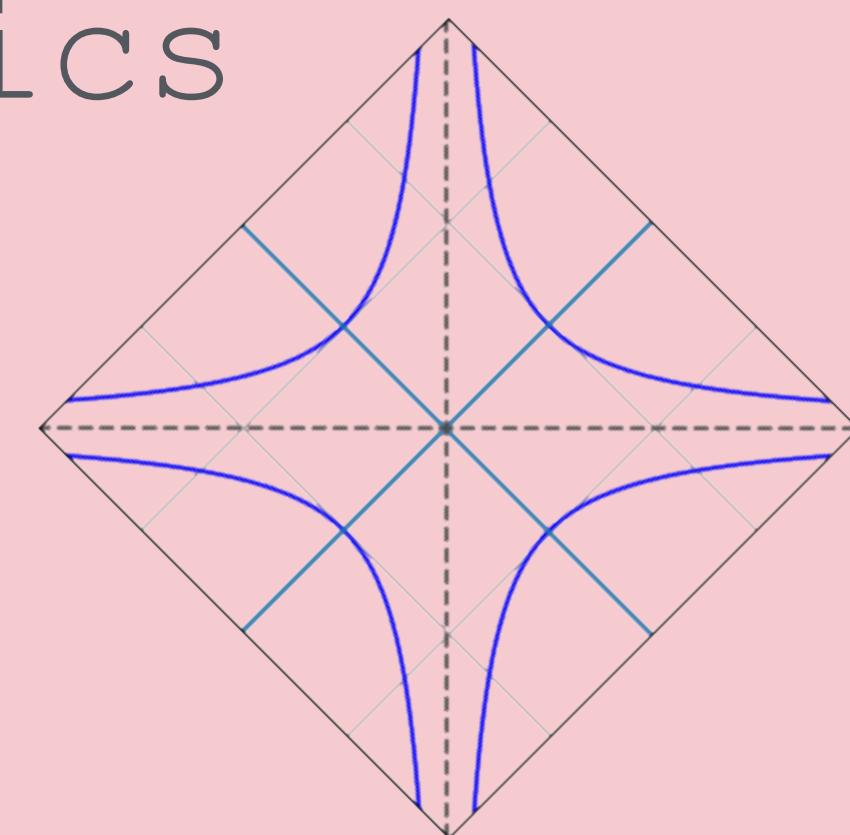
# Outline for tonight's slides

Review last discussion

Discuss God

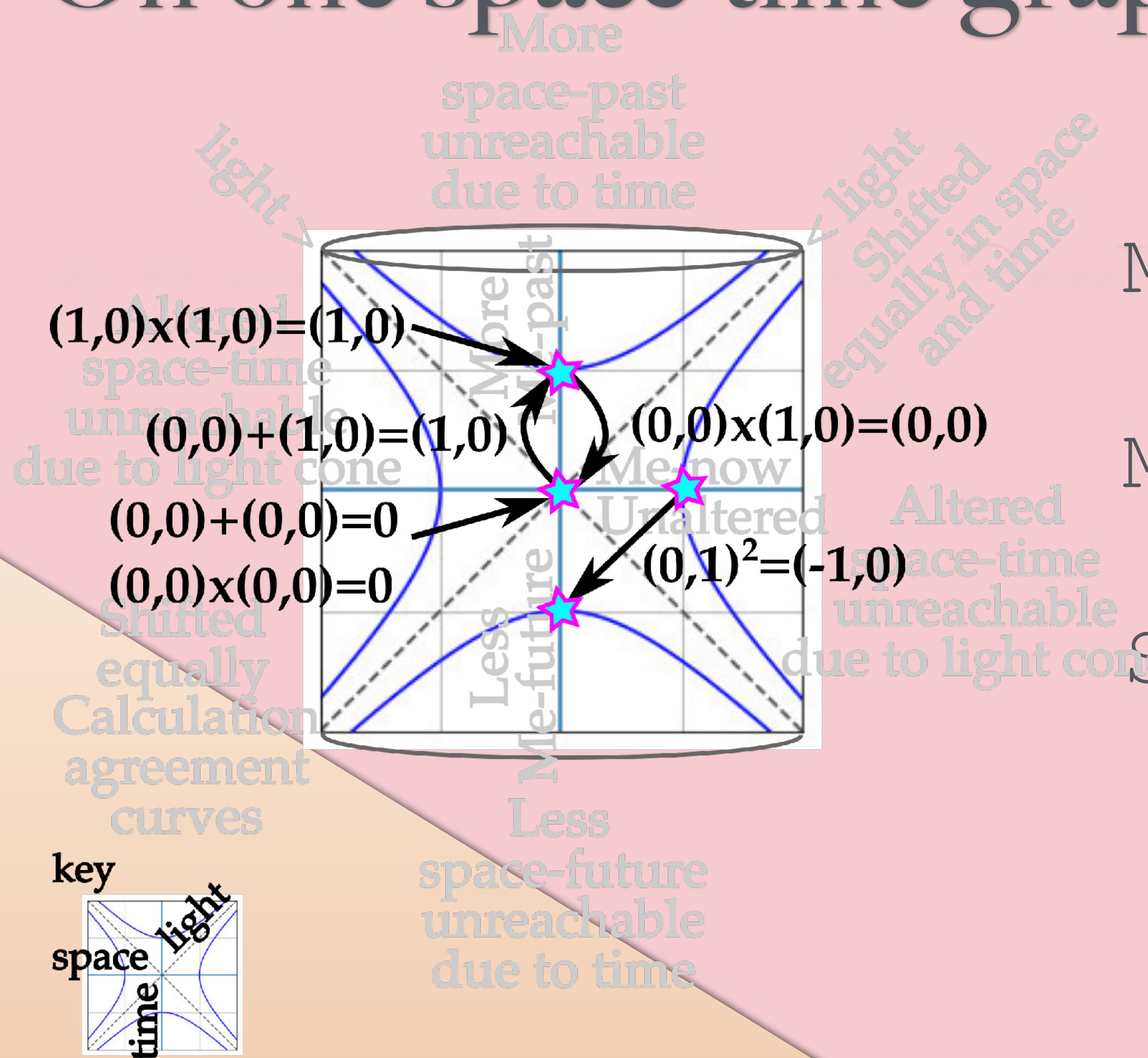
Look at the t-shirt

The mystery of the mystery  
Of quantum mechanics



# The 5 most important equations in physics

## On one space-time graph

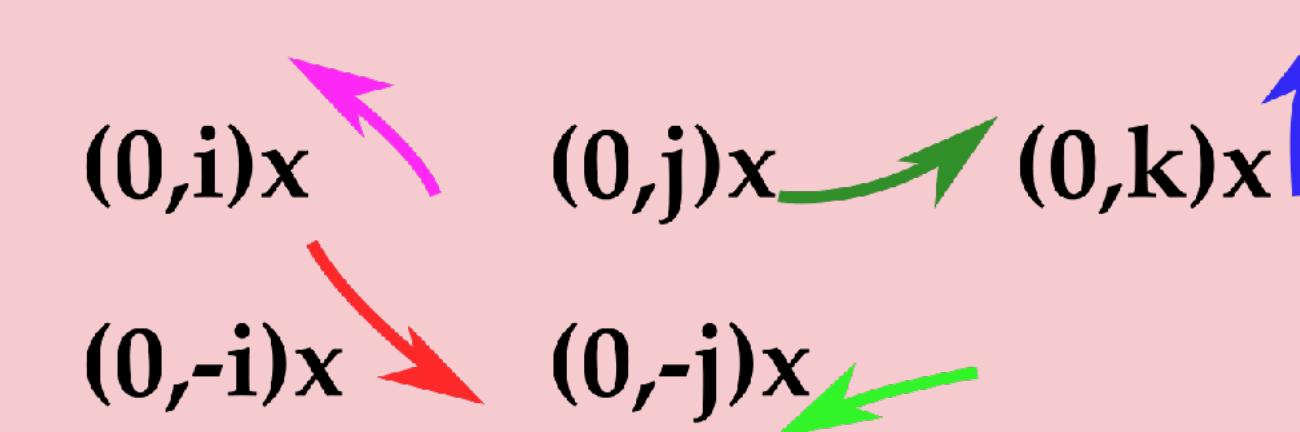
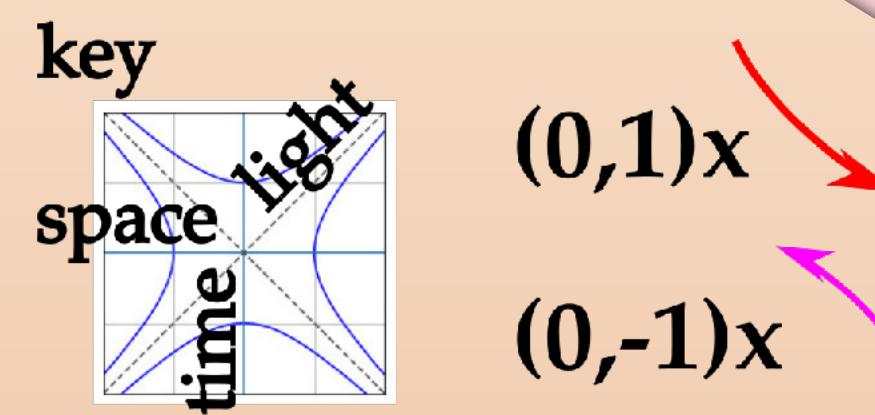
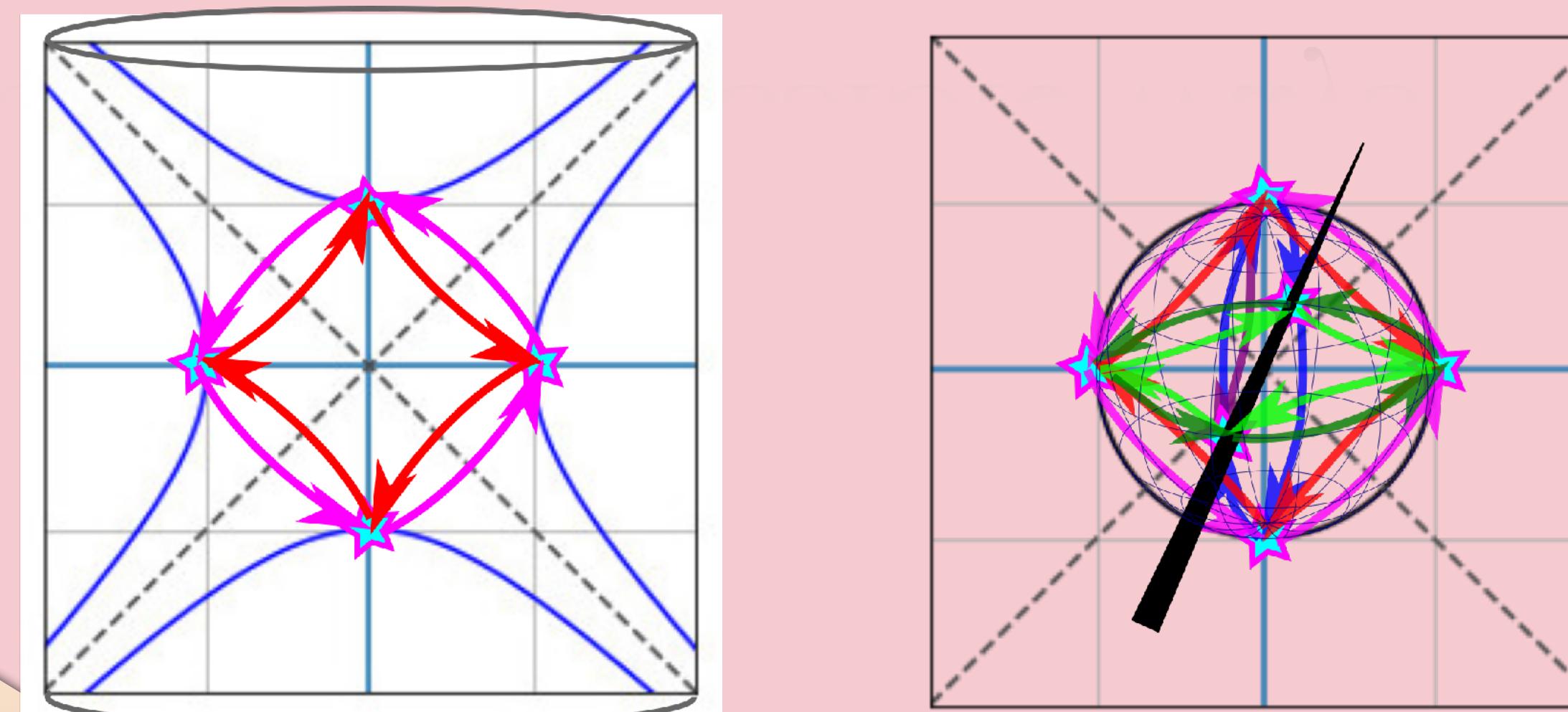


