ISEP
The Internet Science Education Project

ISEP
A California Public Benefit 501(3c) Corporation
presents

The Sarfatti

LECTURES ON POST-MODERN PHYSICS

Conceived, written and produced
for the
World Wide Web
with Microsoft Power Point and
Adobe Acrobat Exchange by

Jack Sarfatti, Ph.D.

jsarfatti@aol.com

Simple animated explanations of

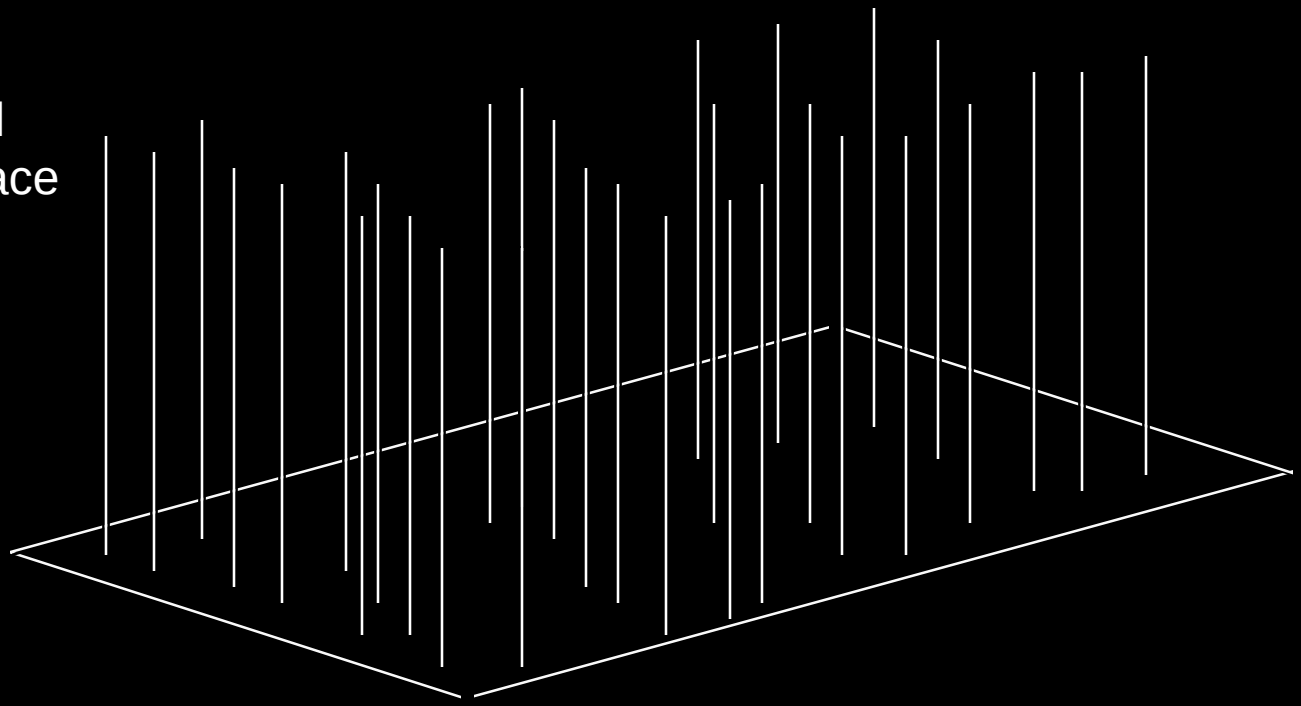
- Hyperspace
- Starship Travel Through The Wormhole
- Einstein-Podolsky-Rosen Effect
- Quantum Teleportation.

- Hyperspace

Einstein’s theories of relativity deal with four-dimensional spacetime. Quantum mechanics shows that this is not a complete description of the Universe. We need extra dimensions in a hyperspace beyond spacetime

Hyperspace is beyond spacetime.

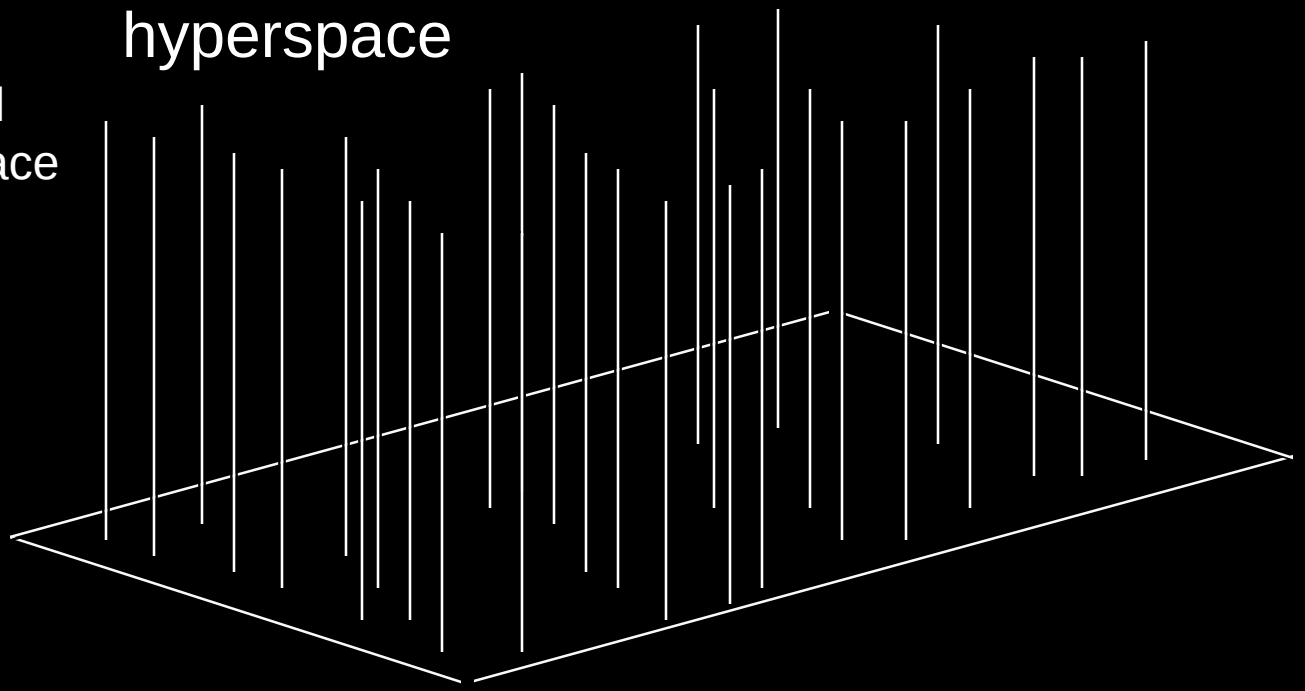
extra-dimensional fibers in hyperspace are attached to each spacetime event in the base spacetime



spacetime base space

hyperspace

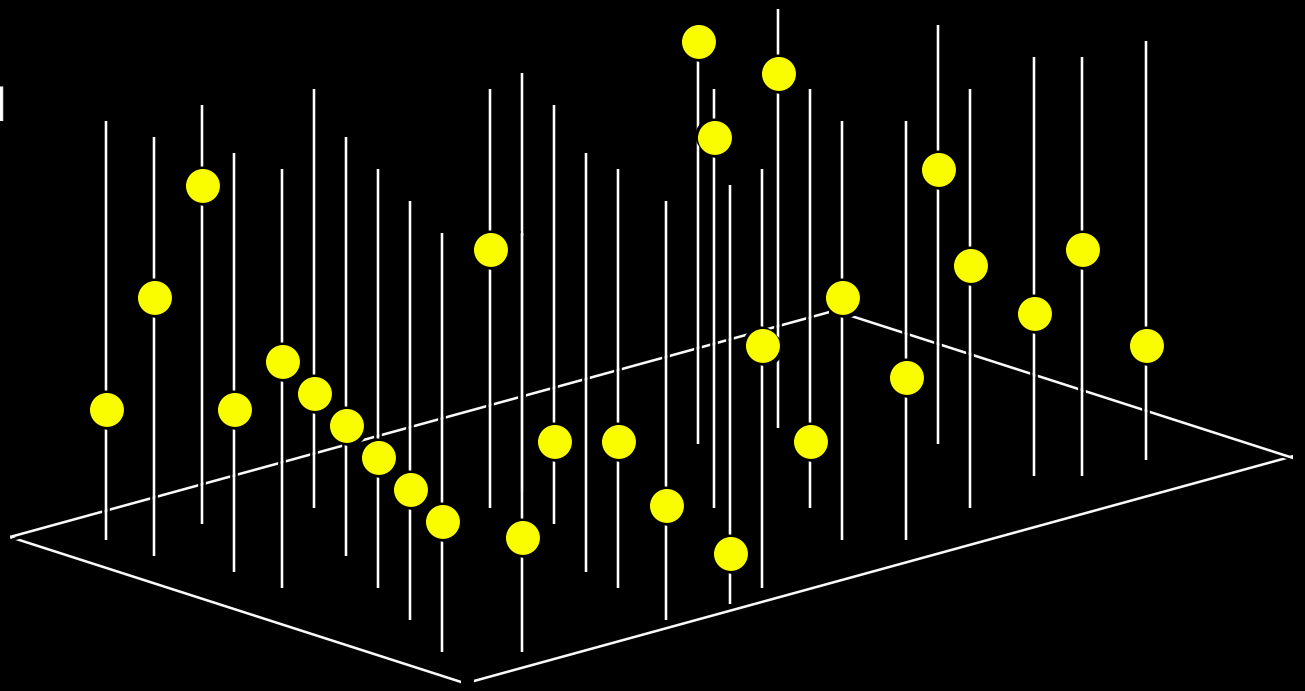
extra-dimensional fibers in hyperspace are attached to each spacetime event in the base spacetime



spacetime base space

This larger space is called a fiber bundle. There are many different kinds of fibers that attach to the same spacetime event.

extra dimensional fibers attached to each spacetime event in the base space



spacetime base space

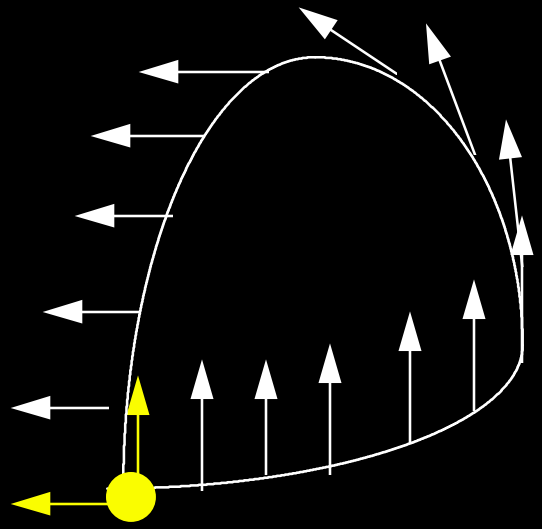
Pick a point P on each fiber. The set of all such points is a hyperspace surface | > that defines a quantum wave pattern for a *single particle*.

