Time travel:
A talk you cannot miss

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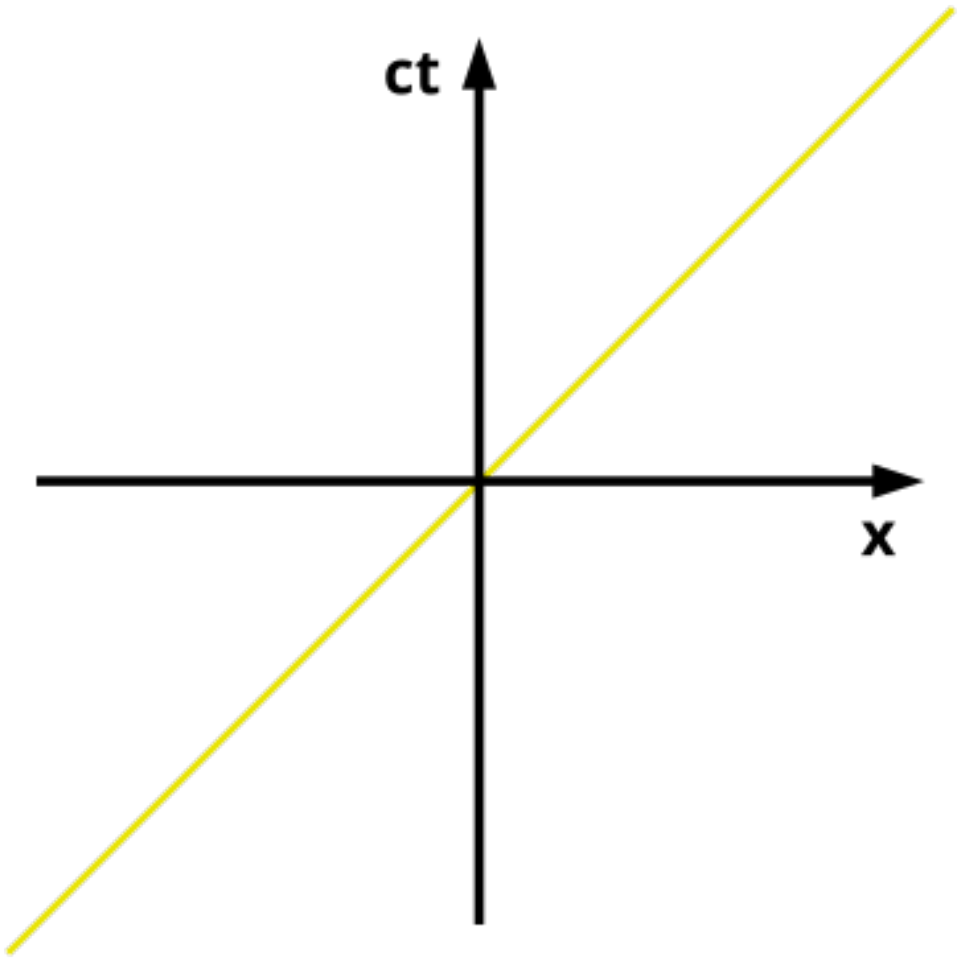
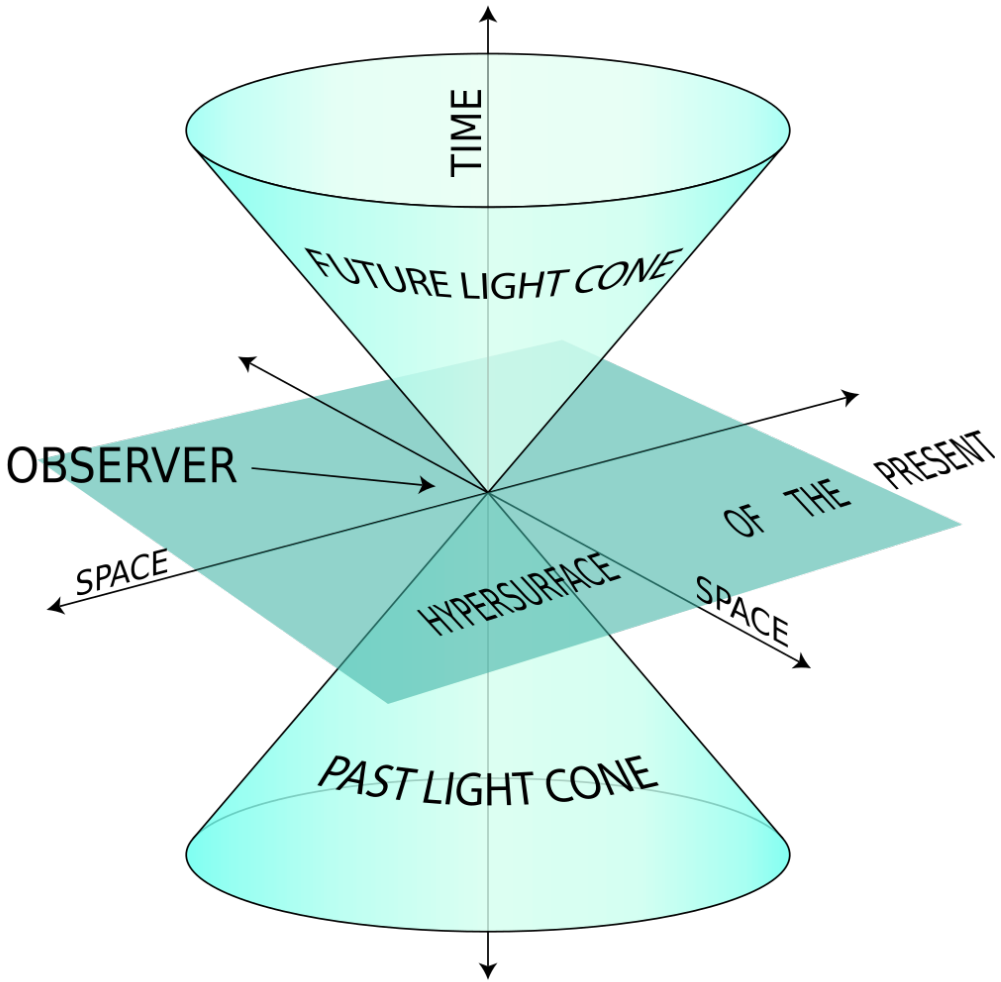
WELCOME TIME
TRAVELLERS