Me-now remains Me-now

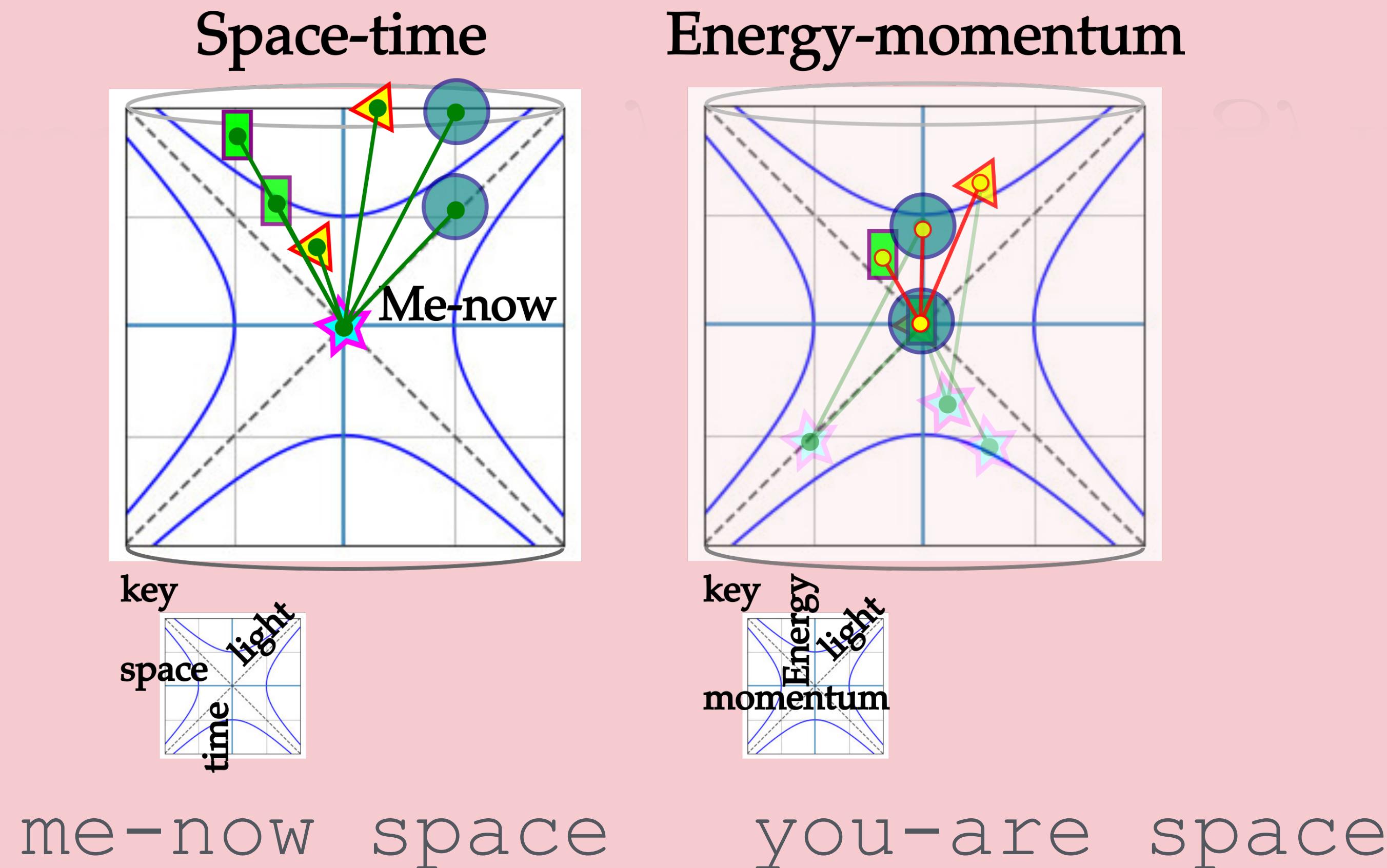
Me-now remembers the past

Square there-now to here-future

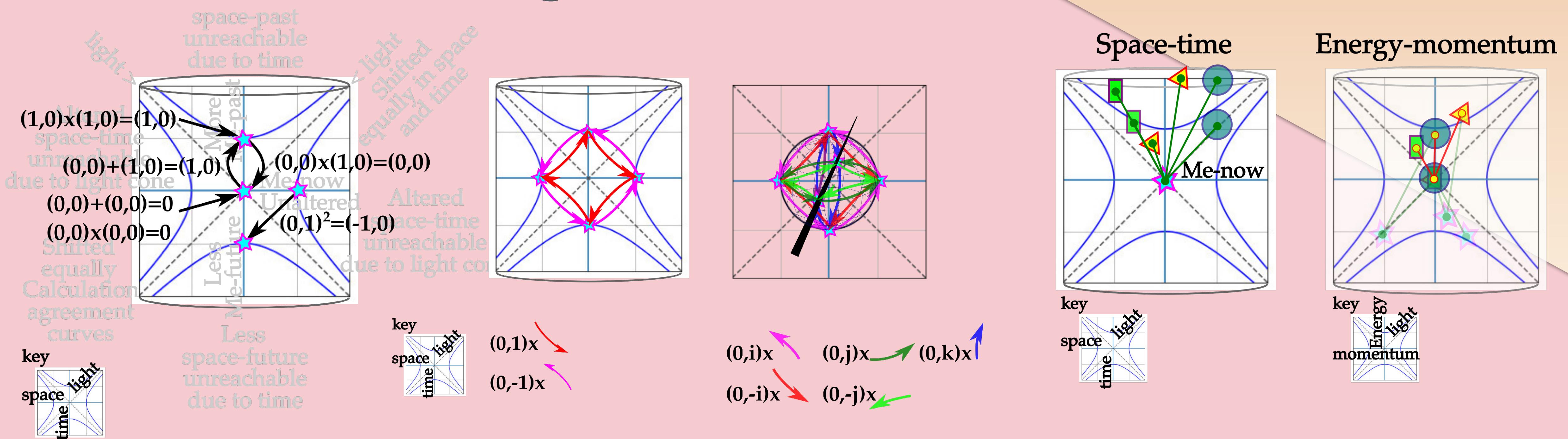
Multiply by 3 there-nows spins the world around me-now in all possible ways



To describe things, we need both me-space  
(space-time) and you-are (energy-momentum)



# Put this all together and it is too much



Numbers  
3D space-time  
Me-space, you-space

# Imagine $10^{23}$ returning-momentum-energy tops!

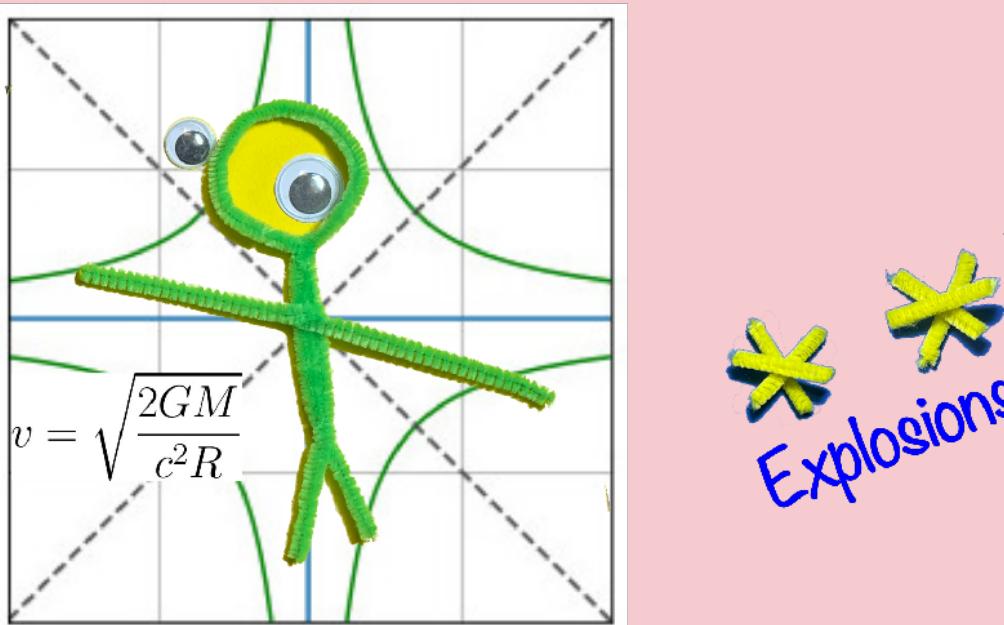


All the random pointing would cancel

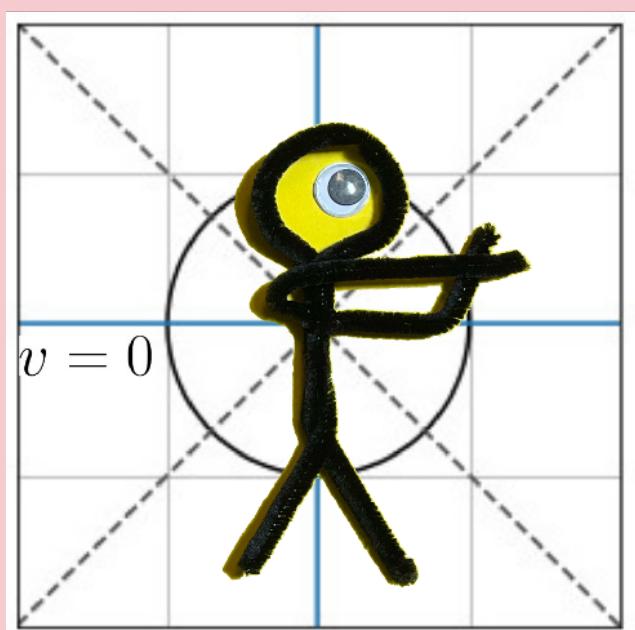
All the energy would add

The new idea:  
Inertia is randomized  
returning-momentum-energy

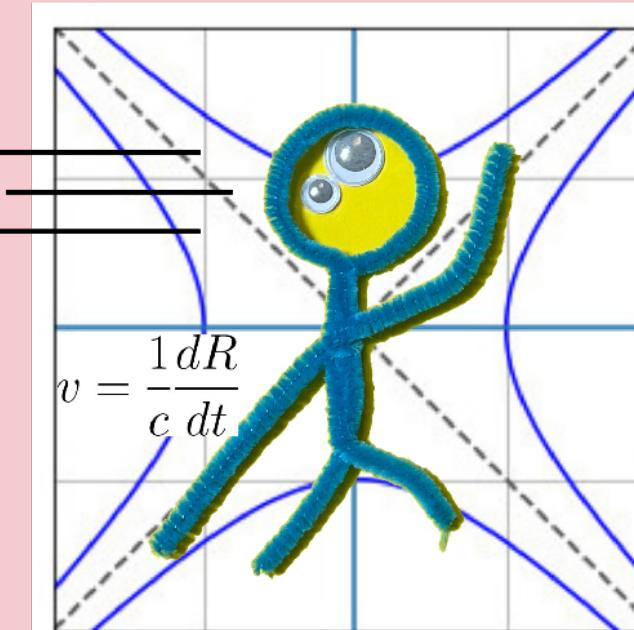
# Speedy relativity uses the velocities you see. Gravity relativity uses escape velocity, calculated