Both spacetime and its several associated extra-dimensional fiber hyperspaces, that are above and beyond it, require structures called “connection-fields”.

The connection fields permit the “parallel transport” of objects called “spinors” and “tensors” along paths in both spacetime and hyperspace.

Each connection-field has a “curvature-field”. Each object is parallel-transported around a set of closed loops. If the final orientation of the object is not identical to the initial orientation, there is a component of curvature. The loops are shrunk to zero to get the curvature-field at each point either in spacetime or in hyperspace.

The vector is parallel transported clockwise around the loop.



loop

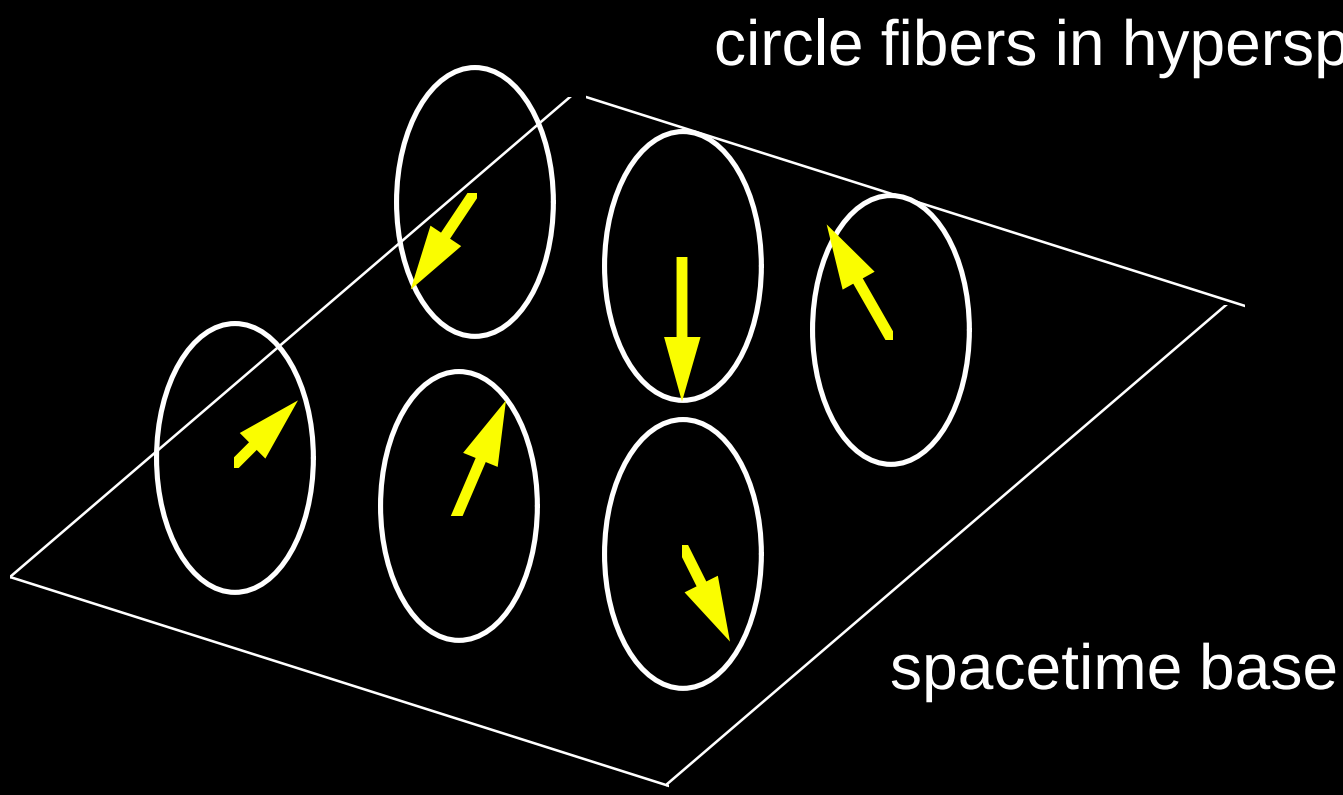
start = finish

The initial orientation differs from the final orientation indicating a curvature. Imagine shrinking the loop to zero.

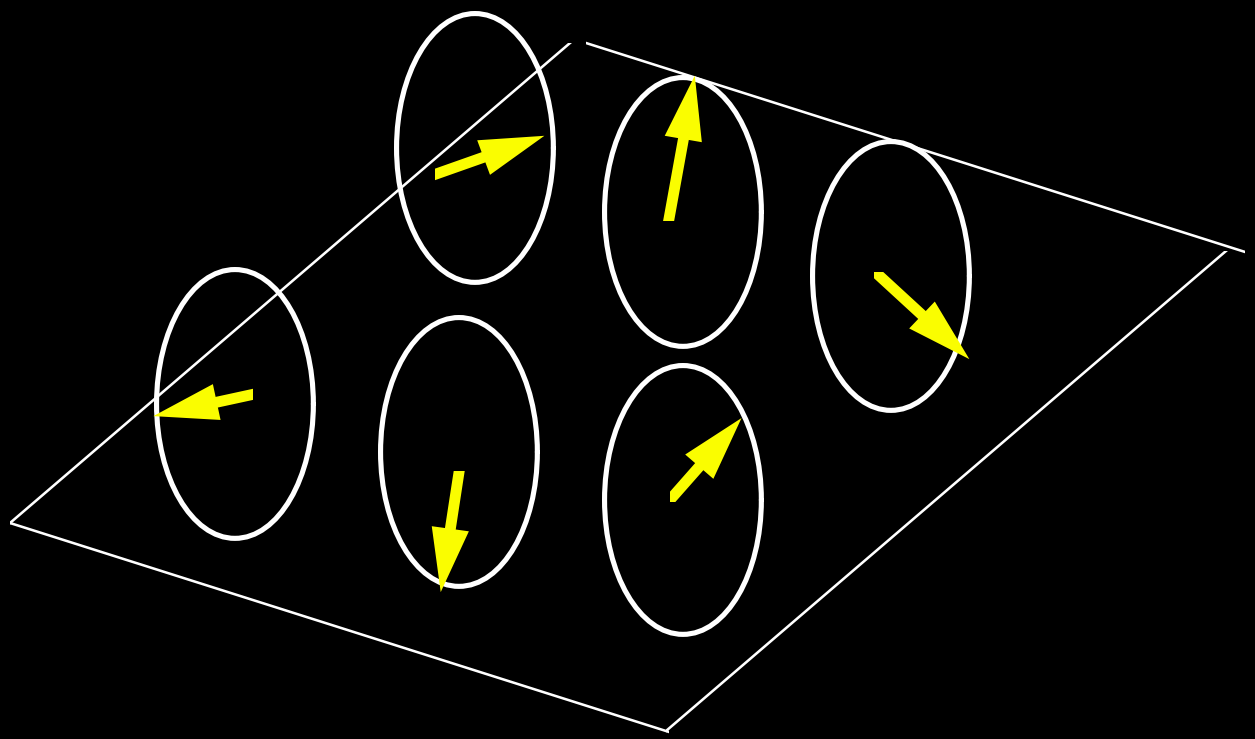
The *classical* gravity force is a curvature-field *in* the spacetime base space.

The classical electromagnetic force is a curvature field in a special fiber that is a one-dimensional circle in hyperspace which is *attached* to, but *above and beyond* each point in spacetime. Each point on the fiber is like a “time” on a Salvidor Dali one-handed clock. Each such point is called a “phase”.

The fiber bundle for the electromagnetic force.



The set of local observers can *reset* their phase clocks in any position on the circle *without changing* the *action* of the electromagnetic force field on electric charges.



The set of local observers can *reset* their phase clocks in any position on the circle *without changing* the *action* of the electromagnetic force field on electric charges.

This is called the “principle of local phase symmetry”. All of the known classical forces between elementary particles (i.e. quarks, leptons and gauge bosons) are forced into existence by this “internal symmetry” law.

