



Dude, where's my spaceship?

Albert Einstein

Science Fiction



Science Fiction

A LONG TIME AGO IN A GALAXY FAR, FAR AWAY...



THE PHANTOM MENACE

ATTACK OF THE CLONES

REVENGE OF THE SITH

A NEW HOPE

THE EMPIRE STRIKES BACK

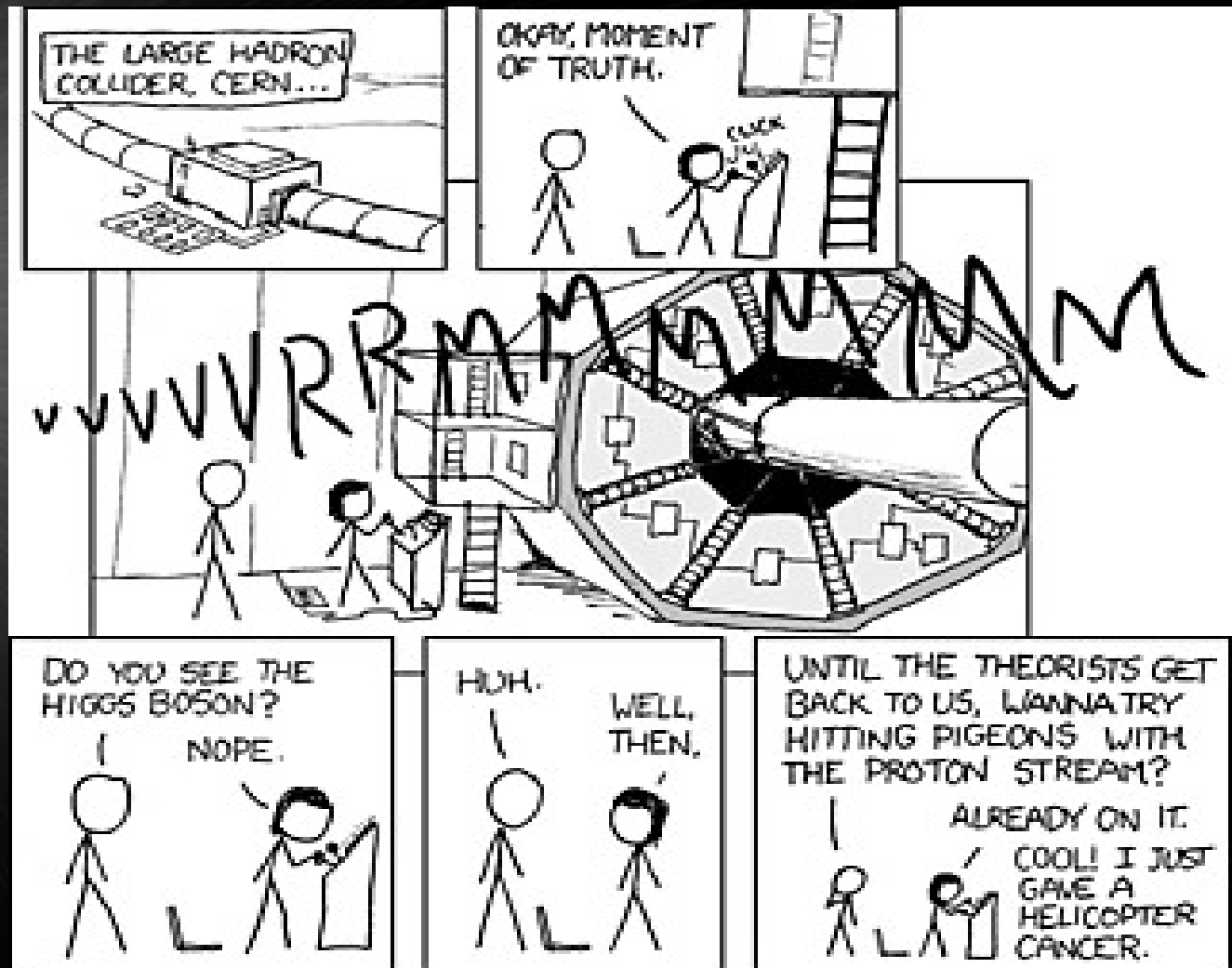
RETURN OF THE JEDI

STAR WARS

Science Fiction

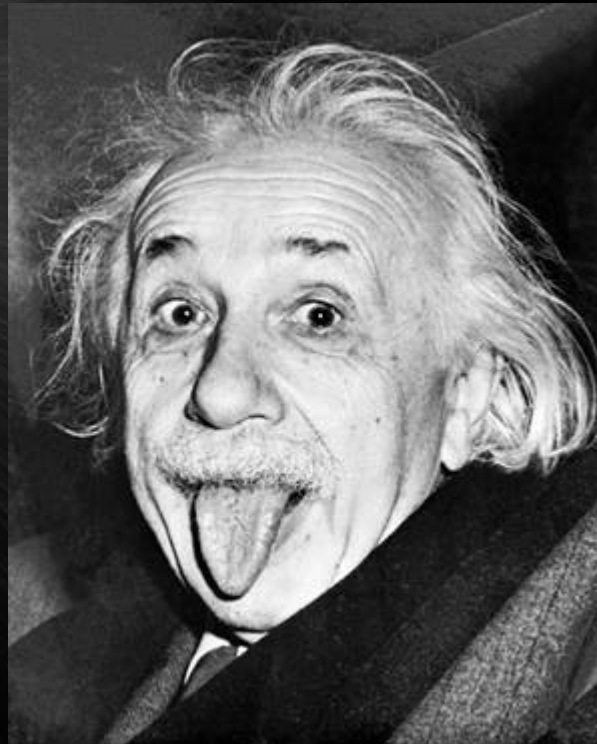


Science Fiction



c

- 299,792,458 m/s (in a vacuum)
- The fundamental constant of relativity



Gedankin, anyone?

- Two ships, one beam of light

Gedankin, anyone?

- Two ships, one beam of light
- Both see light as going c
- Something's gotta give
- Time!