High Guy is  
Gravity relativity



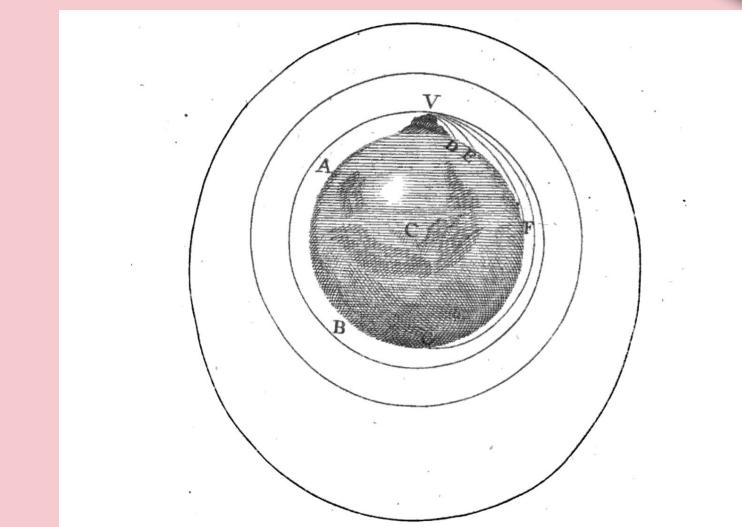
Me here-now  
Precise!



Zippy You is  
Special relativity

Same hyperbolas, rotated by 45 degrees

$$v_{esc} = \sqrt{2 \frac{GM}{c^2 R}}$$



$$\begin{aligned} d\tau^2 &= dt^2 - dx^2 \\ d\tau'^2 &= dt'^2 - dx'^2 \\ &= \frac{1}{\gamma^2} dt^2 - \gamma^2 dx^2 \\ &\approx (1 - \beta^2) dt^2 - (1 + \beta^2) dx^2 \\ \text{if } \beta &= \sqrt{2 \frac{GM}{c^2 R}} \\ d\tau'^2 &\approx \left(1 - 2 \frac{GM}{c^2 R}\right) dt^2 - \left(1 + 2 \frac{GM}{c^2 R}\right) dx^2 \end{aligned}$$

# God, your Kendi definition? (His Antiracist book chapters start with definitions)

Polytheist - show profound respect (hard)

Old testament - harsh male

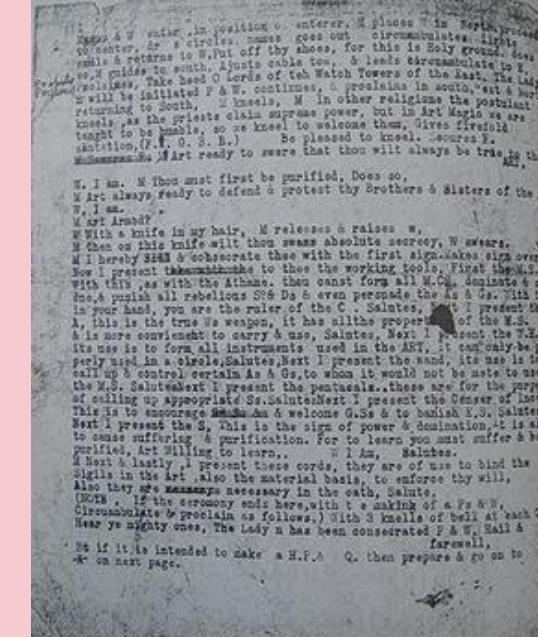
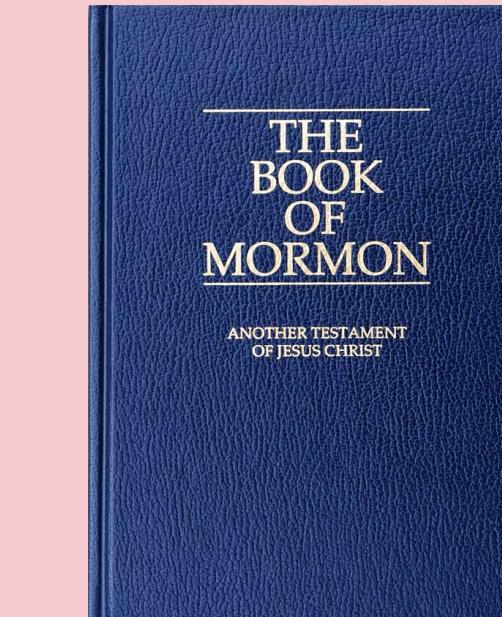
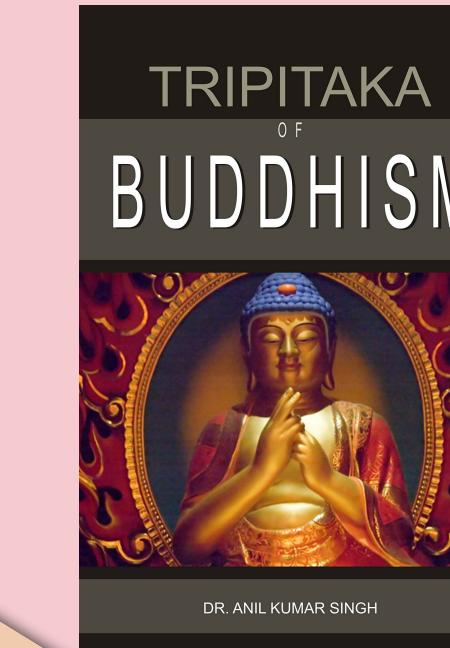
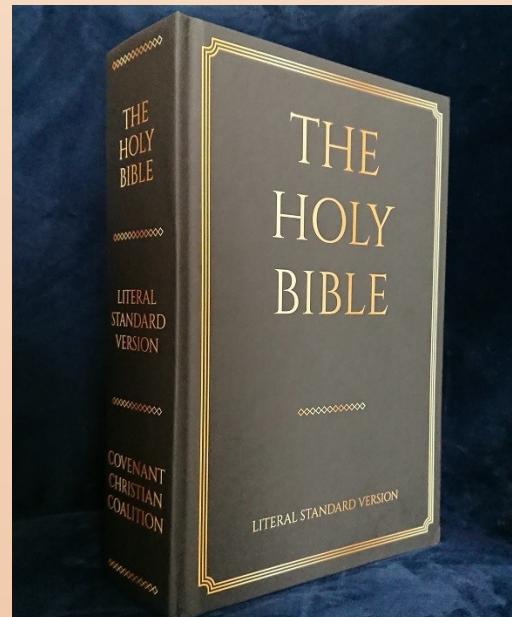
New testament - loving male (if you accept)