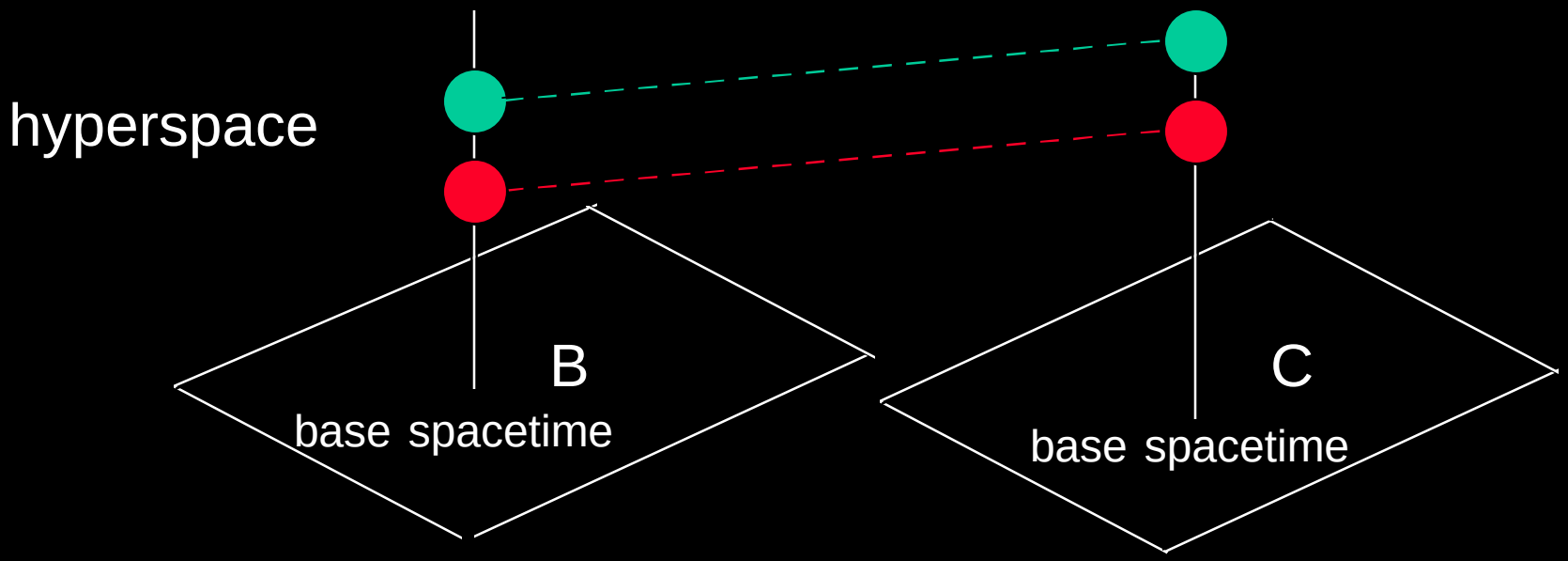
The classical weak force that causes radioactive beta decay is the curvature field of a three-dimensional hyperspace sphere attached to each point event in spacetime.

The classical strong force binding quarks into nucleons and nucleons into the nuclei of atoms is the curvature-field of an eight-dimensional hyperspace sphere attached to each point event of spacetime.

This is the hyperspace geometry of the classical limit of the standard model of elementary particles of physics today.

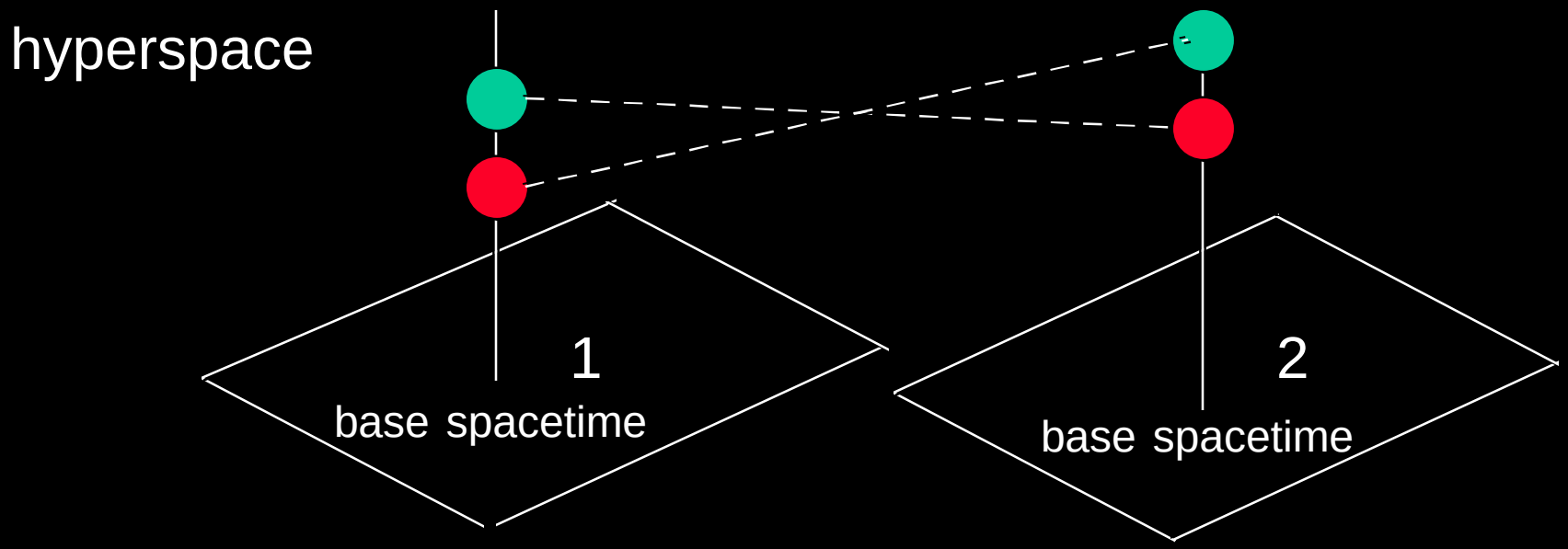
What happens if there are two or more particles? We need to draw a separate spacetime base space for each particle. As Roger Penrose has written in *The Emperor's New Mind*, in quantum mechanics, each particle carries its own spacetime geometry. We shall see, in more advanced lectures, how these patterns entangle with each other to make faster-than-light quantum hyperspace links between widely separated particles

$$|B,C\rangle = |B\rangle|C\rangle + |B\rangle|C\rangle$$



This is the pattern of the “Einstein-Podolsky-Rosen” quantum hyperspace link observed for two *photons* B and C in Paris in 1982 by Alain Aspect.

$$|1,2\rangle = |1\rangle|2\rangle - |1\rangle|2\rangle$$



This is the pattern of the “Einstein-Podolsky-Rosen” quantum hyperspace link predicted for two *electrons* 1 and 2.

Hyperspace has an infinite number of dimensions.
The wave patterns of matter exist in hyperspace.
These wave patterns may emerge into mind for
sufficiently complex open organizations of matter.

The wave patterns exert a quantum force on matter that is different from the classical forces.

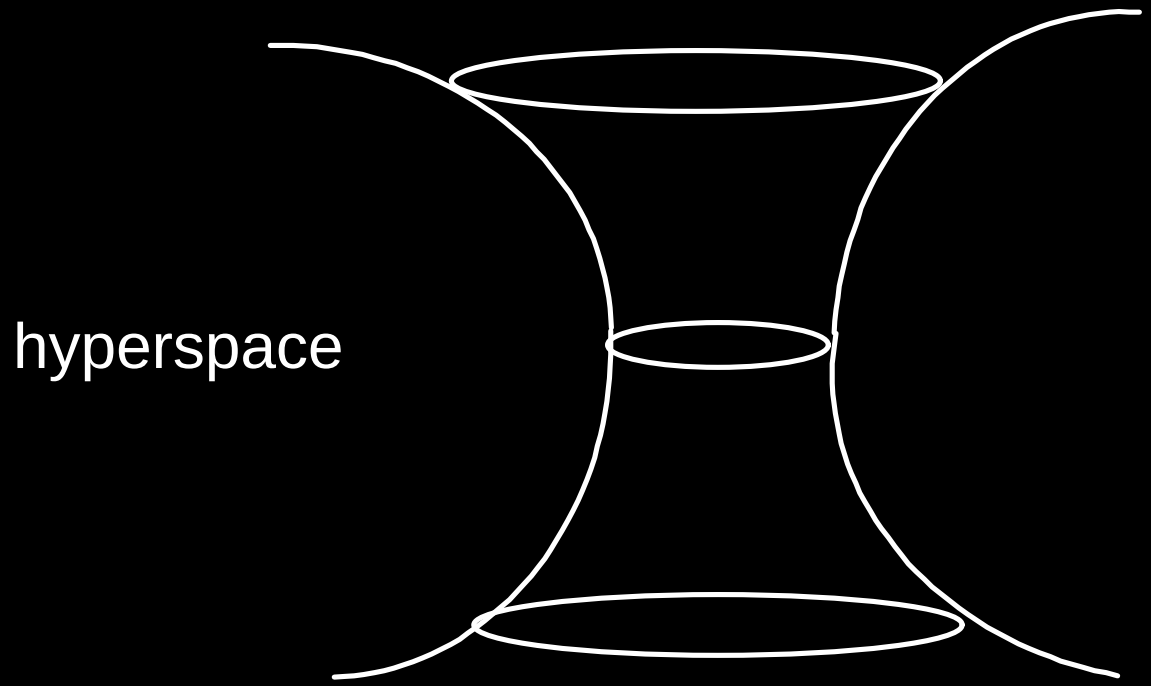
The hypothesis is that living matter
is able to exert a direct counter force
back on the wave patterns in hyperspace.
This would be a necessary condition for
conscious mind to emerge.

Hawking, at the end of his book.
A Brief History of Time
asks about the “Mind of God”.
The Mind of God, if it exists,
exists in hyperspace above and
beyond spacetime.

Back to main menu.