Another example

- Clocks (to the whiteboard!)
- What if the moon disappears?

Paradox of the twins



More Trouble

- Infinite mass to reach the speed of light in finite time or with finite acceleration

Can anything move faster?

- Two objects moving away at $0.99c$?
 - No information travel!
- Rotating a giant stick
 - Transmits force at most c
- Tachyons
 - Imaginary mass, or already moving faster than c
 - Can't detect them, so they are useless

Surely there's a way

- Here are some possibilities

Casimir Effect

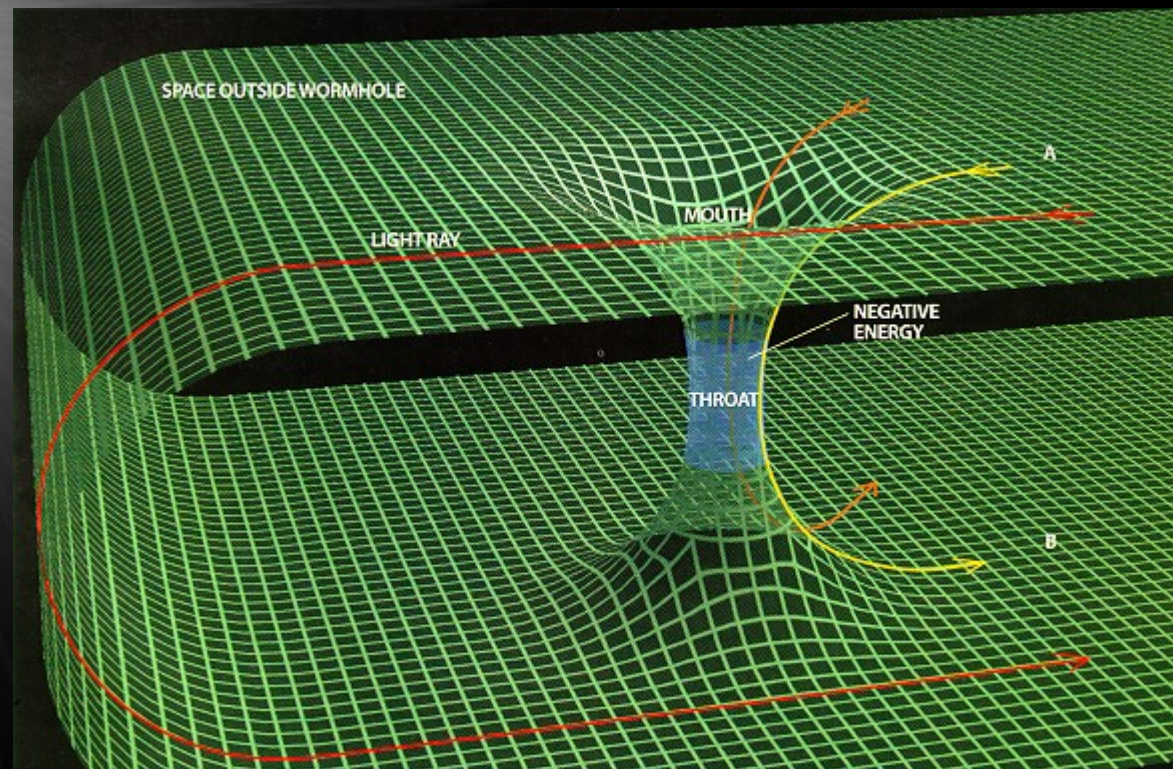
- Vacuum Energy
 - Lower the energy, c becomes bigger
 - Negligible increase