Koran - the one God that is all and too much

Tripitaka - Goal of enlightenment, not God

The Book of Mormon - Jesus in the USA

The Book of Shadows - diverse pagan covens



# My own personal definition

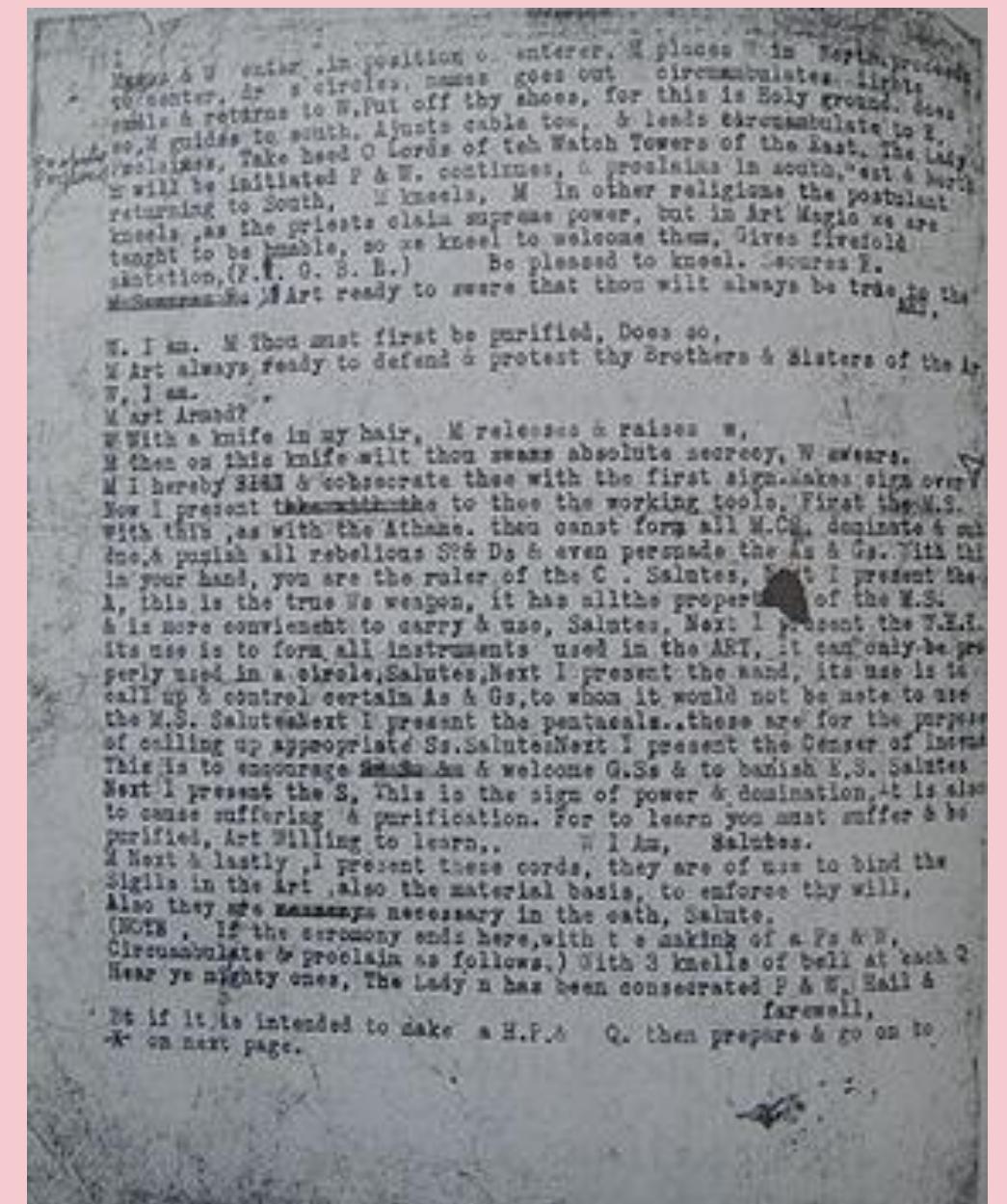
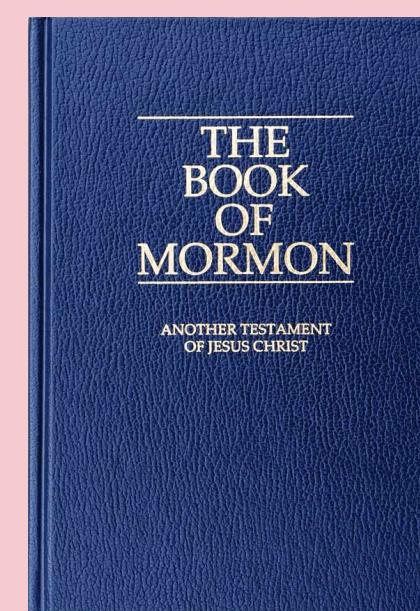
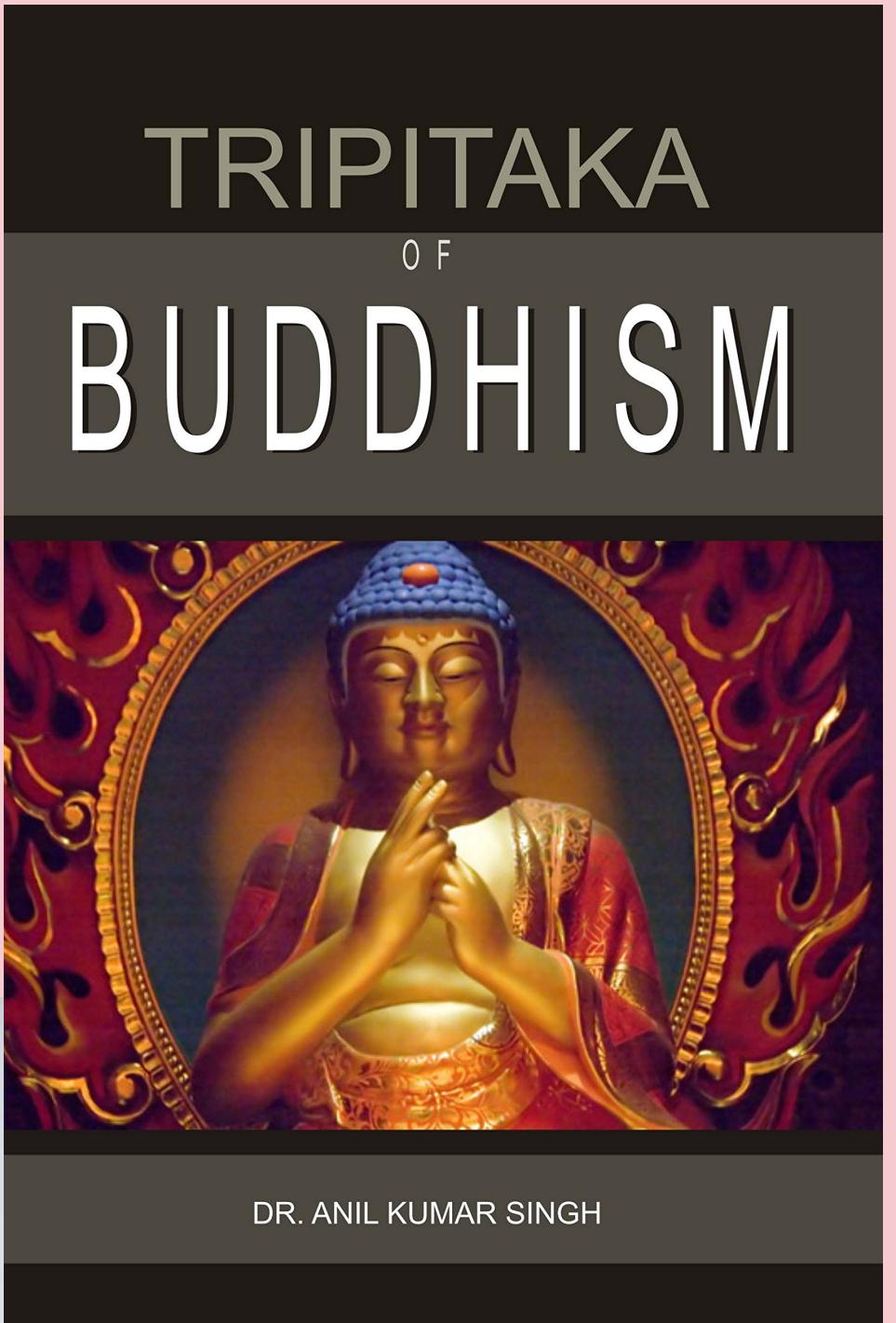
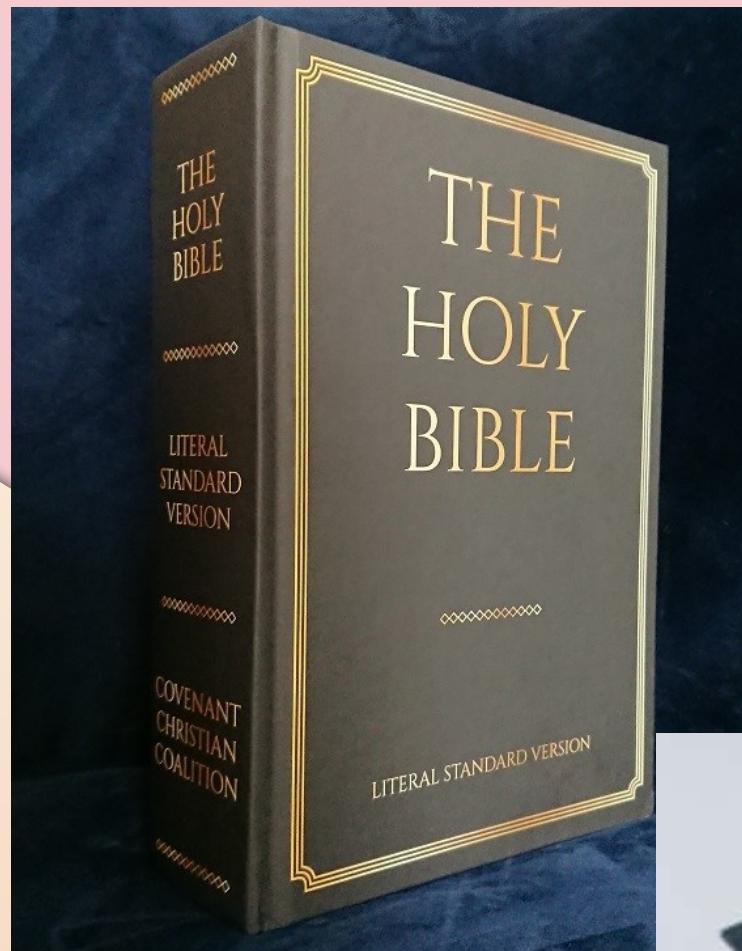
God is every event that ever was anywhere-when  
and

Every event ever that will be anywhere-when  
And

The only door between the past to the future  
Is through you and me

Physics study is close to  
this definition of God!

# As a Unitarian Universalist with this definition of God, I embrace the diversity of God



# Quantum Mechanics, your definition?

## 13 listed in the chart to choose from...

Interpretation	Year published	Author(s)	Deterministic?	Ontic wave-function?	Unique history?	Hidden variables?	Collapsing wave-functions?	Observer role?	Local dynamics?	Cou fact defi
Ensemble interpretation	1926	Max Born	Agnostic	No	Yes	Agnostic	No	No	No	
Copenhagen interpretation	1927-	Niels Bohr, Werner Heisenberg	No	Some <sup>[54]</sup>	Yes	No	Some <sup>[55]</sup>	No <sup>[56][57]</sup>	Yes	
de Broglie-Bohm theory	1927-1952	Louis de Broglie, David Bohm	Yes	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	Yes	Phenomenological	No	No	
Quantum logic	1936	Garrett Birkhoff	Agnostic	Agnostic	Yes <sup>[c]</sup>	No	No	Interpretational <sup>[d]</sup>	Agnostic	
Time-symmetric theories	1955	Satosi Watanabe	Yes	No	Yes	Yes	No	No	No <sup>[58]</sup>	
Many-worlds interpretation	1957	Hugh Everett	Yes	Yes	No	No	No	No	Yes	III
Consciousness causes collapse	1961-1993	John von Neumann, Eugene Wigner, Henry Stapp	No	Yes	Yes	No	Yes	Causal	No	
Many-minds interpretation	1970	H. Dieter Zeh	Yes	Yes	No	No	No	Interpretational <sup>[e]</sup>	Yes	III
Consistent histories	1984	Robert B. Griffiths	No	No	No	No	No <sup>[f]</sup>	No	Yes	
Transactional interpretation	1986	John G. Cramer	No	Yes	Yes	No	Yes <sup>[g]</sup>	No	No <sup>[h]</sup>	
Objective collapse theories	1986-1989	Ghirardi-Rimini-Weber, Penrose interpretation	No	Yes	Yes	No	Yes	No	No	
Relational interpretation	1994	Carlo Rovelli	No <sup>[59]</sup>	No	Agnostic <sup>[i]</sup>	No	Yes <sup>[j]</sup>	Intrinsic <sup>[k]</sup>	Possibly <sup>[l]</sup>	
QBism	2010	Christopher Fuchs, Rüdiger Schack	No	No <sup>[m]</sup>	Agnostic <sup>[n]</sup>	No	Yes <sup>[o]</sup>	Intrinsic <sup>[p]</sup>	Yes	

"I think I can  
safely say no one  
understands  
quantum mechanics"  
Richard Feynman

# Einstein was always impress with QM success, Not with the ontology- why it worked



"Quantum theory yields much, but it hardly brings us close to the Old One's secrets. I, in any case, am convinced He does not play dice with the universe." Letter to Born

"Einstein, stop telling God what to do." Bohr

# Einstein would not be happy with any of the 13 I don't embrace this diversity



His objects were subtle and evolved.  
We must be missing IDEAS to this day.

Interpretation	Year published	Deterministic?	Ontic wave-function?	Unique history?	Hidden variables?	Collapse without an observer?	Observer function?	Local dynamics?	Coupling defn?
Ensemble interpretation	1927–1930	Agnostic	No	Yes	Agnostic	No	No	No	No
Copenhagen interpretation	1927–1952	Yes <sup>[a]</sup>	Some <sup>[b]</sup>	Yes	No	No	Yes	No	No
de Broglie–Bohm theory	1927–1952	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	Yes <sup>[b]</sup>	No	No	No	No	No
Quantum logic	1936	George Birkhoff, John von Neumann	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	No	Interpretational <sup>[d]</sup>	Agnostic	No
Time-symmetric theories	1955	Satoshi Watanabe	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	No	No	No <sup>[e]</sup>	No <sup>[f]</sup>
Many-worlds interpretation	1957	Hugh Everett	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	No	Yes	Yes	Yes
Consciousness causes collapse	1961–1993	John von Neumann, Eugene Wigner, Henry Stapp	No	Yes	Causal	No	No	No	No
Many-minds interpretation	1970	H. Dieter Zeh	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	Interpretational <sup>[e]</sup>	Yes	Yes	Yes
Consistent histories	1984	Robert Griffiths	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	No	Yes	Yes	Yes
Transactional interpretation	1986	John Cramer	Yes <sup>[a]</sup>	Yes <sup>[b]</sup>	No	No	No <sup>[h]</sup>	No <sup>[h]</sup>	No <sup>[h]</sup>
Objective collapse theories	1990	John Wheeler, Hugh Everett III	Yes	Yes	No	No	No	No	No
Relational interpretation	2001	Robert G. Ross	No <sup>[g]</sup>	No <sup>[g]</sup>	Agnostic <sup>[i]</sup>	No	No	Possibly <sup>[j]</sup>	Possibly <sup>[j]</sup>
QBism	2010	John C. Stapp	No	No <sup>[m]</sup>	Agnostic <sup>[n]</sup>	No	Yes	Intrinsic <sup>[o]</sup>	Yes

# A new idea: use space-time numbers as an Upgrade to complex numbers

All calculation in QM today only use complex numbers

Complex numbers have 2 parts

What ARE they??? NO idea

Space-time numbers have 4 parts, three for space, one for time

# Upgrade to complex numbers for QM talks have not gone well - the usual silence

I am a flawed spokesman

- No institutional backing
- Physicists know I am not a physicist
- Spotty training at best

8 old guys in a Zoom room for 30'  
No discussions.