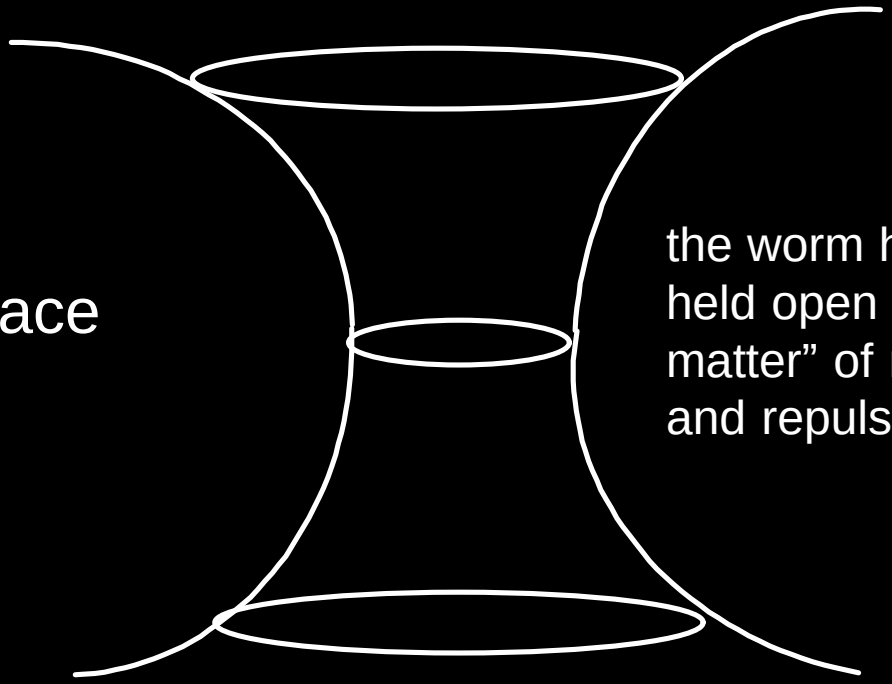
- Starship Travel Through The Wormhole

Traversable wormholes that might be used by advanced societies for fast interstellar space travel are multiply-connected spacetimes in hyperspace.



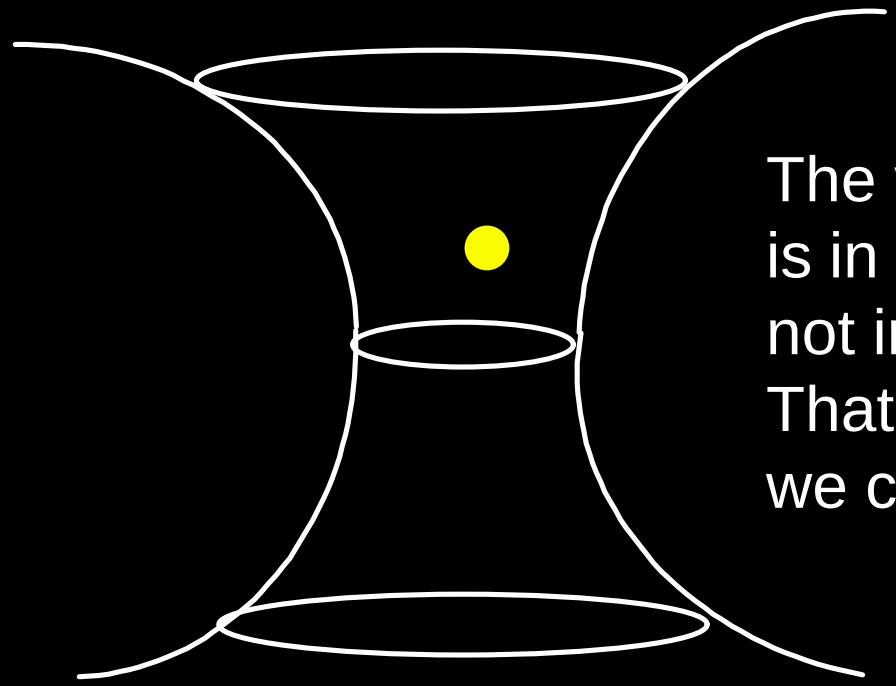
This is an *instant* snapshot (i.e.,spacelike slice)
of a wormhole spacetime surrounded by hyperspace.

3d physical space is confined to the “surface” formed by the white lines.



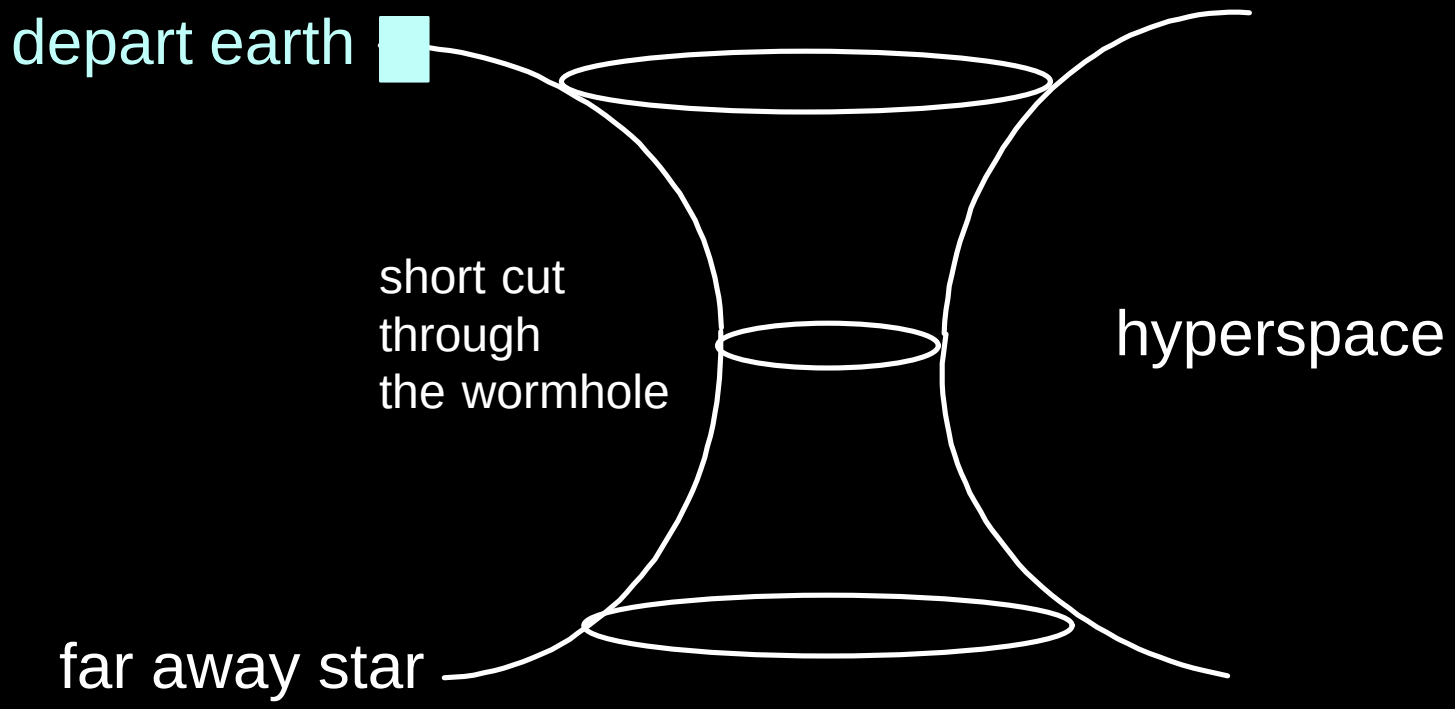
hyperspace

the worm hole is held open by “exotic matter” of negative energy and repulsive gravity

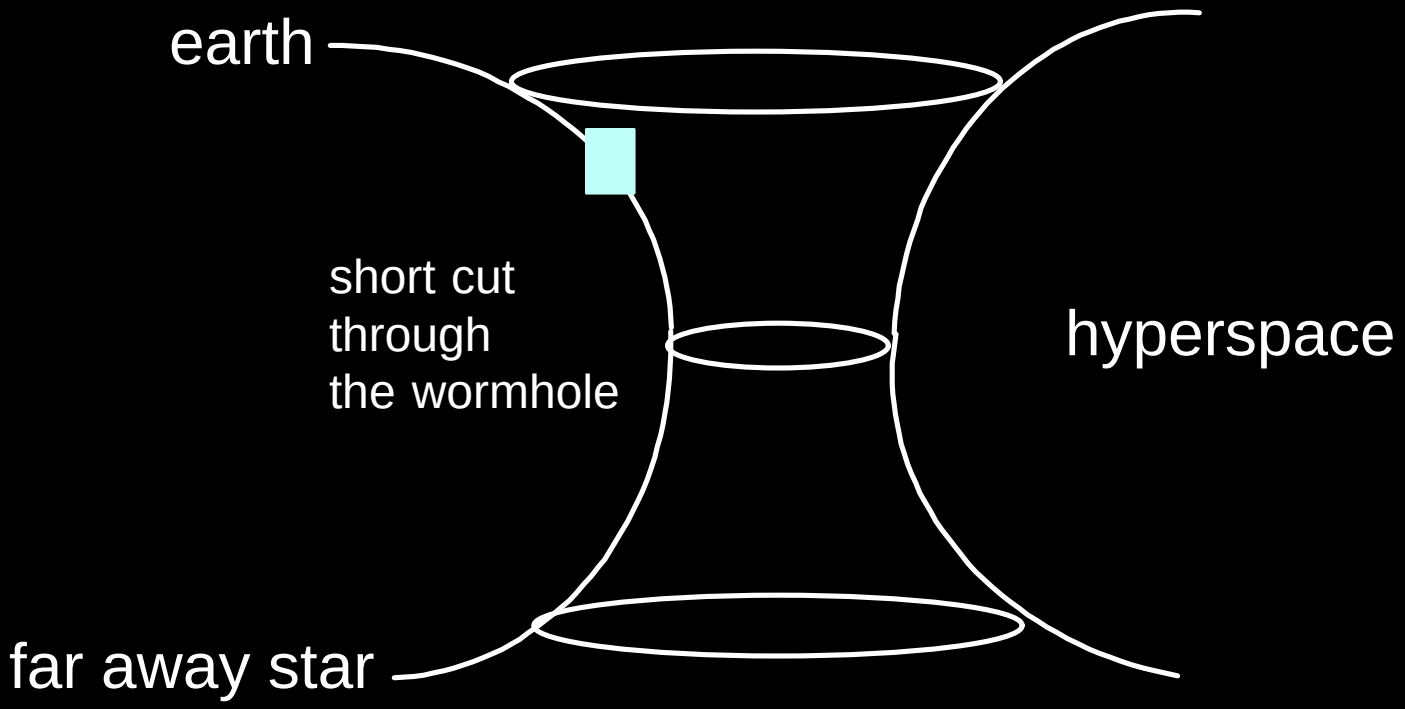


The yellow ball is in hyperspace not in 3-d space. That's *not* where we can go.