Quantum Entanglement

- Spooky action at a distance
- Can't be used to transmit information

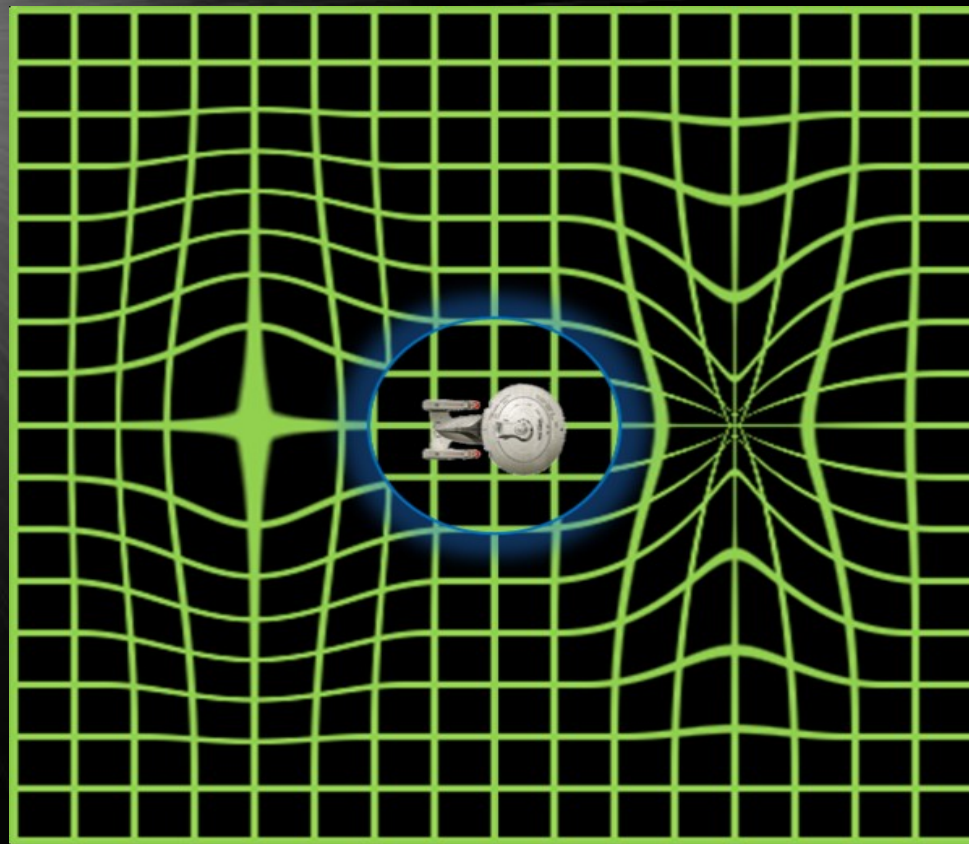
Wormholes

- Connection between two distant points in space
- Closed timelike curves
- Causality violations?