I think the idea will be repackaged by  
others some day

# Complex numbers are about space-time, where space is lumped together (my view only)

Real numbers are different from imaginaries  
Time is different from space

To reverse in time, one needs to remember  
To reverse in space, one needs a mirror

Might as well make space 3D, not 1D.

Pros: complex numbers are a tool without physical meaning

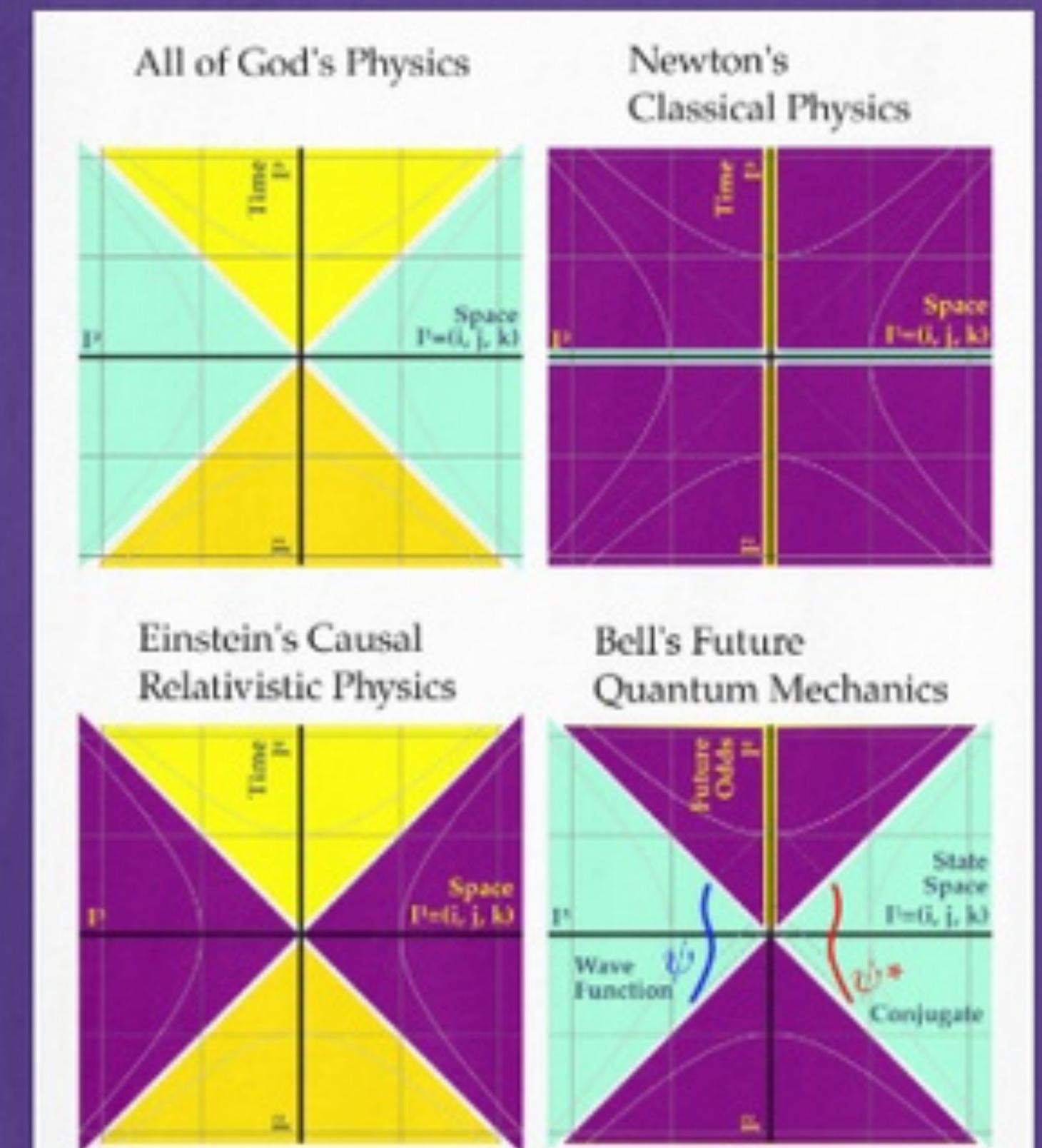
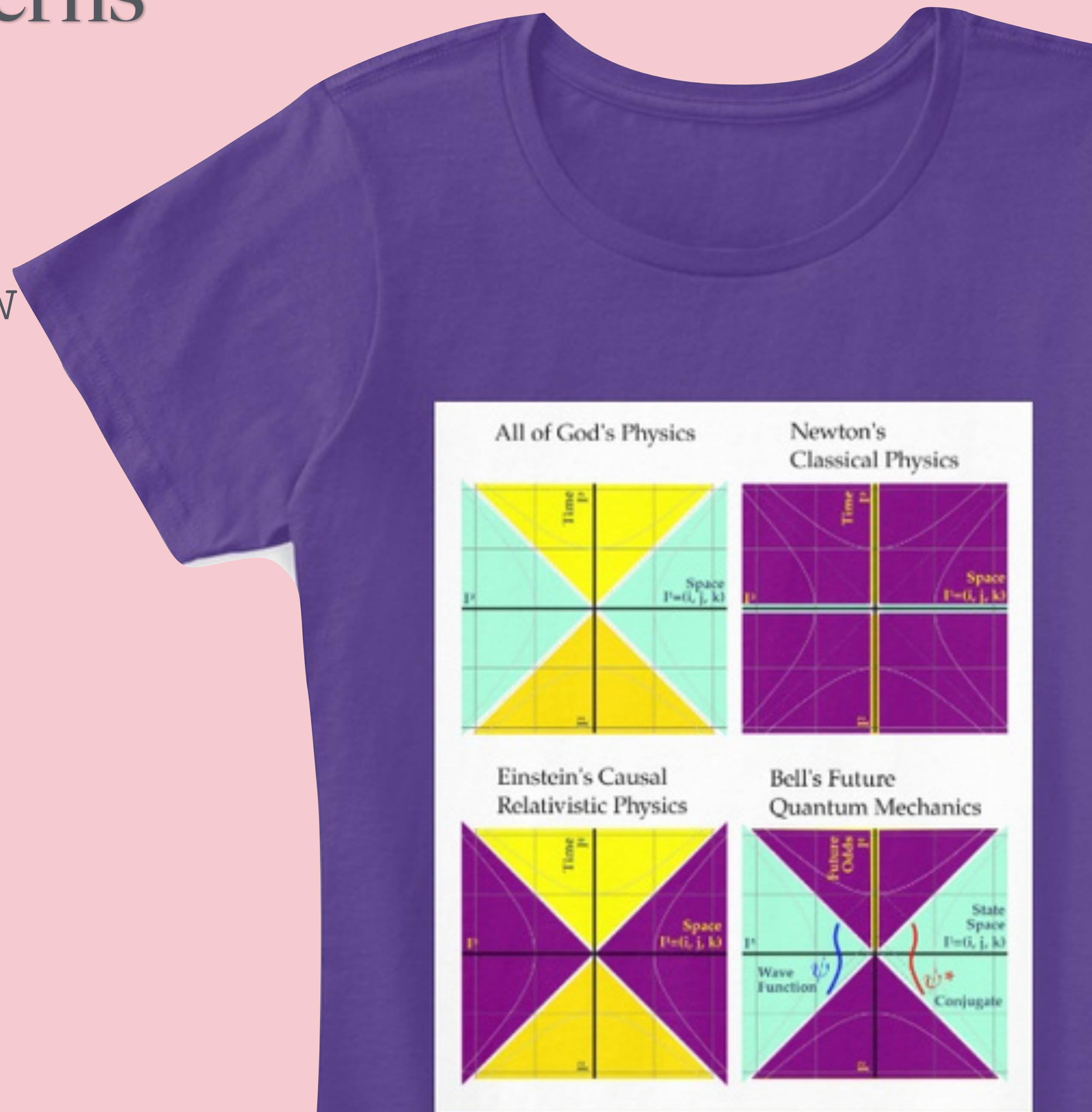
Missing idea I:  
2D complex numbers to 4D space-time numbers  
for a 4D Universe