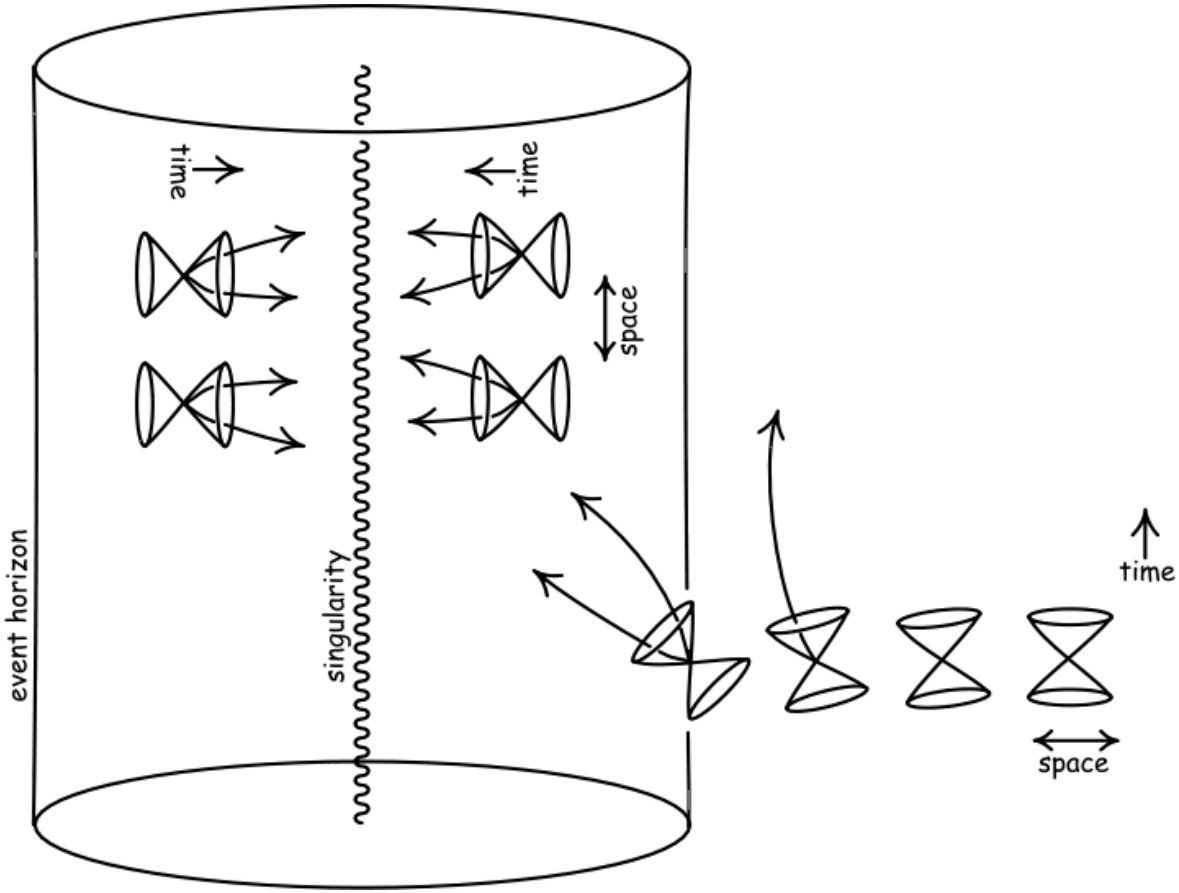
Minkowski diagram



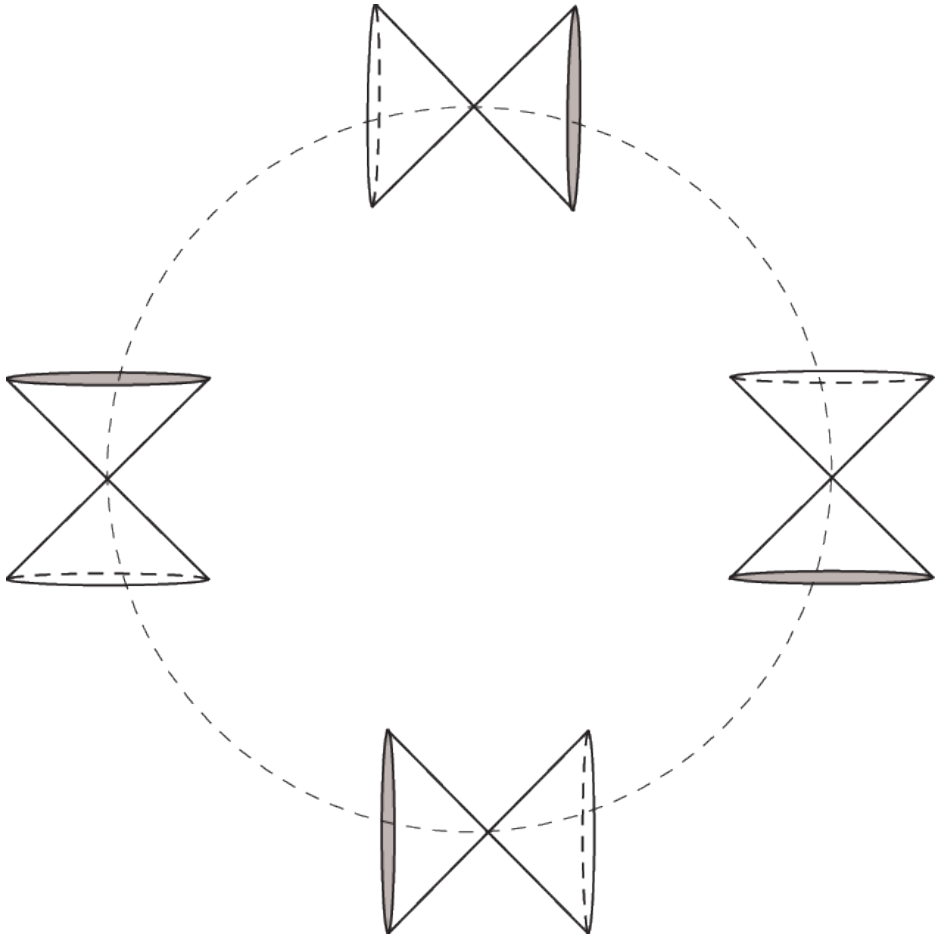
Light cones


TIME
FUTURE LIGHT CONE
OBSERVER
SPACE
HYPERSURFACE
OF THE PRESENT
SPACE
PAST LIGHT CONE