Alcubierre Drive

- Contract space in front of ship while expanding space behind it rapidly
- Requires ridiculous amounts of dark energy



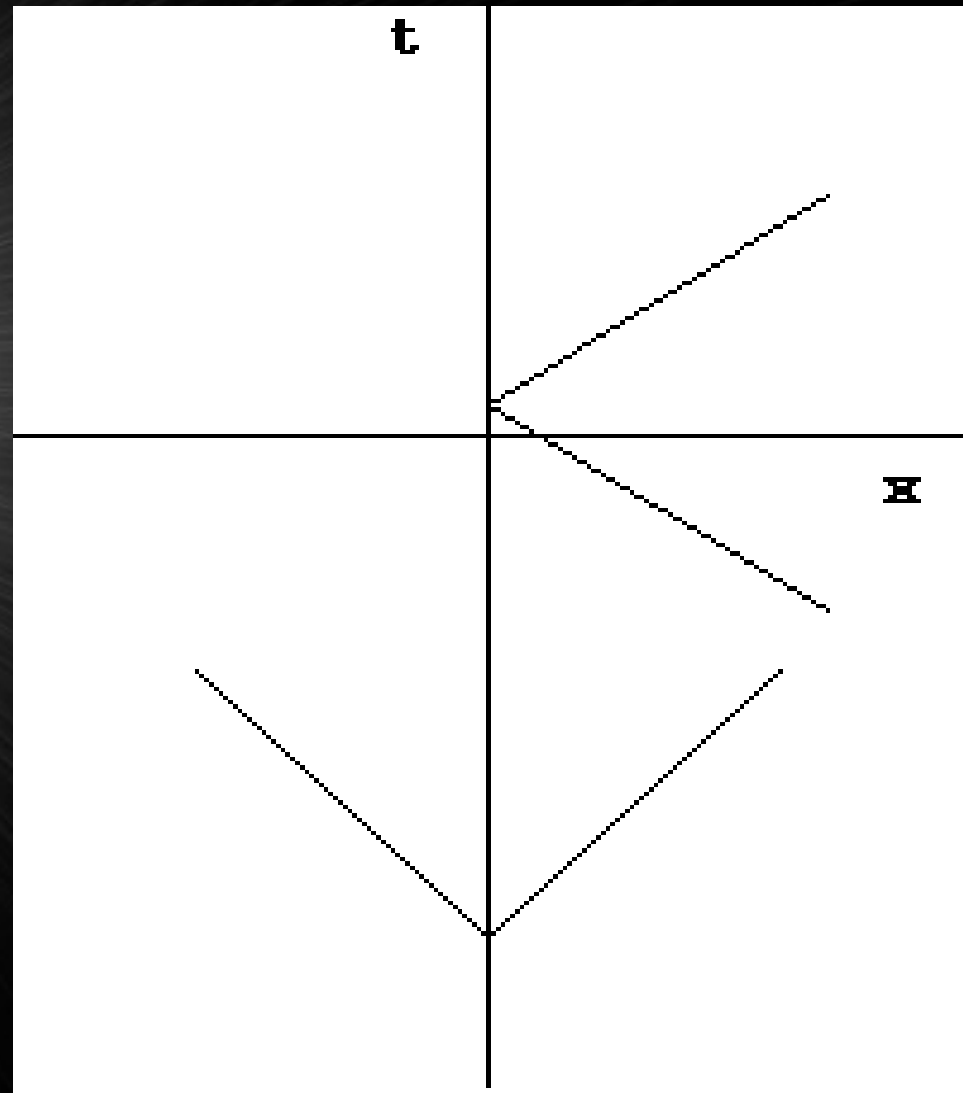
Time travel

- Paradoxical?
 - e.g. Grandfather paradox
- There are philosophical arguments that prevent paradox

Faster than light travel

- Relativity of Simultaneity
 - Train thought experiment
- The mathematics show that if a signal is sent at FTL, some frames will see it as being received before it is sent

Closed time-like curves



Wormholes again

- Take one entrance to the wormhole
- Accelerate it to near c
- Move it back to other entrance
- Time inside the wormhole remains synchronized
- Can only move back as far as when the system was created
- Requires dark energy

What does the future hold?