# Look at the color patterns In the t-shirt

Dark and light yellow

Turquoise

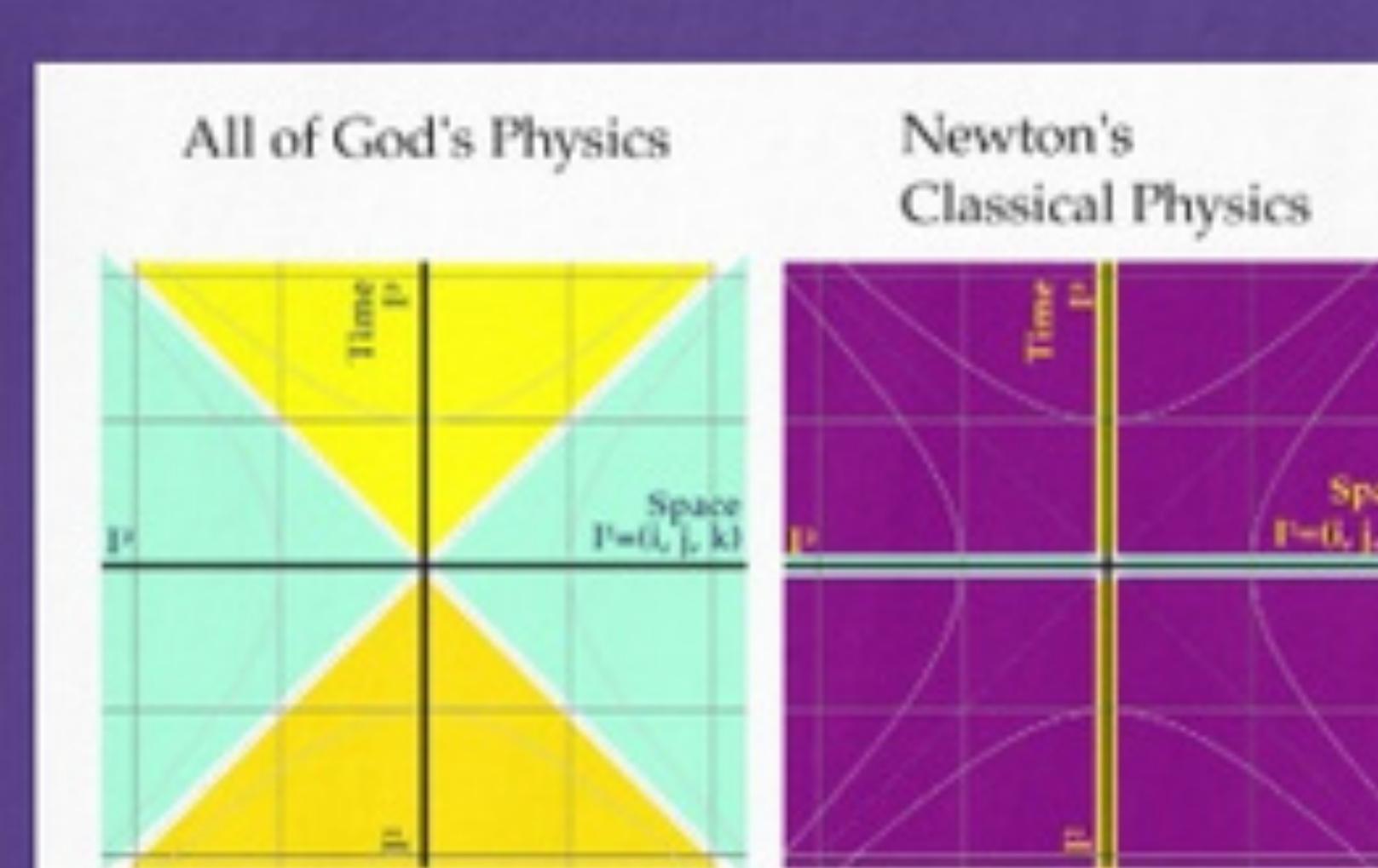
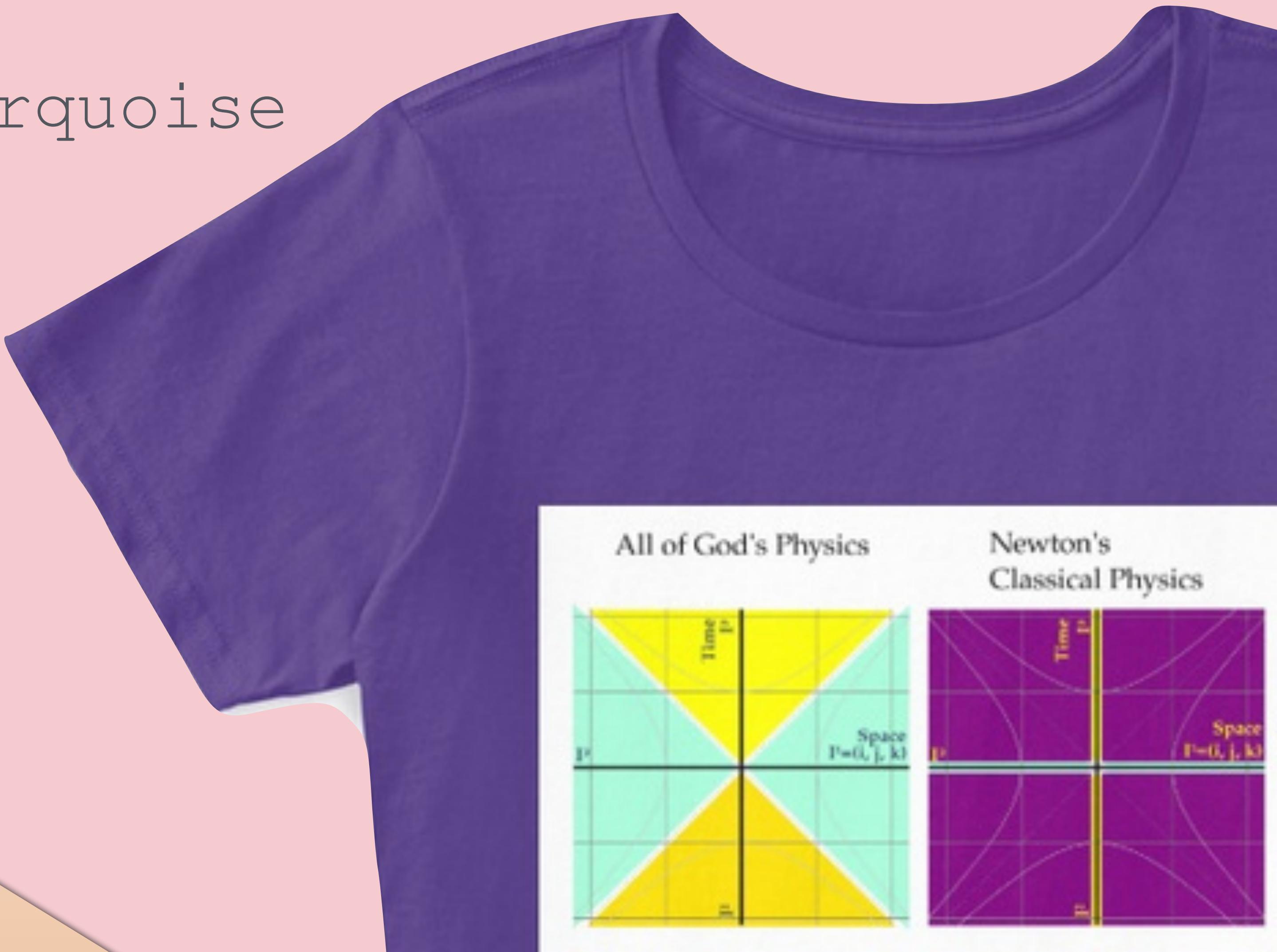
Dark purple



# Look at the color patterns In the t-shirt

All yellow and turquoise

Almost all purple



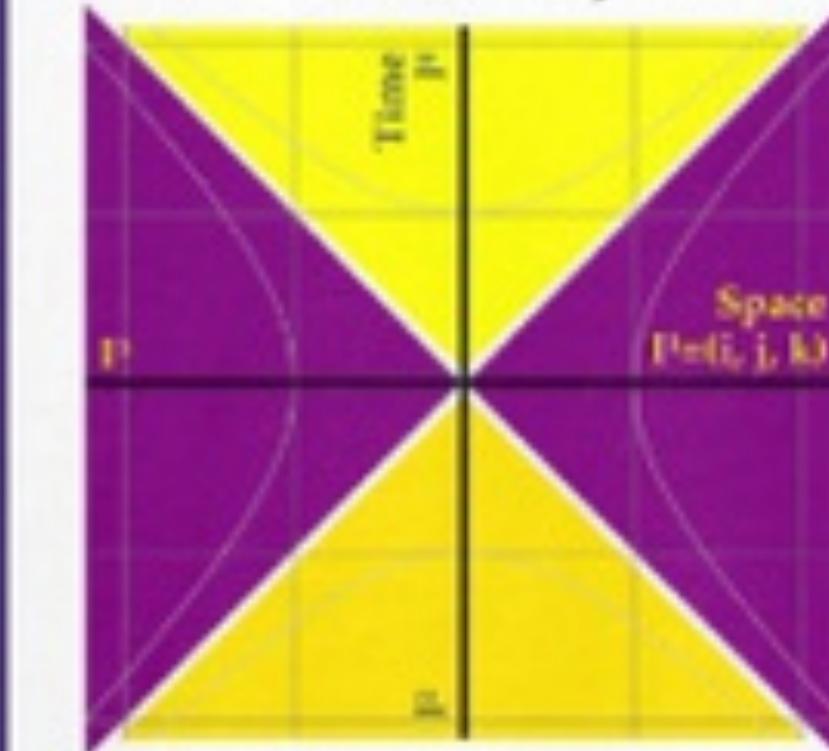
# Look at the color patterns In the t-shirt