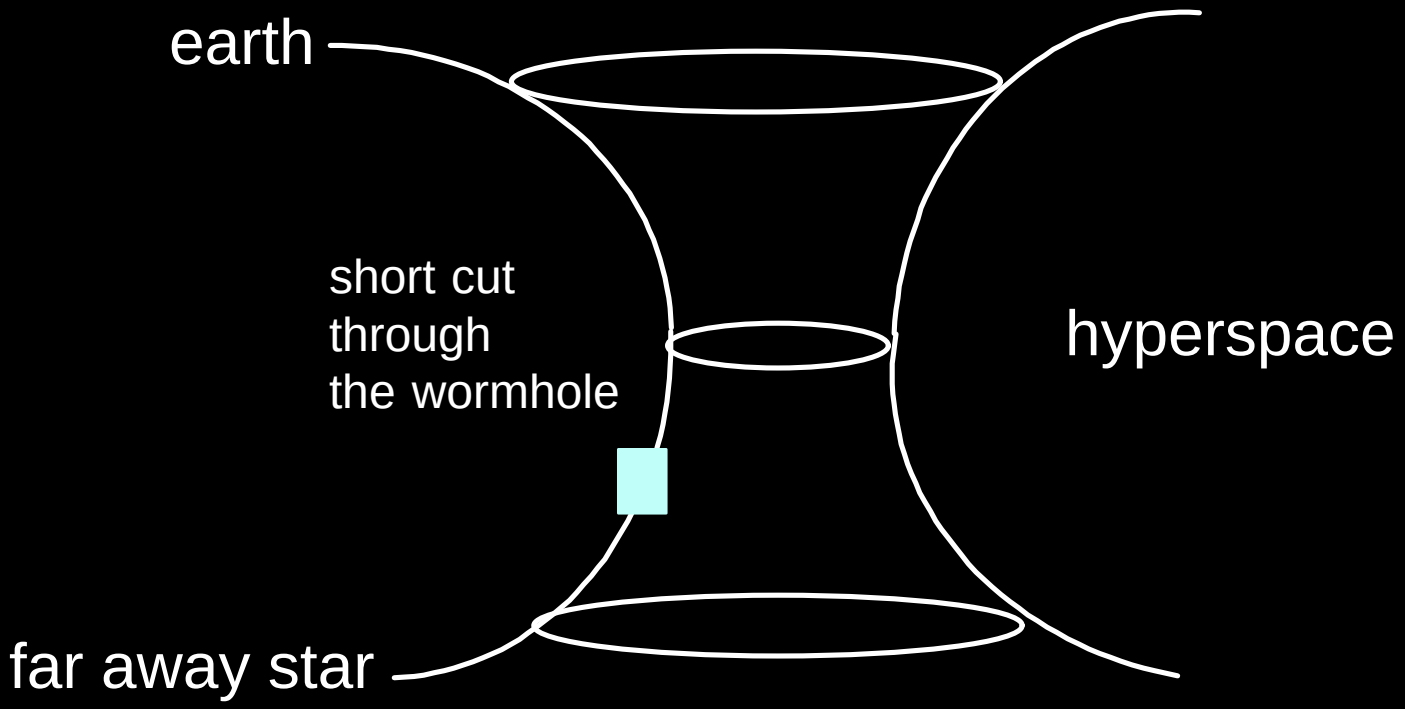
The starship is confined to the *3-d subspace* that is our physical space.



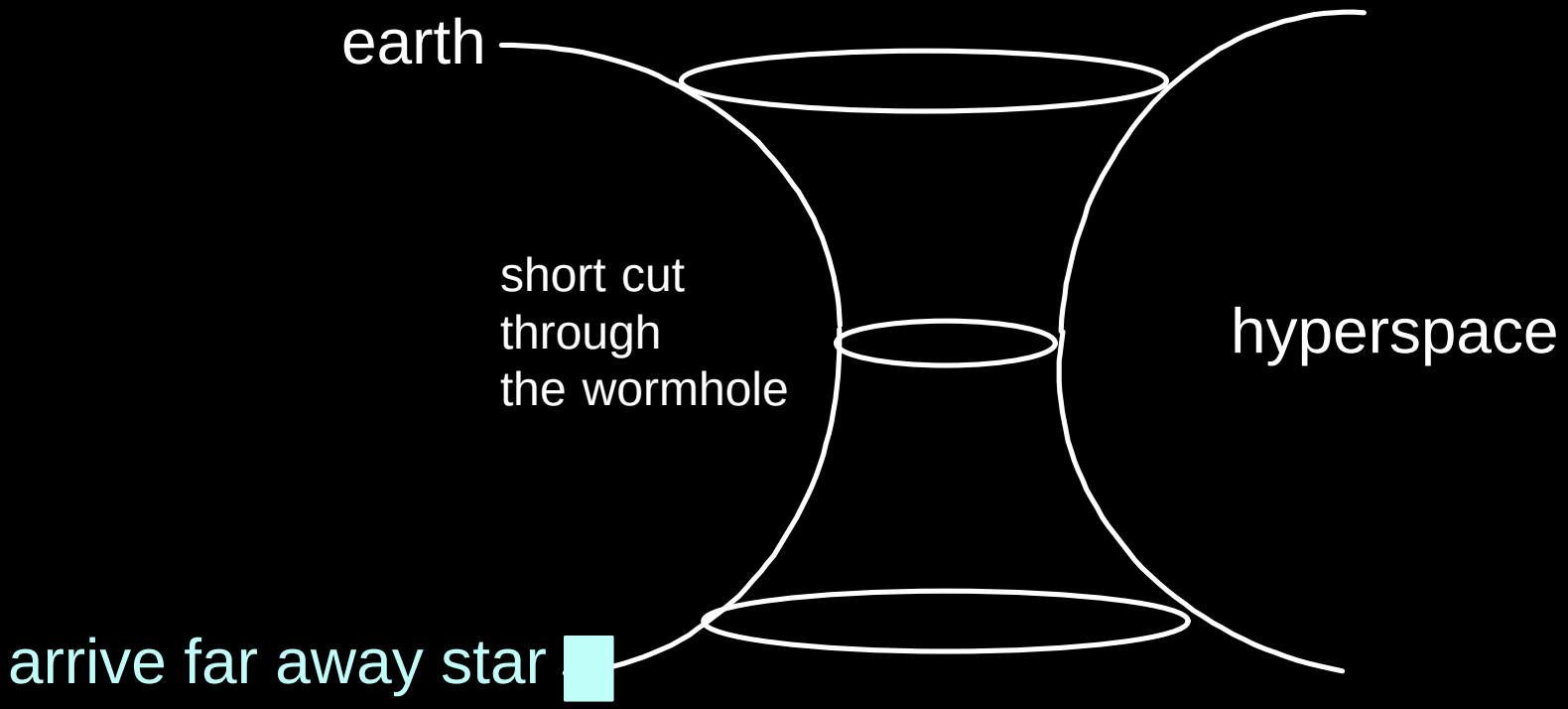
The starship is confined to the *3-d subspace* that is our physical space.



The starship is confined to the *3-d subspace* that is our physical space.



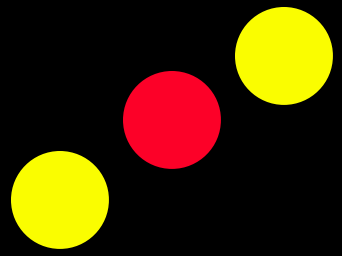
The starship is confined to the *3-d subspace* that is our physical space.