Time in black holes



Closed curve



Sending information instantaneously

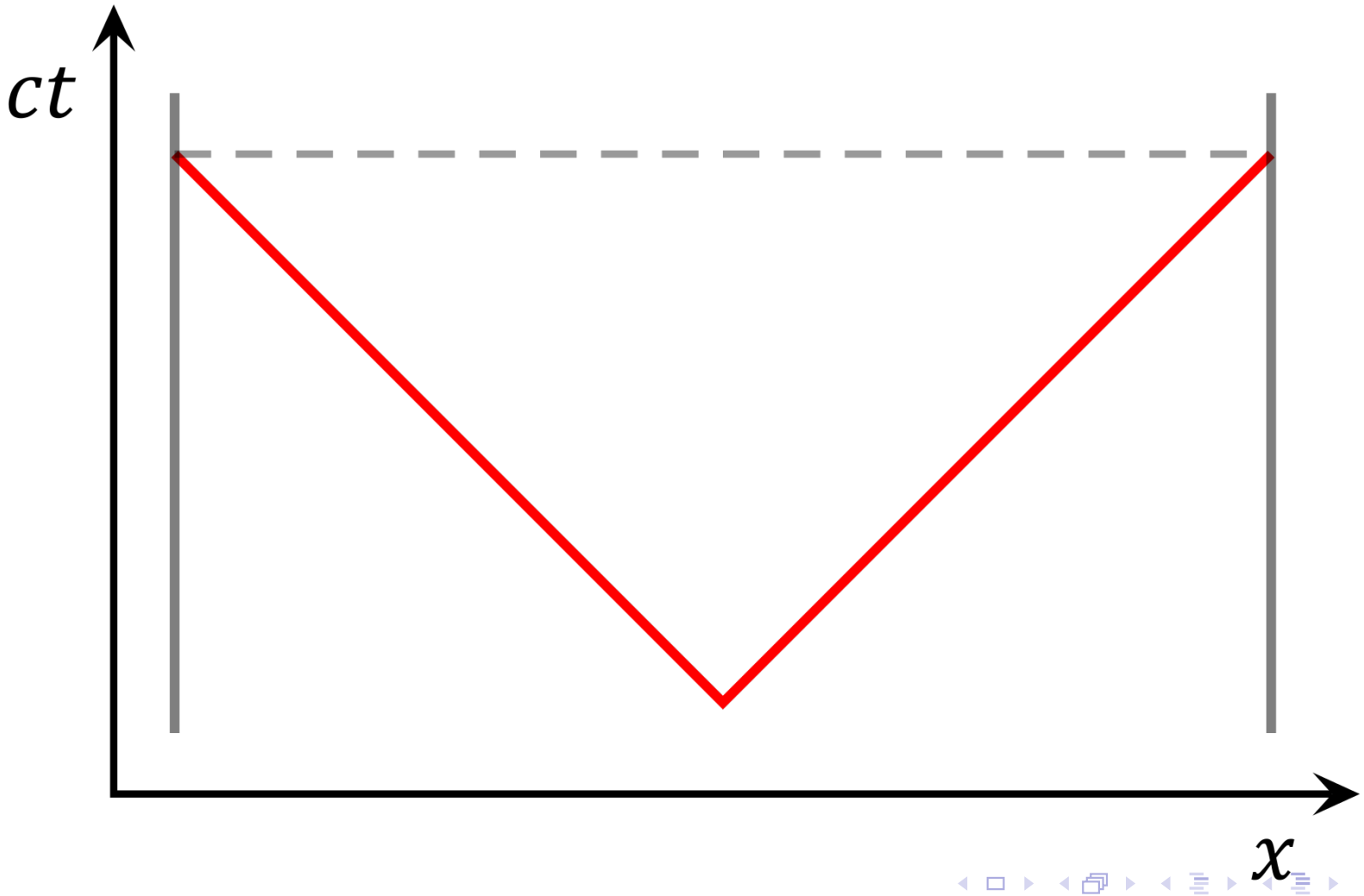
Faster than light (FTL) communication
$\Rightarrow$ Sending information back in time