Half yellow  
Half purple

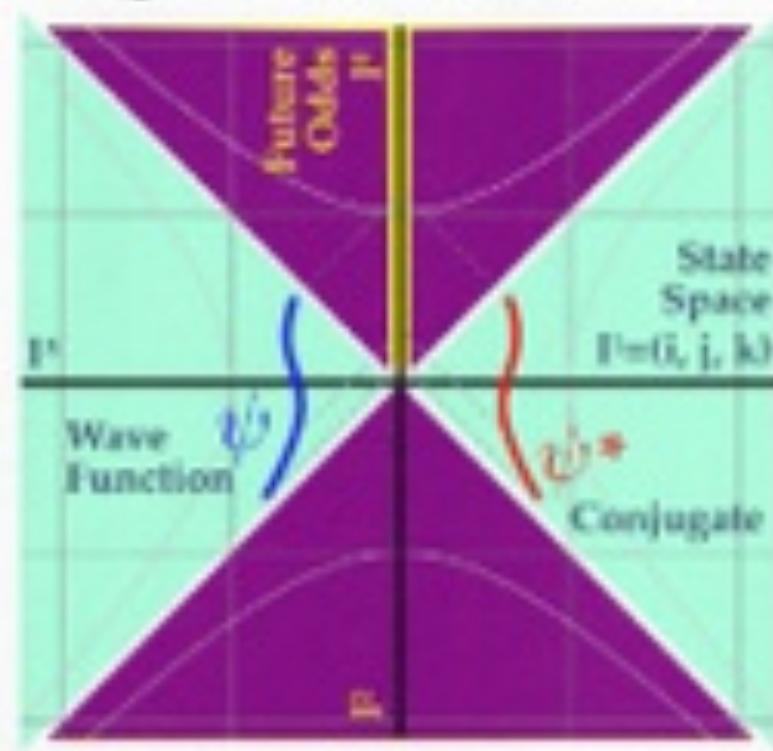
And

Half green  
Half purple

Einstein's Causal  
Relativistic Physics



Bell's Future  
Quantum Mechanics



# The 4 labels

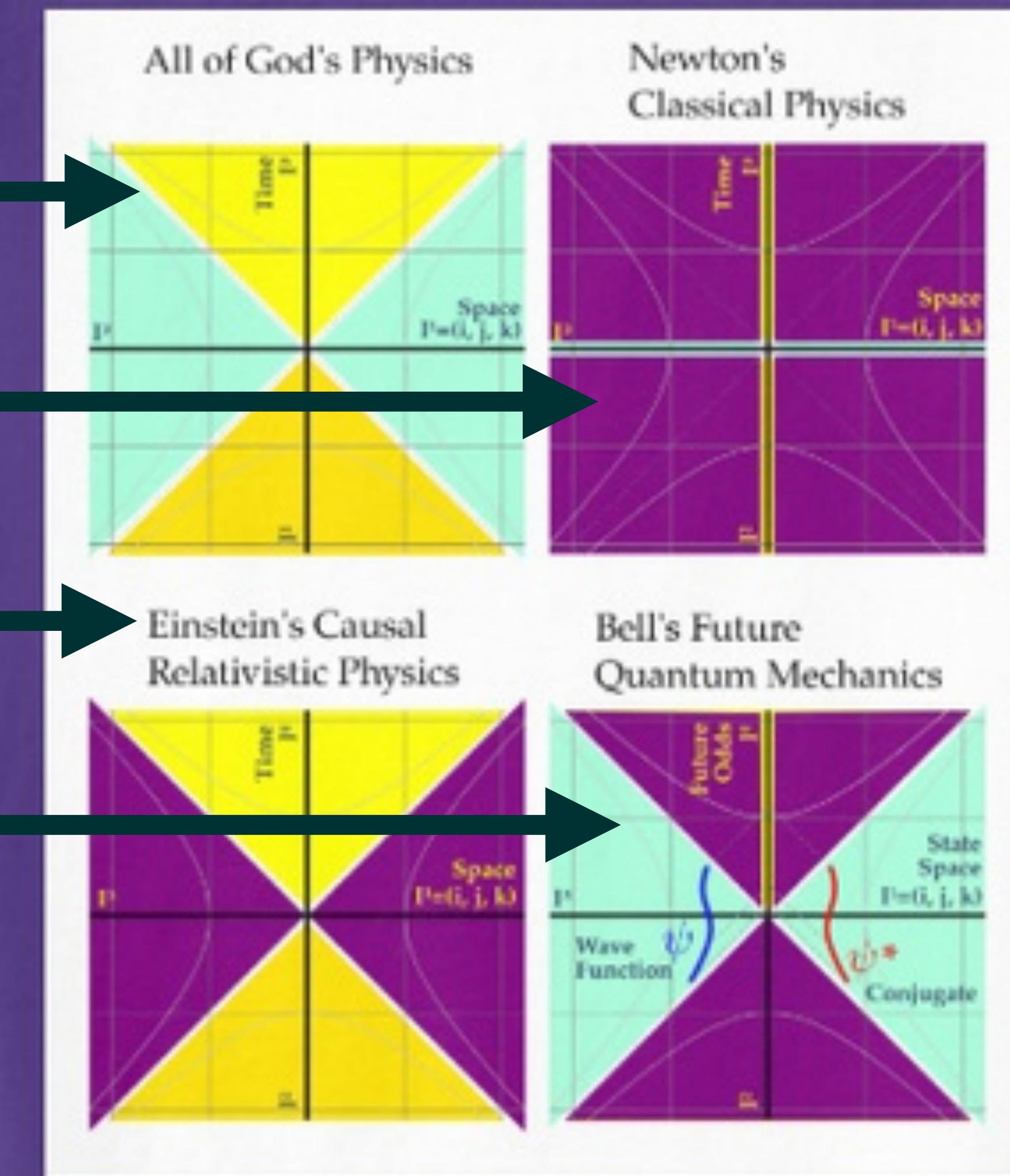
All of God's physics

Newton's classical physics

Einstein's Causal Relativistic physics

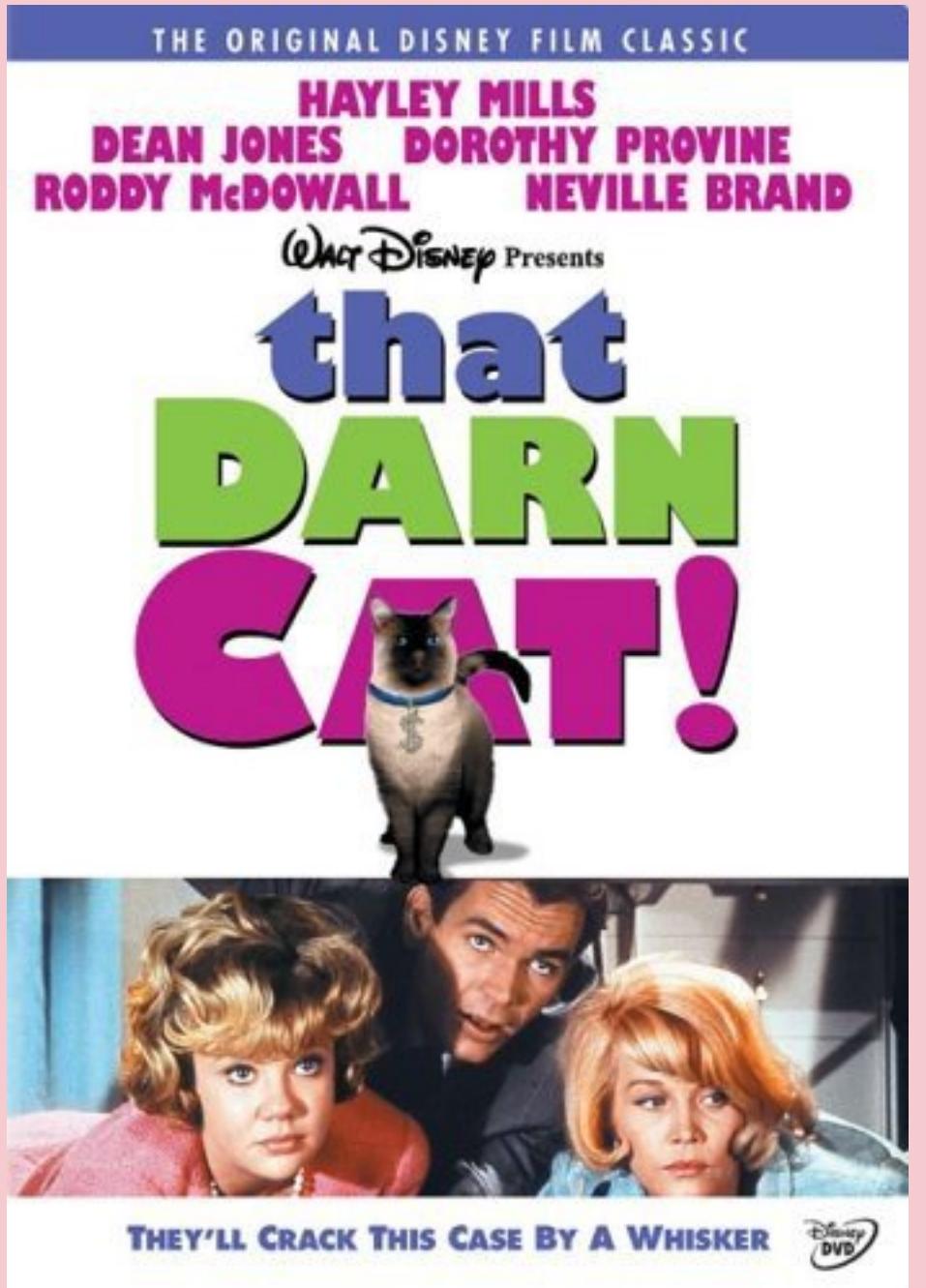
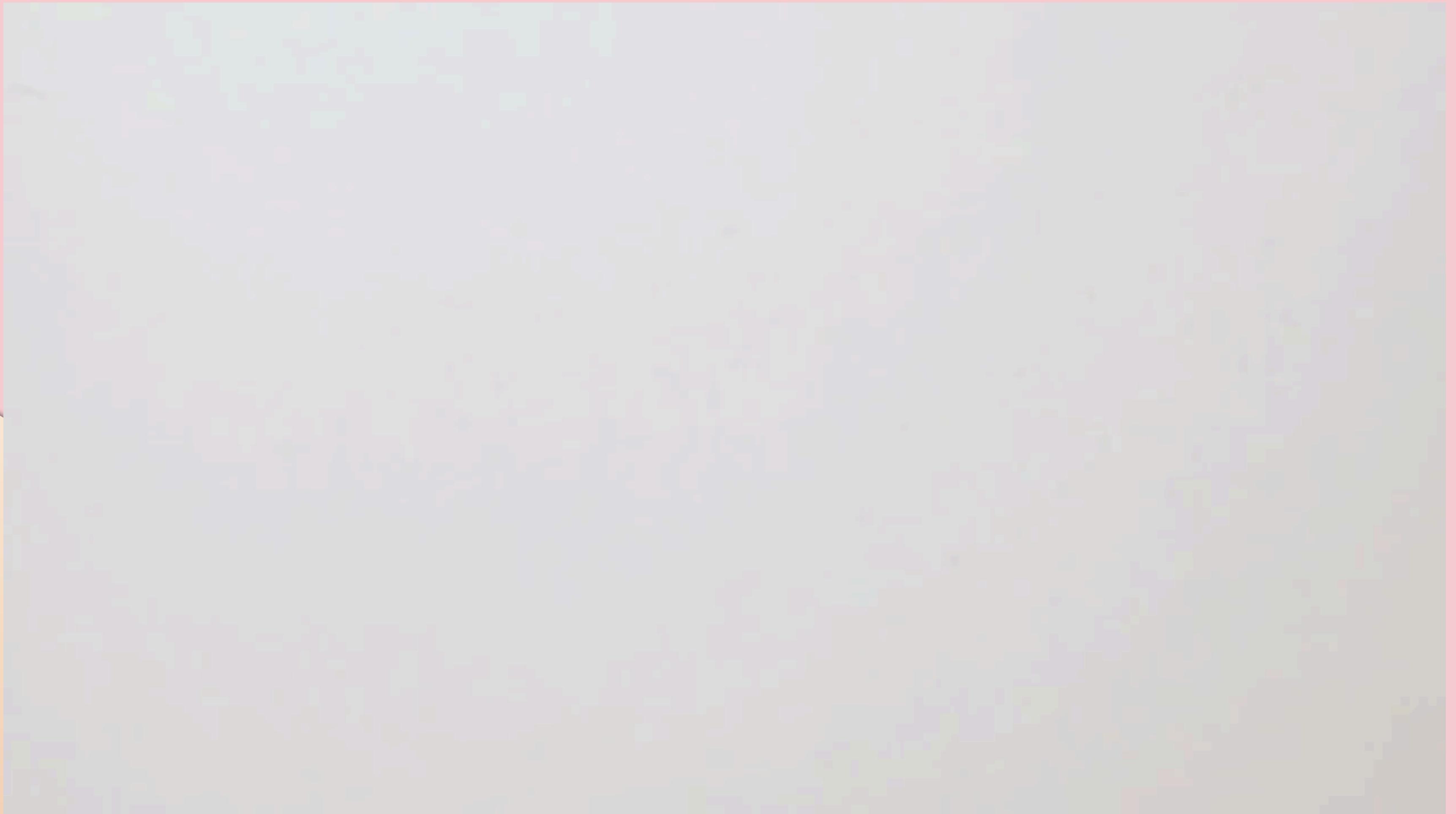
Bell's Future QM