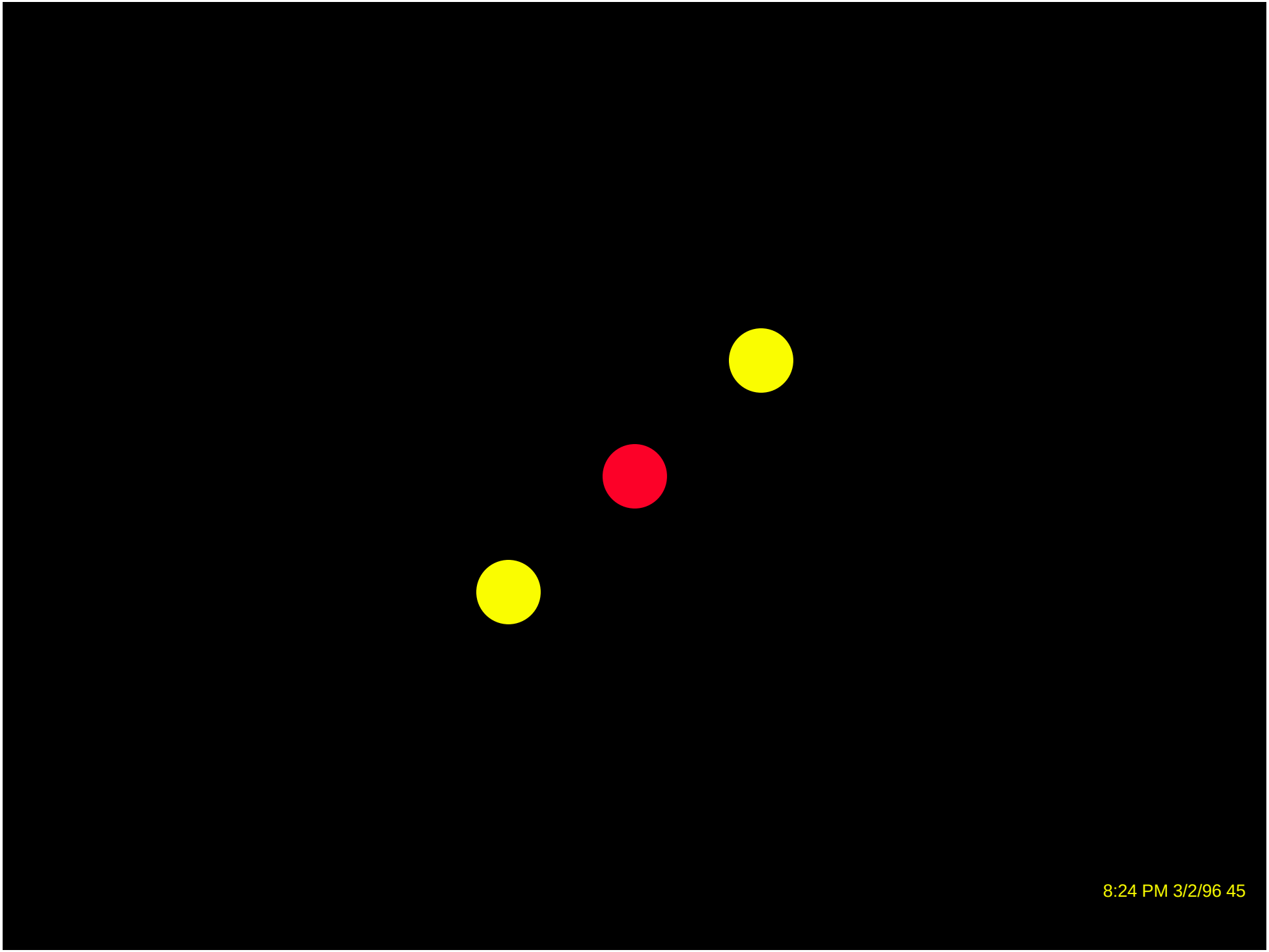
Back to main menu.

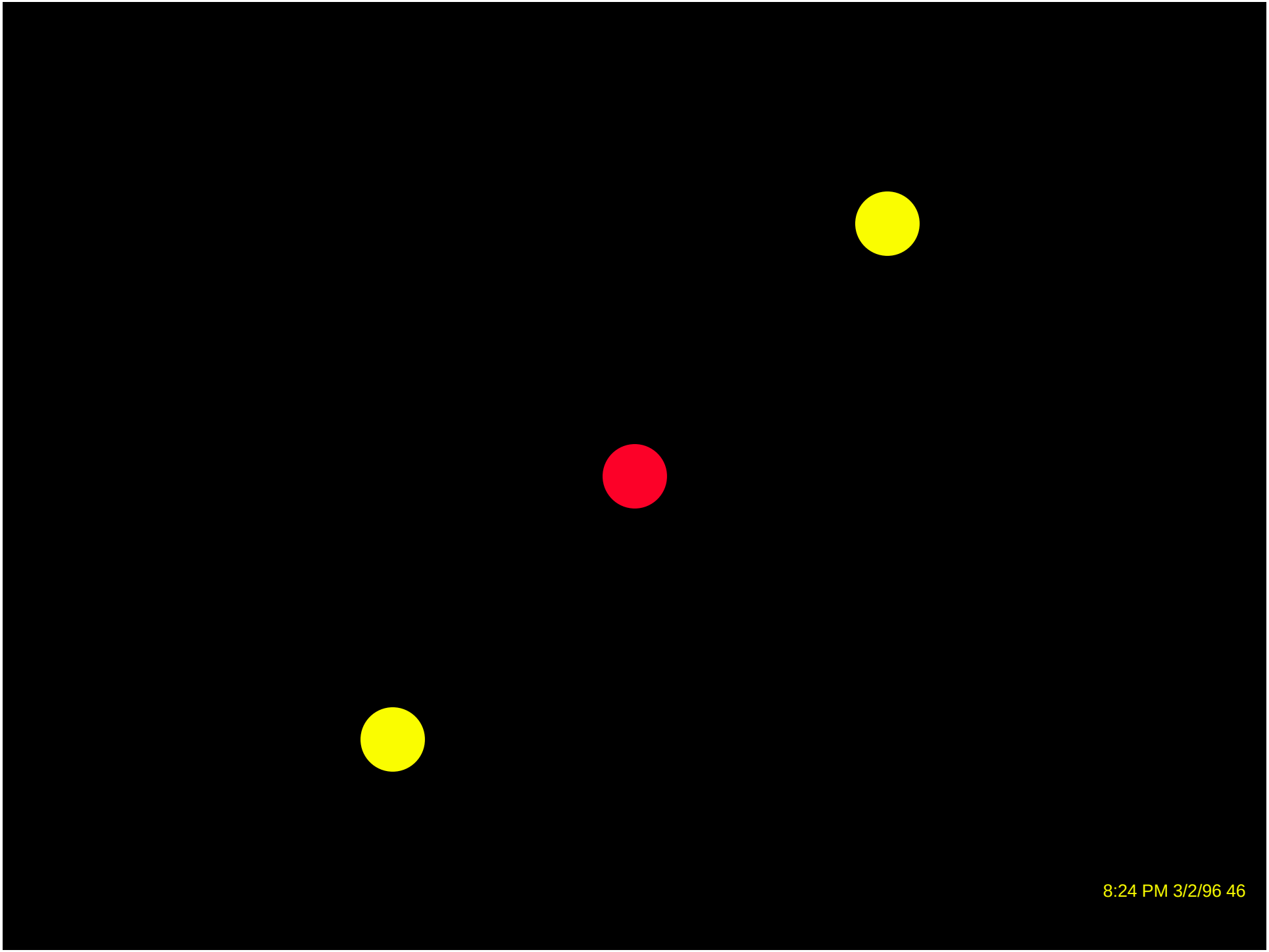
- Einstein-Podolsky-Rosen Effect

A simple intuitive explanation of why experiments require an explanation using a faster-than-light quantum force in the Einstein-Podolsky-Rosen-Bohm effect (EPRB) actually done by Aspect at the University of Paris in 1982.

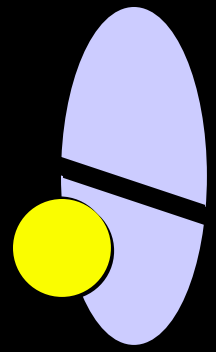


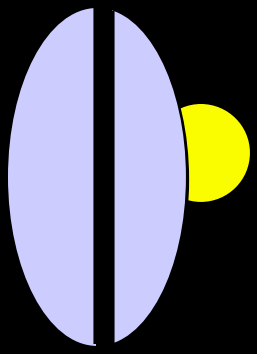
An atom emit two photons B and C moving in opposite directions.


8:24 PM 3/2/96 45

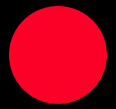

8:24 PM 3/2/96 46

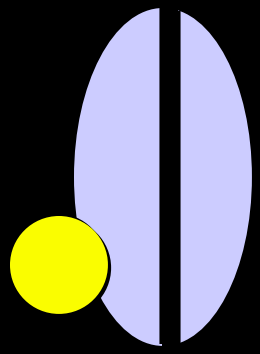
A pair of crossed polarizers are *suddenly* placed in the path of the two photons *after* they have been emitted from the same atom.



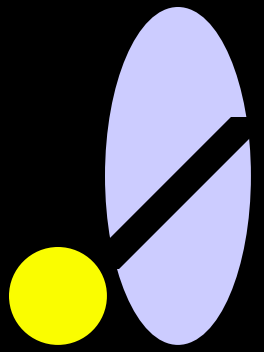


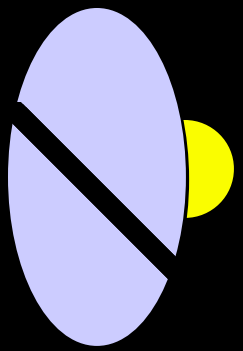
Only *one* photon will pass through a polarizer. Its twin will be absorbed heating its polarizer up. *Never* will *both* photons from the *same* pair pass *both crossed* polarizers.



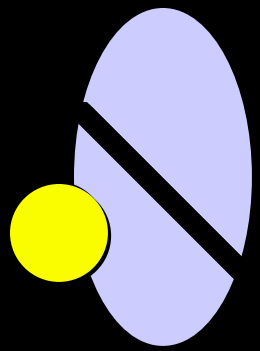


Now suppose we chose instead to insert the crossed polarizers at 45 degrees to the orientation of the first set of crossed polarizers.