Faster than light (FTL) travel
$\Rightarrow$ Sending matter back in time

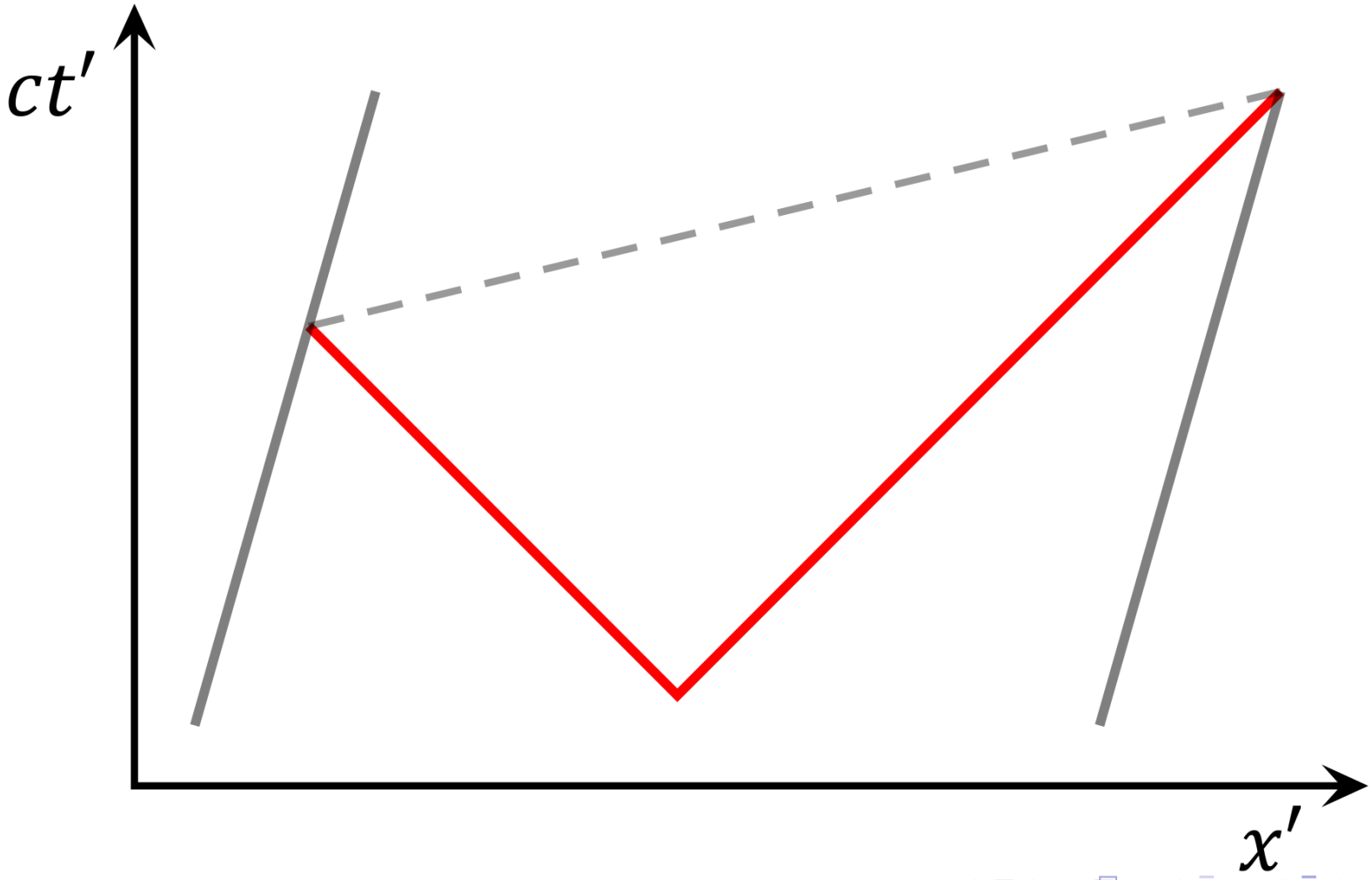
Pick two:

Relativity Causality FTL

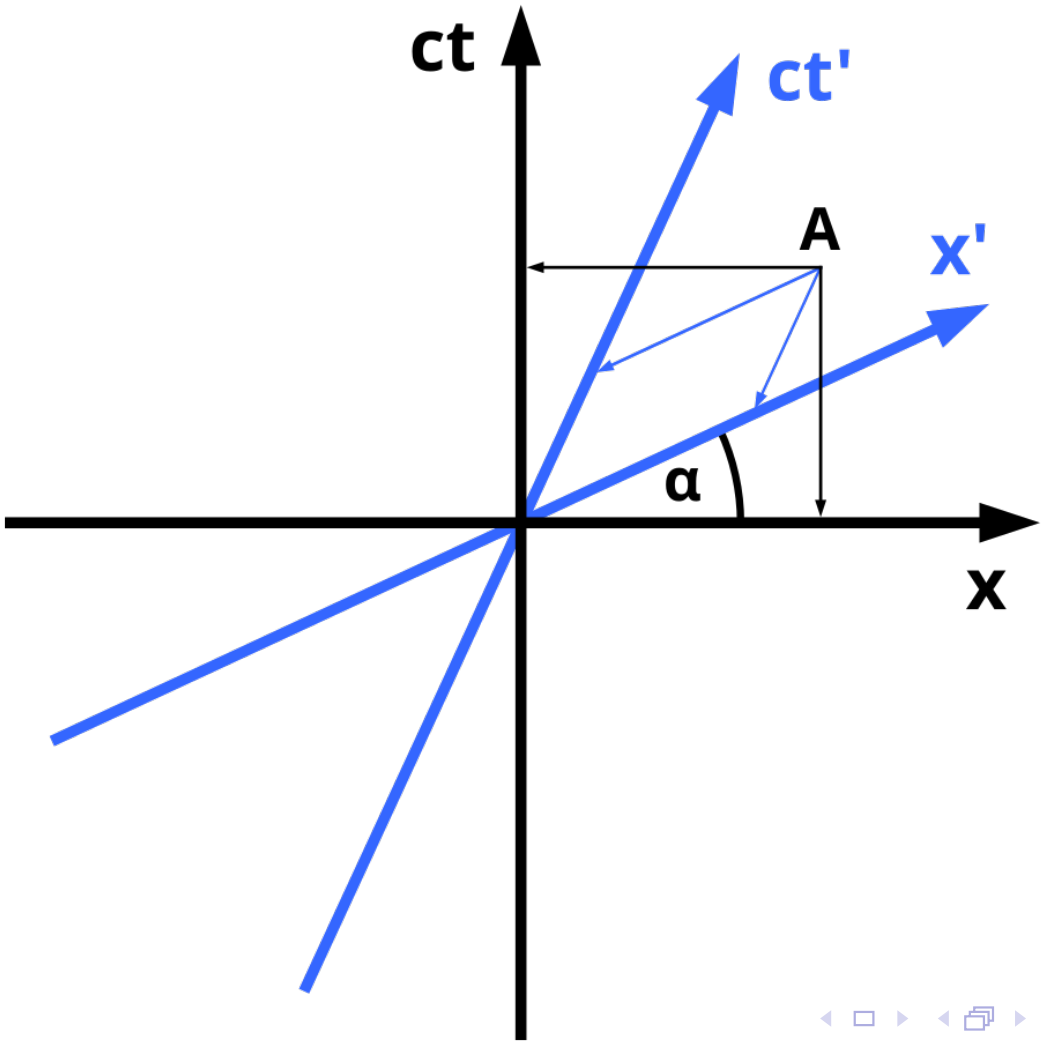
Resting system



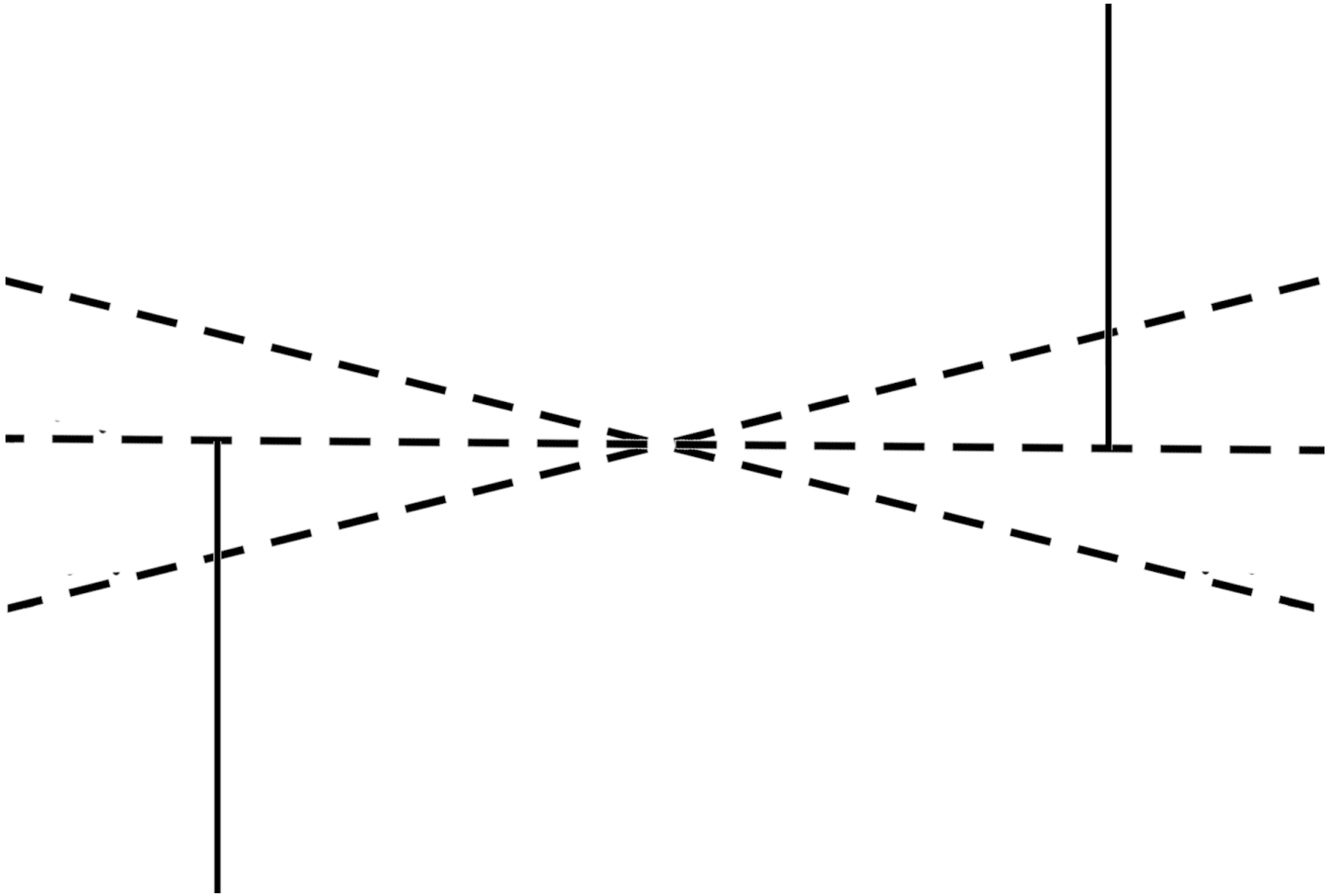
Moving system



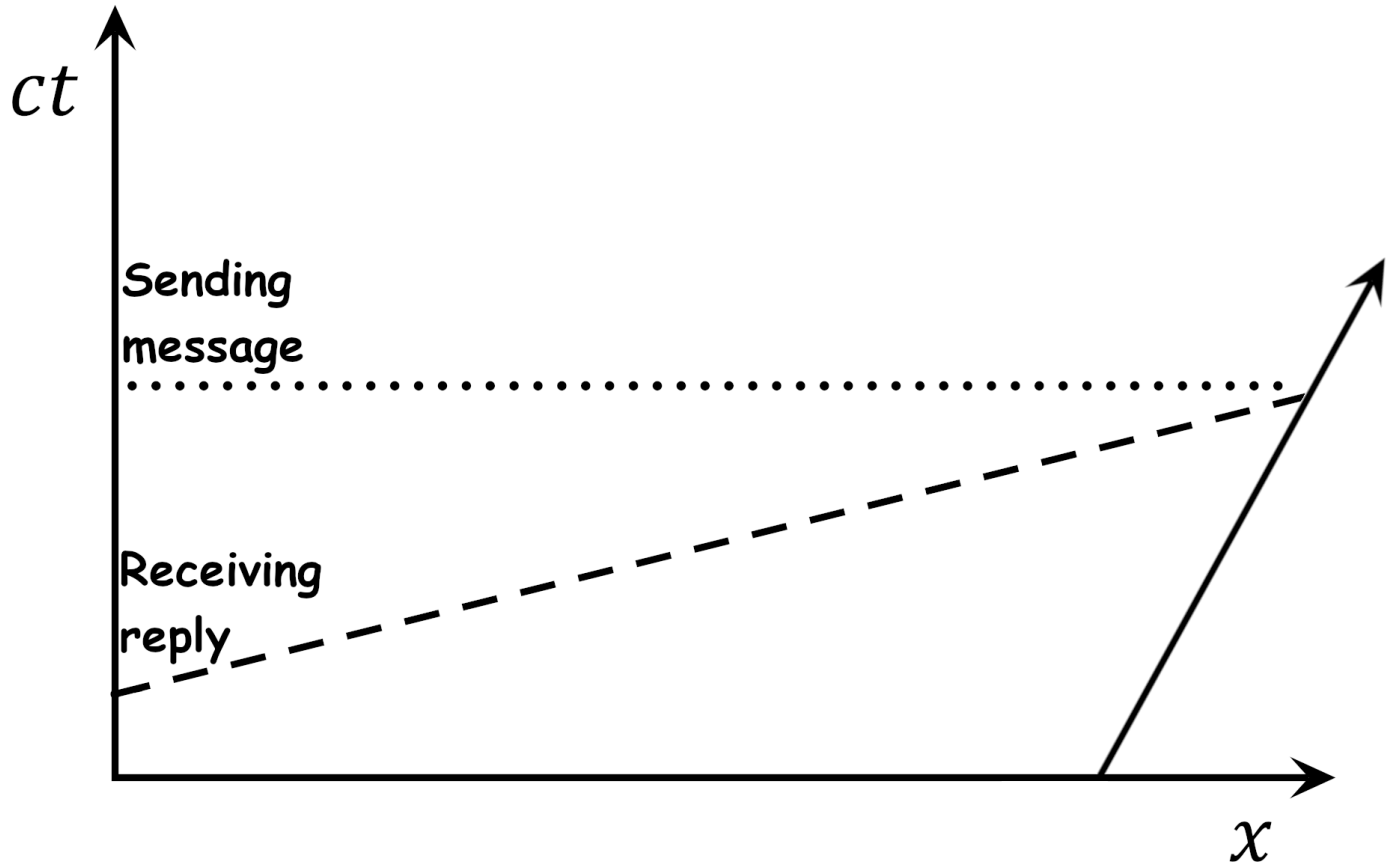