Note: no one draws these

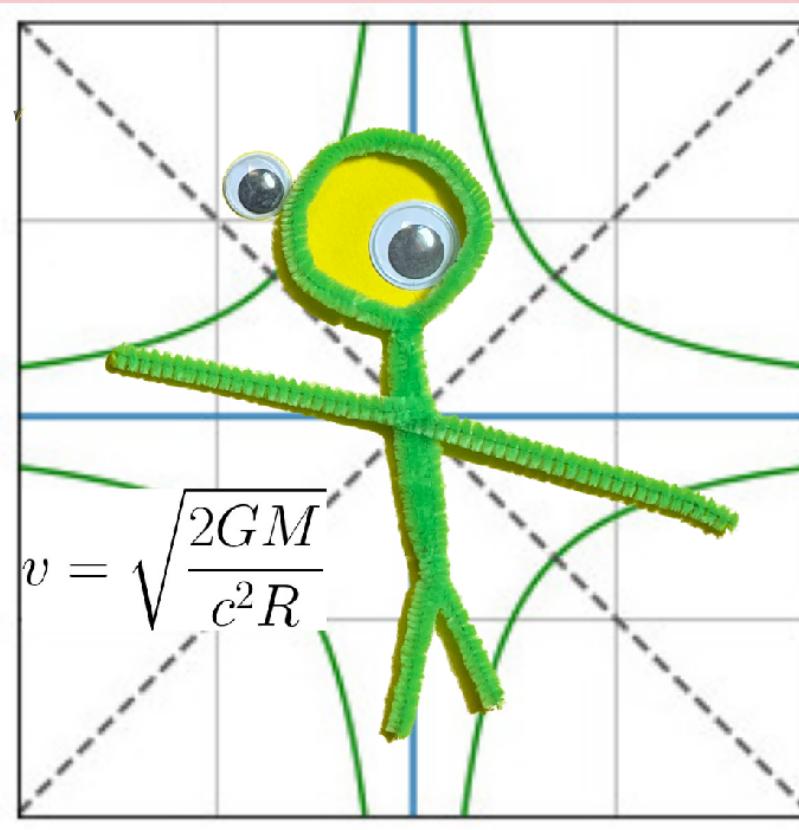


Missing idea 2:  
Use space-like regions of space-time for  
quantum mechanics

# That darn cat of Schrödinger



“I think I can safely say no one understands quantum mechanics” Richard Feynman

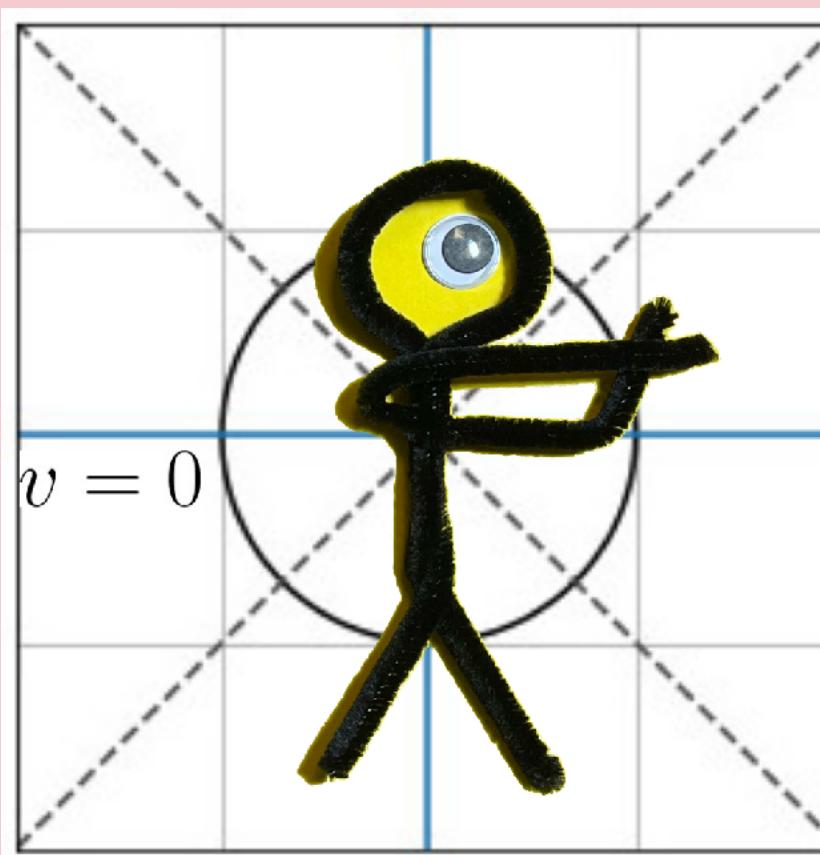


High Guy is  
Gravity relativity



$$(dt, dx, dy, dz)^2 =$$

$$(dt^2 - (dx^2 + dy^2 + dz^2), 2dtdx, 2dtdy, 2dtdz)$$



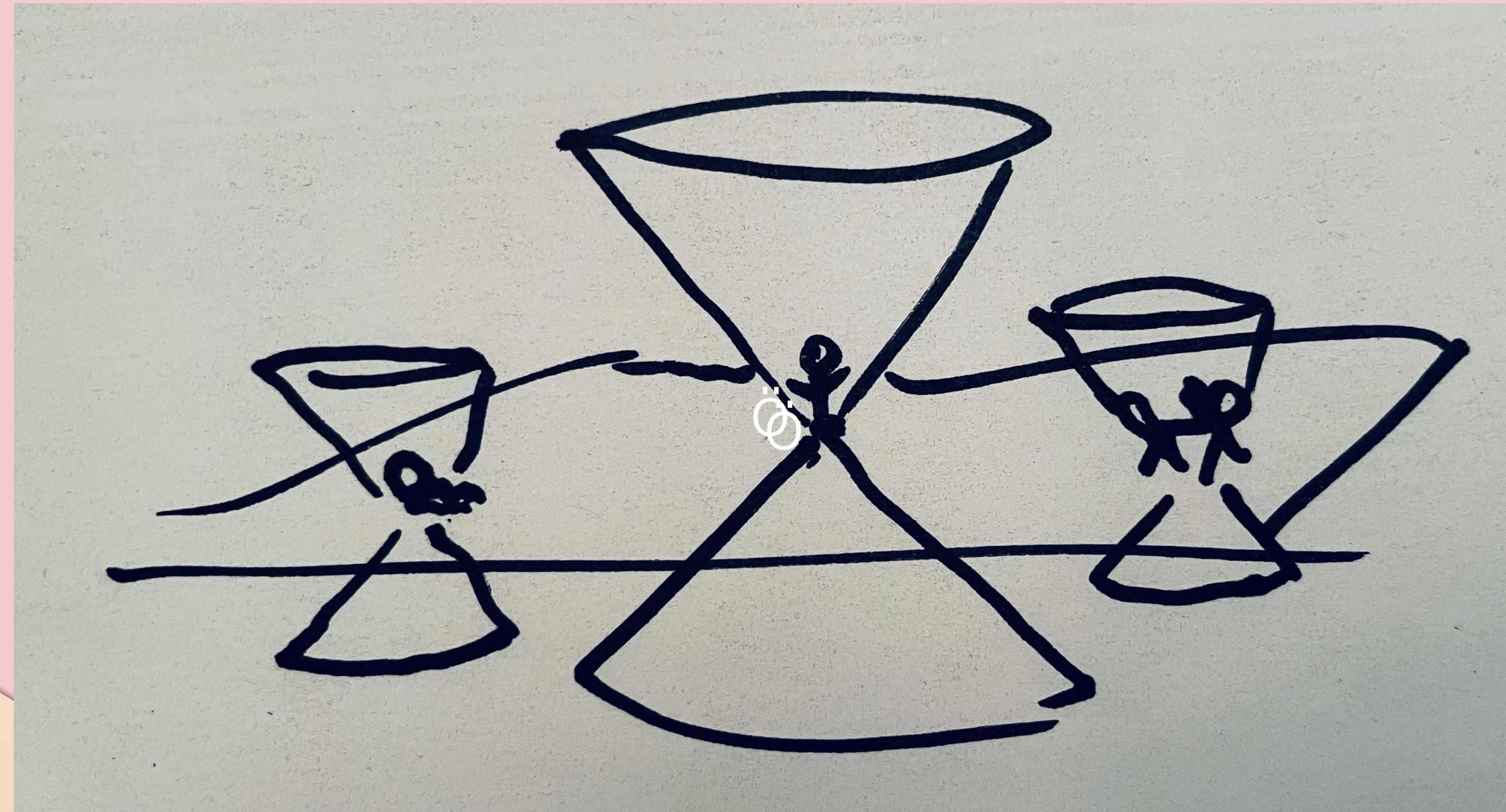
Me here-now



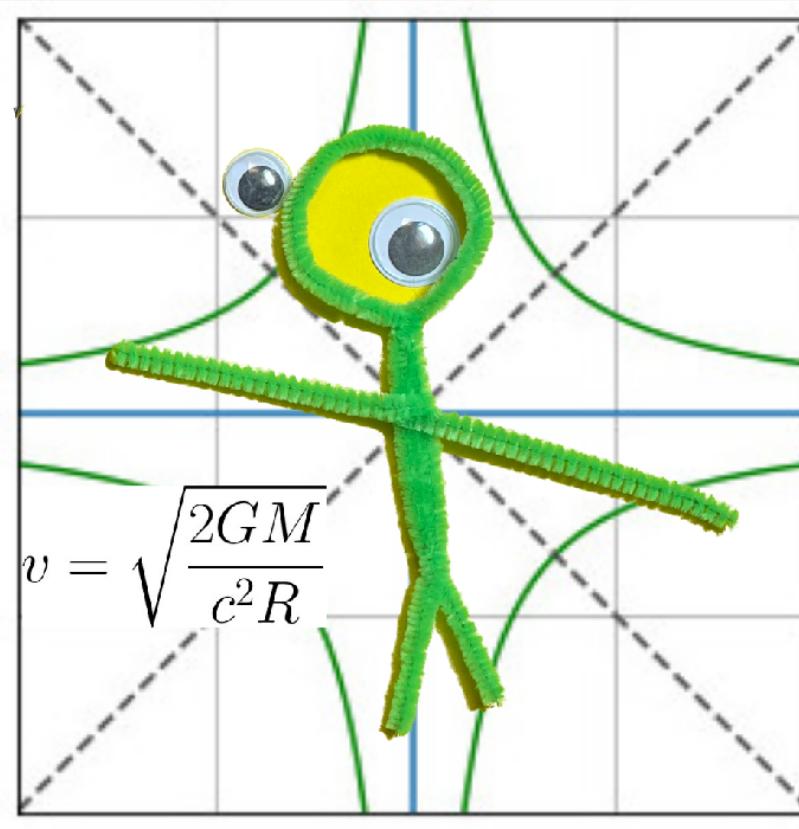
Resources:

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[https://bit.ly/SPR\\_zoom](https://bit.ly/SPR_zoom)  
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# All Schrödinger cats are space-like separated



“I think I can safely say no one understands quantum mechanics” Richard Feynman

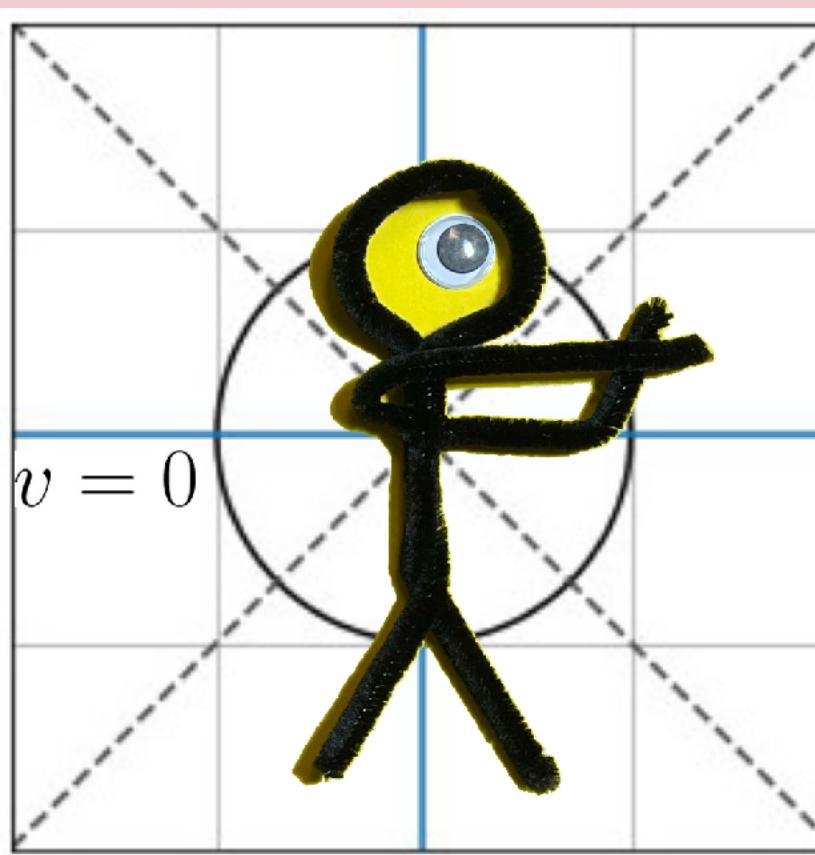


High Guy is  
Gravity relativity



$$(dt, dx, dy, dz)^2 =$$

$$(dt^2 - (dx^2 + dy^2 + dz^2), 2dtdx, 2dtdy, 2dtdz)$$



Me here-now



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