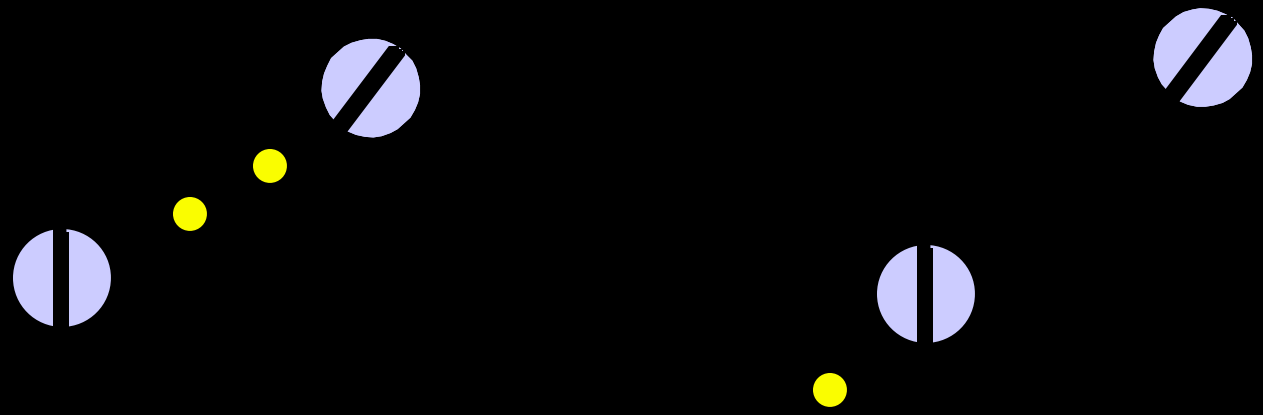




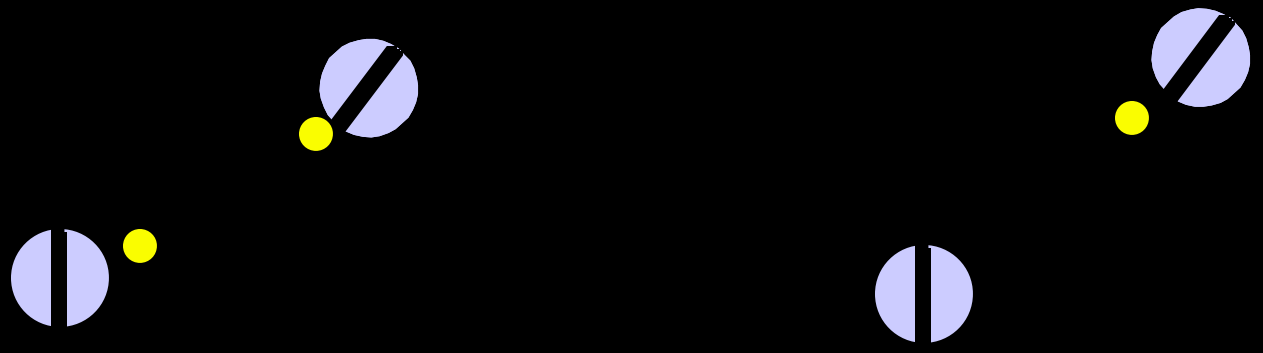
Once again only *one* photon will pass through a polarizer. Its twin will be absorbed heating its polarizer up. *Never* will *both* photons from the *same* pair pass *both crossed* polarizers.



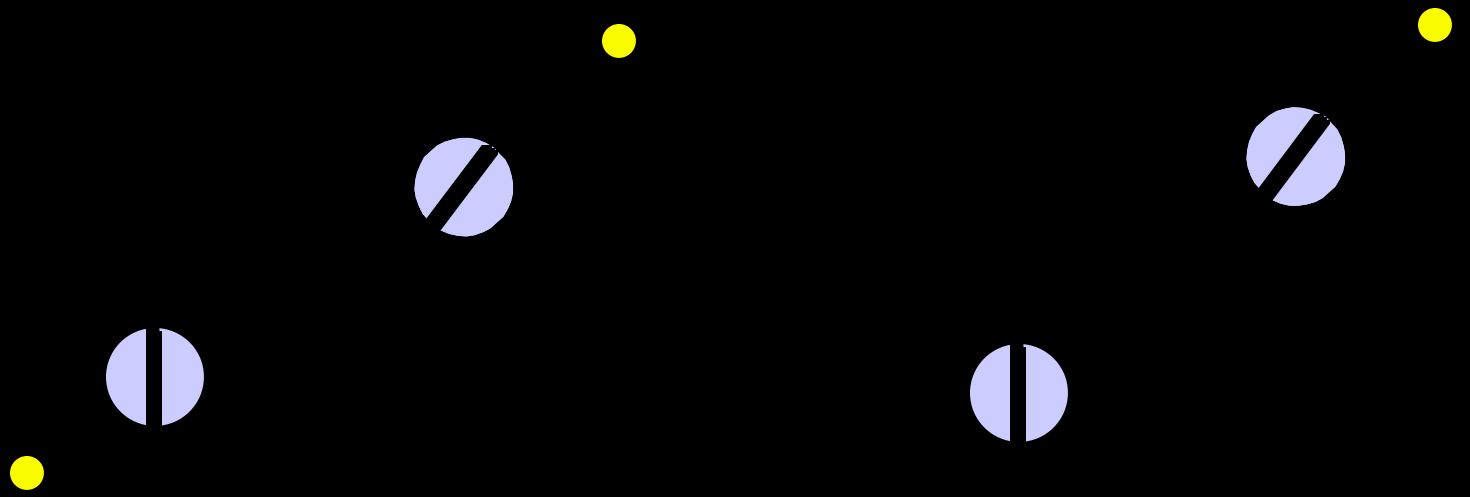
The pair of widely separated quantum-connected photons *each* passing through one polarizer behaves exactly like one photon passing through two polarizers one after the other.

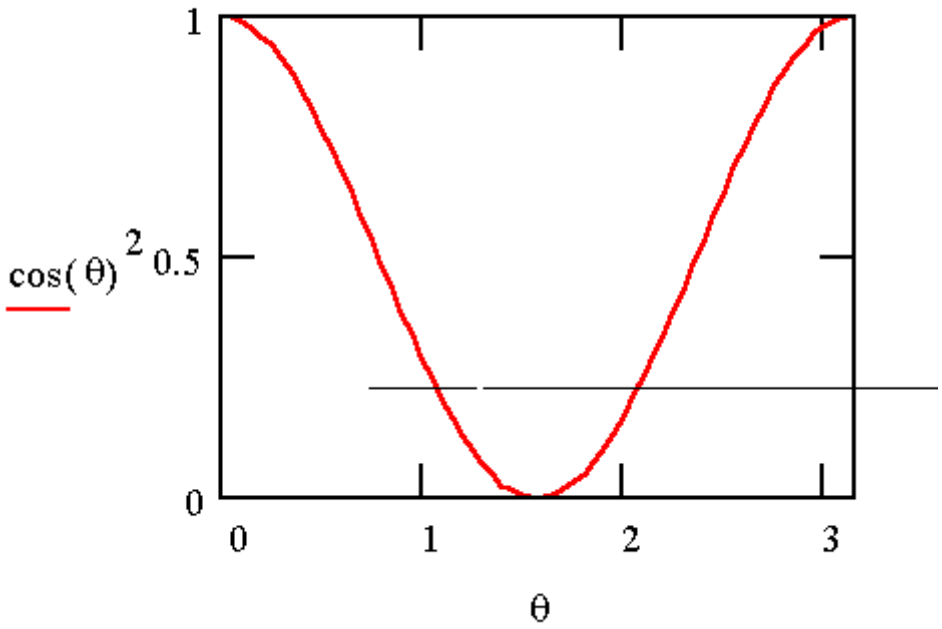


The pair of widely separated quantum-connected photons *each* passing through one polarizer behaves exactly like one photon passing through two polarizers one after the other.



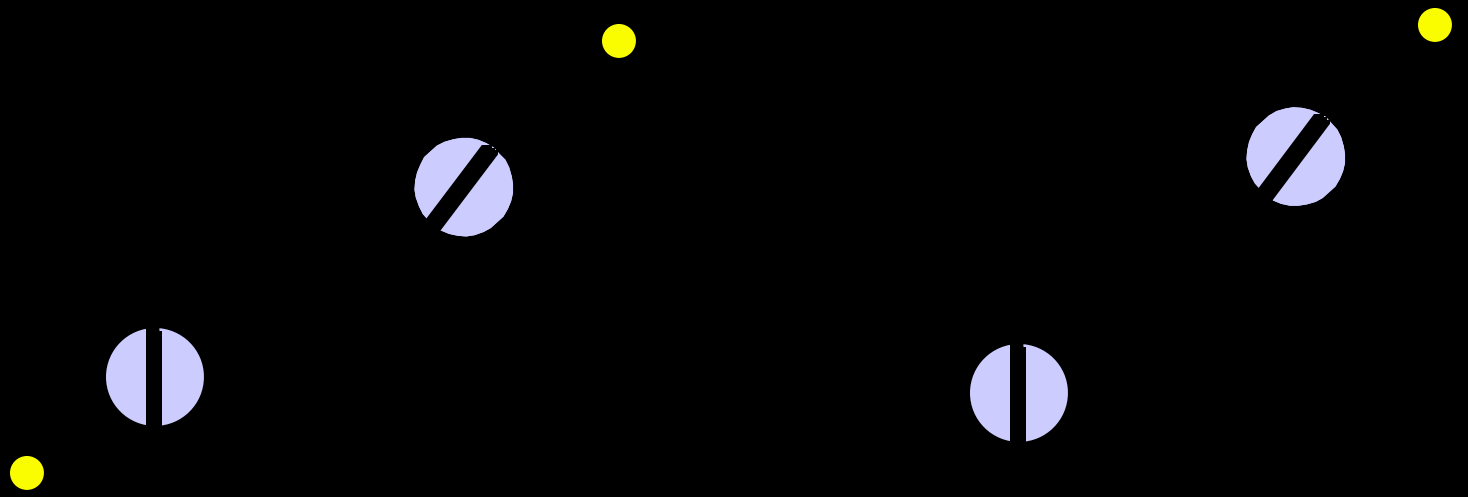
In both cases, the probability that a photon passes *both* polarizers is proportional to the square of the cosine of the relative angle between the polarizers.