Transformation



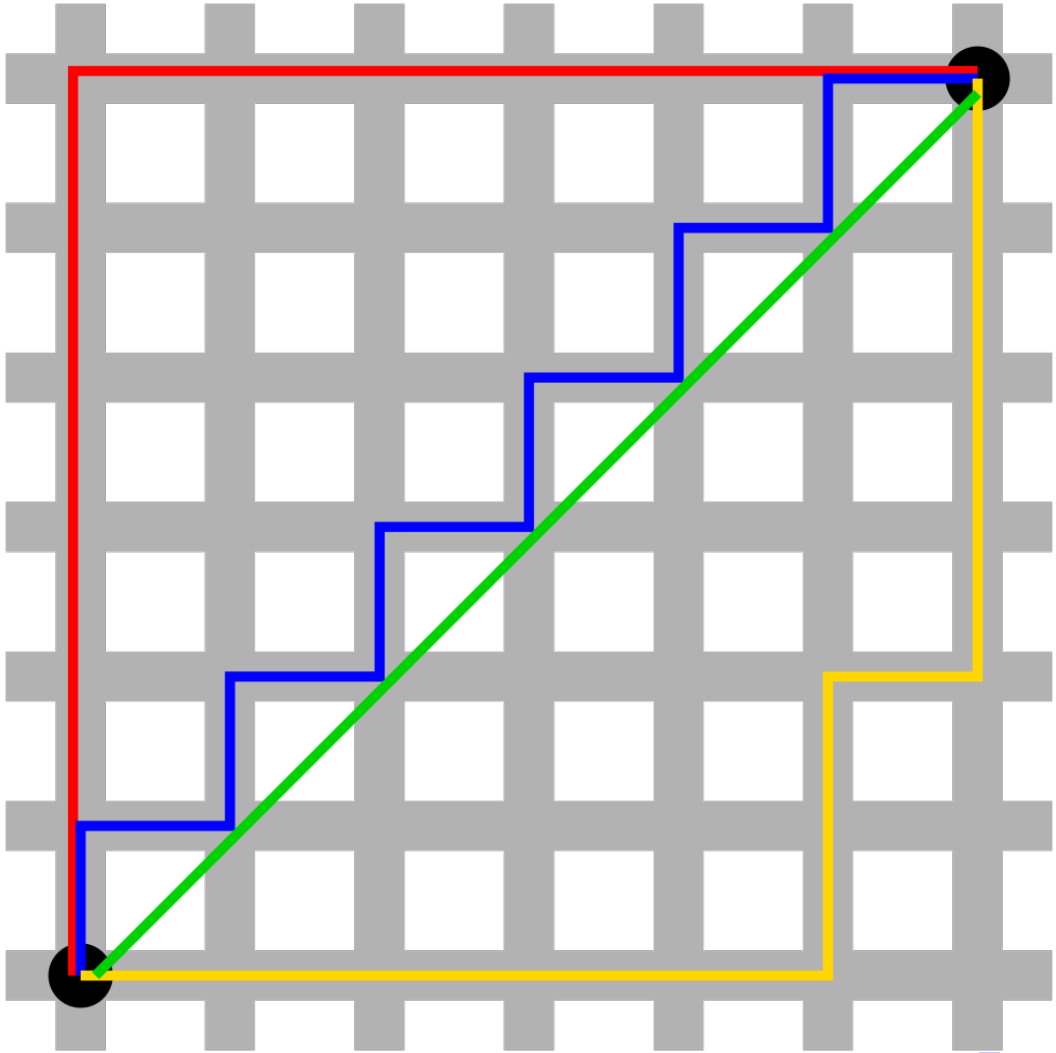
Sending messages back



Sending messages back



Manhattan metric



Lorentzian universe

In our universe, distance is calculated using:

$$s^2 = c^2t^2 - x^2 - y^2 - z^2$$

$s^2 \geq 0$ yields $c^2t^2 \geq x^2 + y^2 + z^2$
or $ct \geq r$ with traveled distance $r^2 = x^2 + y^2 + z^2$
or $c \geq v$ with traveled velocity $v = r/t$.