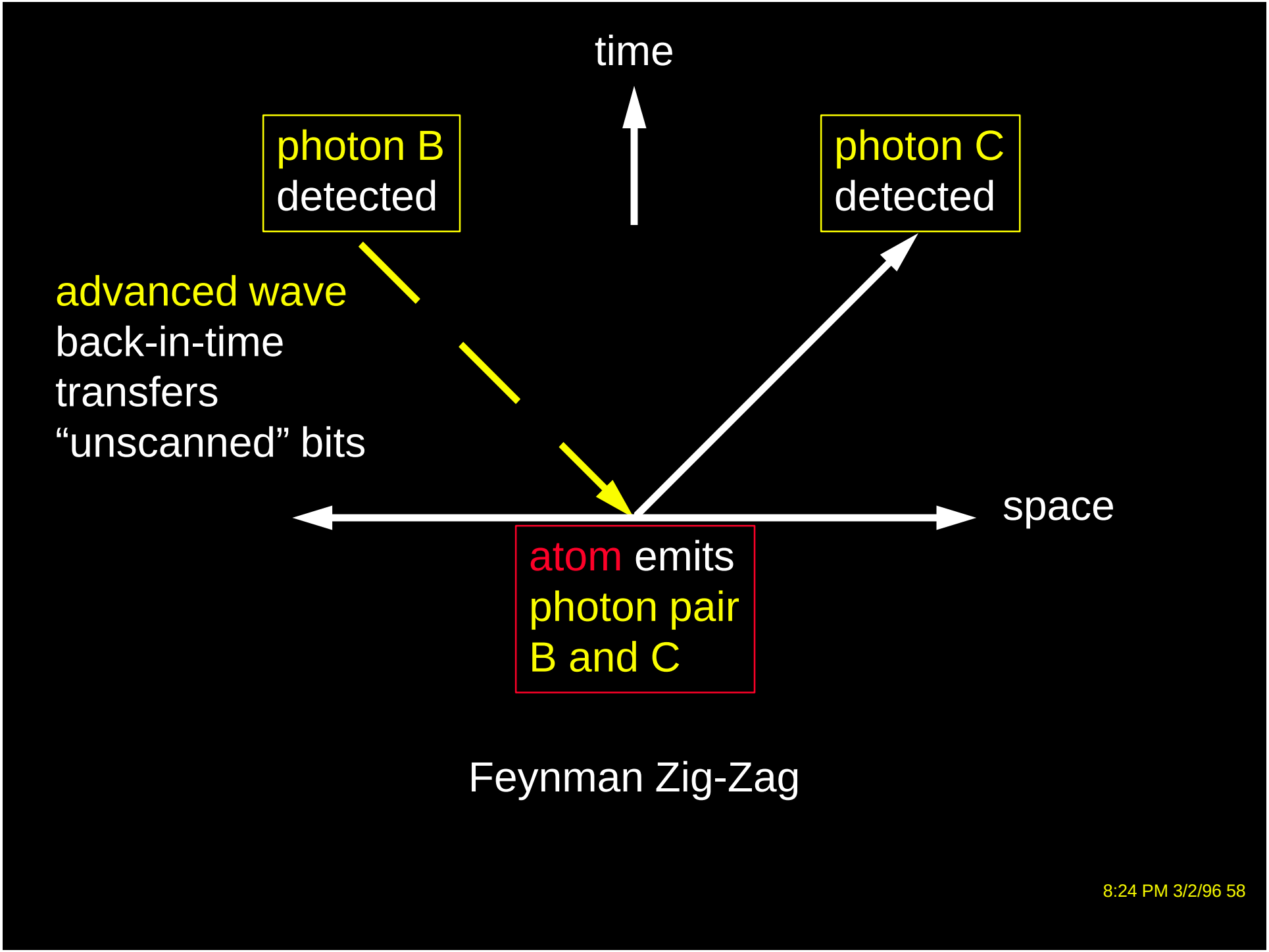
This curve plots the conditional probability as a function of the relative angle θ between the polarizers, that if one photon passes its polarizer, then its far away twin will also pass its polarizer. The angle is not chosen until after both photons are far away from their emitting atom and there is no overlap in their waveforms.

Thus, the quantum-connected photon pair is a whole greater than the sum of its parts. It is one indivisible *super-photon* at a higher level of complexity. This is the simplest example of *nonlocal emergent quantum order*.



The EPR effect only depends upon the relative angle between the two widely separated polarizers. It does not depend upon their absolute orientation in space. But the *choice* of orientation, relative or absolute, can be *delayed* until after the photons have been emitted and are widely separated from each other. How does each photon know what is happening to the other? How do they conspire to correlate exactly so that, in the case of crossed polarizers only one passes never both?

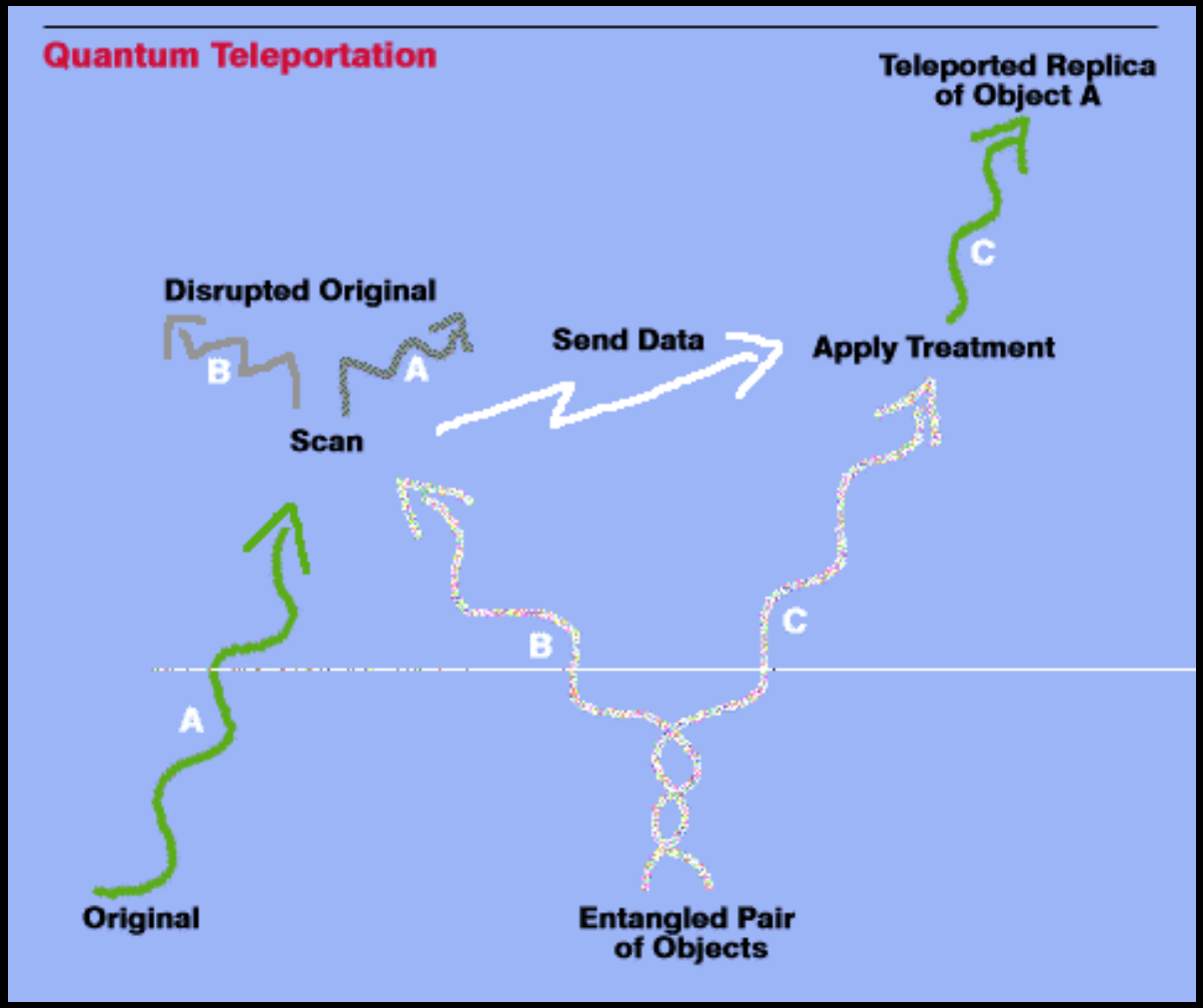
One explanation, which fits the *observed quantum teleportation at IBM* is that information “zig-zags” *backward-in-time* from the detection of one photon to the source emission event of both photons. Each photon precognitively remote views the fate of its twin at the exact moment of their common birth in this explanation. Thus, a *direct* faster-than-light (FTL) effect is replaced by an equivalent *indirect* backward-in-time (BIT) effect.



Feynman Zig-Zag

Back to main menu.

•Quantum Teleportation.



"As the figure to the left suggests, the unscanned part of the information is conveyed from A to C by an intermediary object B, which interacts first with C and then with A. What? Can it really be correct to say "first with C and then with A"? Surely, in order to convey something from A to C, the delivery vehicle must visit A *before* C, not the other way around. But there is a subtle, unscannable kind of information that, unlike any material cargo, and even *unlike ordinary information*, can indeed be delivered in such a *backward* fashion." quoted from a press release by IBM

Murray Gell-Mann in his book,
The Quark and the Jaguar
stumbles here. He tries to replace nonlocality, FTL or BIT, by a many-worlds view, but his explanation is logically faulty and does not hold up under critical examination. We shall examine this in detail later.

Either continue to

The Black Hole and The Brain

or

return to main menu