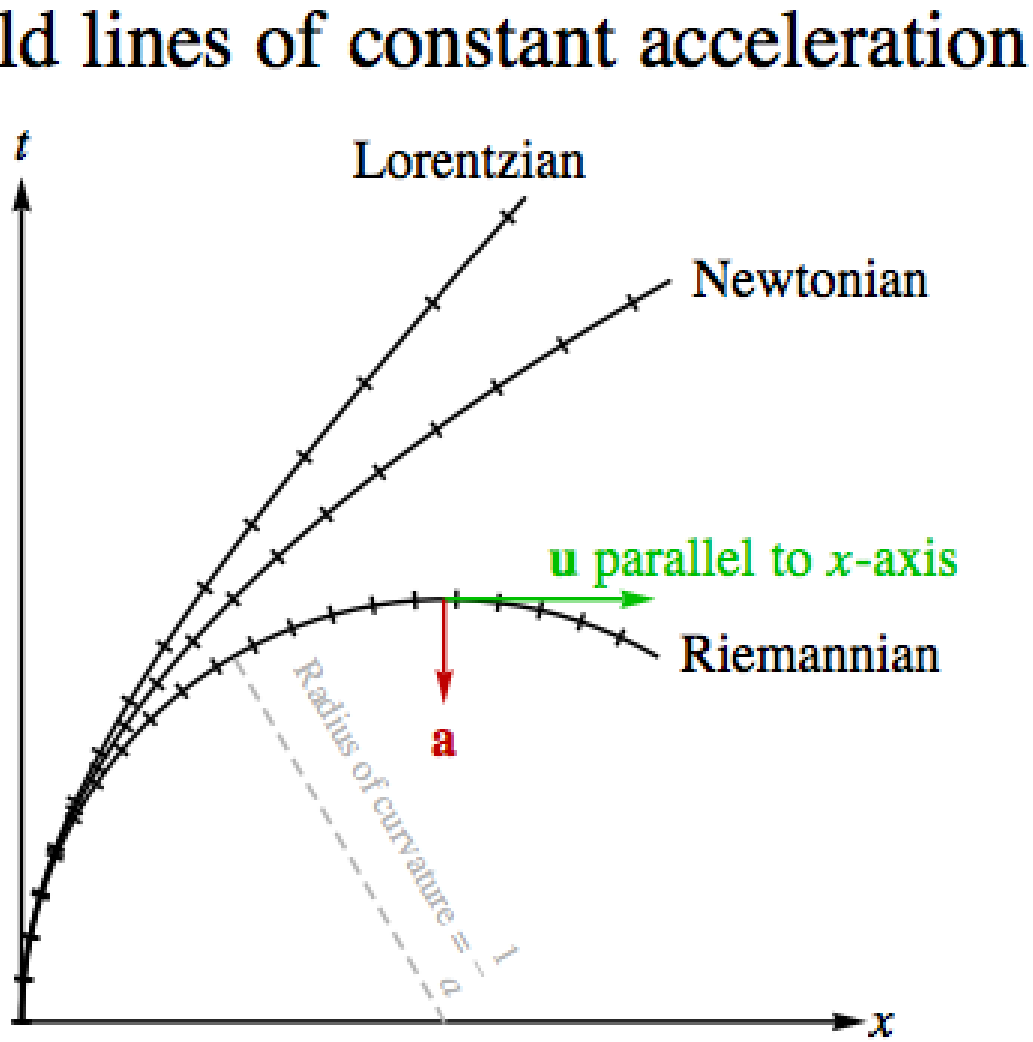
Riemannian universe

In a different universe, distance is calculated using:

$$s^2 = c^2 t^2 + x^2 + y^2 + z^2$$

$s^2 \geq 0$ is always fulfilled.

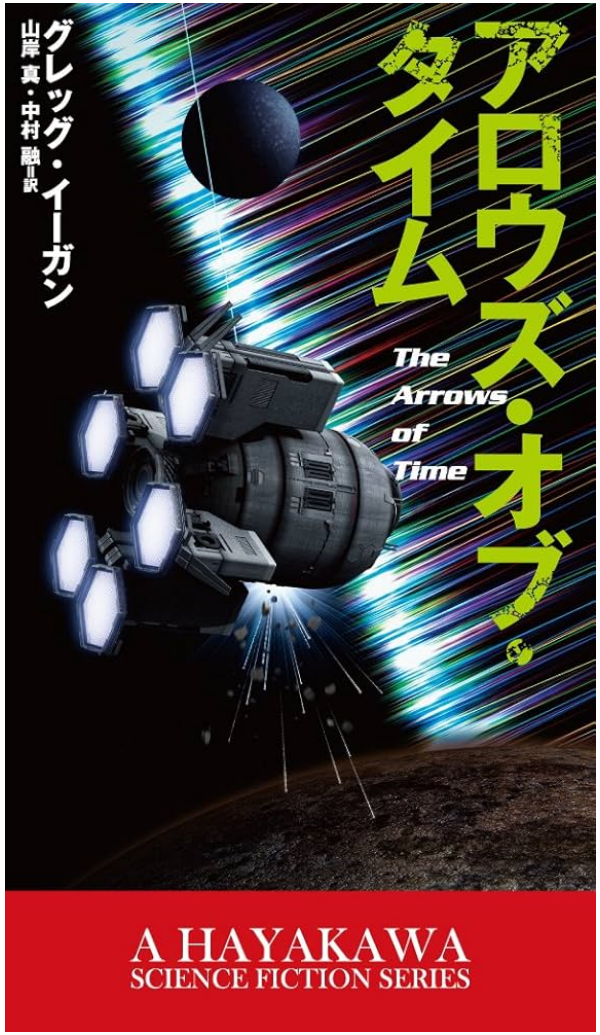
Worldlines


World lines of constant acceleration
t
Lorentzian
Newtonian
u parallel to x-axis
Riemannian
a
Radius of curvature = 1/a
x

Orthogonal


CLOCKWORK ROCKET
GREG EGAN
ETERNAL FLAME
GREG EGAN
THE ARROWS OF TIME
GREG EGAN

The Arrows of Time



Thanks for your attention! :-)

Questions?