GD300

Time + Motion + GD

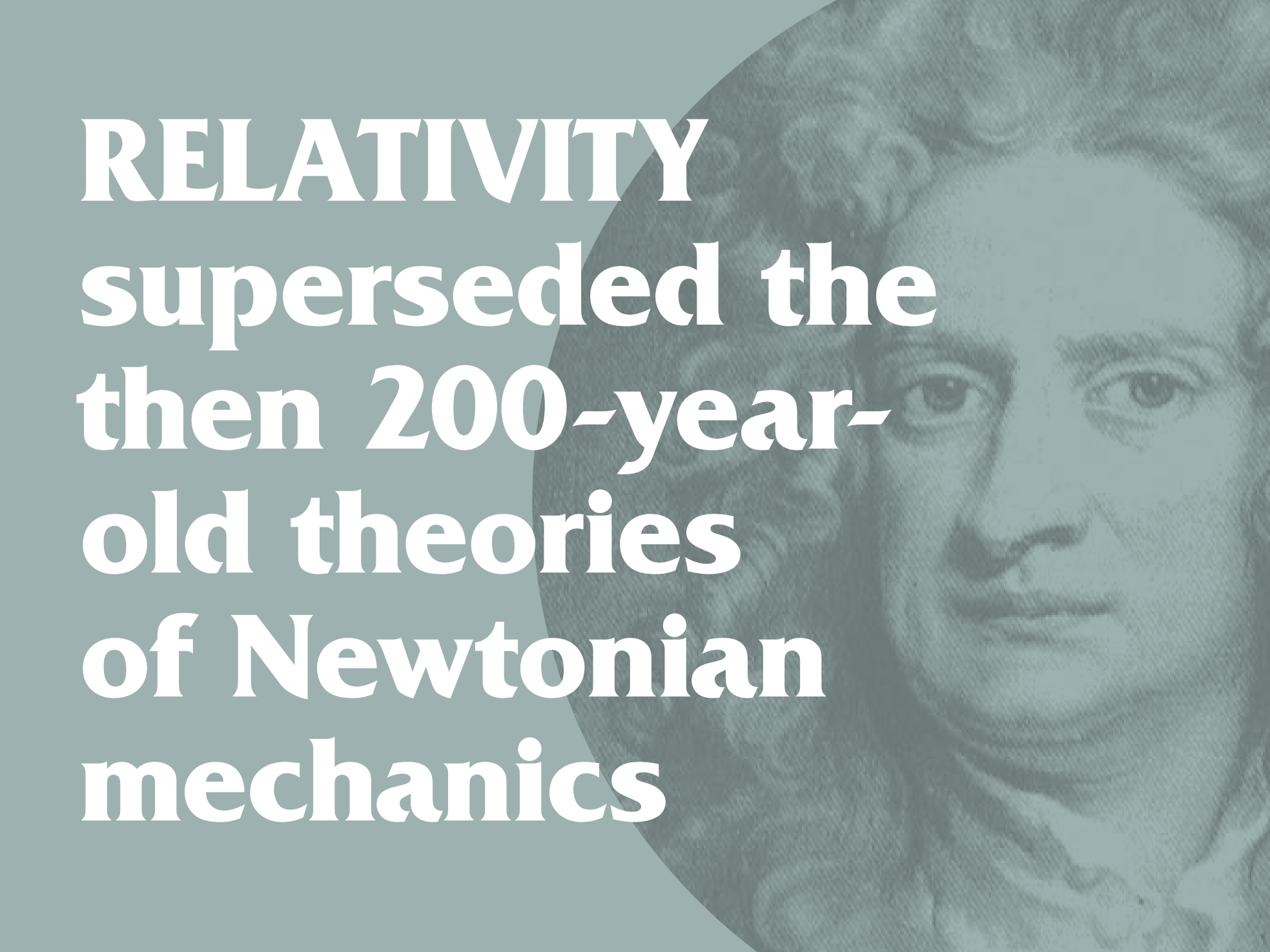
Relativity.

Einstein

+

Relativity

This throws newtonian mechanics out the window, and tries to describe the motion of EVERYTHING from the small (atoms) to the large (planets).



RELATIVITY superseded the then 200-year-old theories of Newtonian mechanics

NEWTON's LAWS stop working once you get to things moving really fast, or things that are really small, or things that are really large.

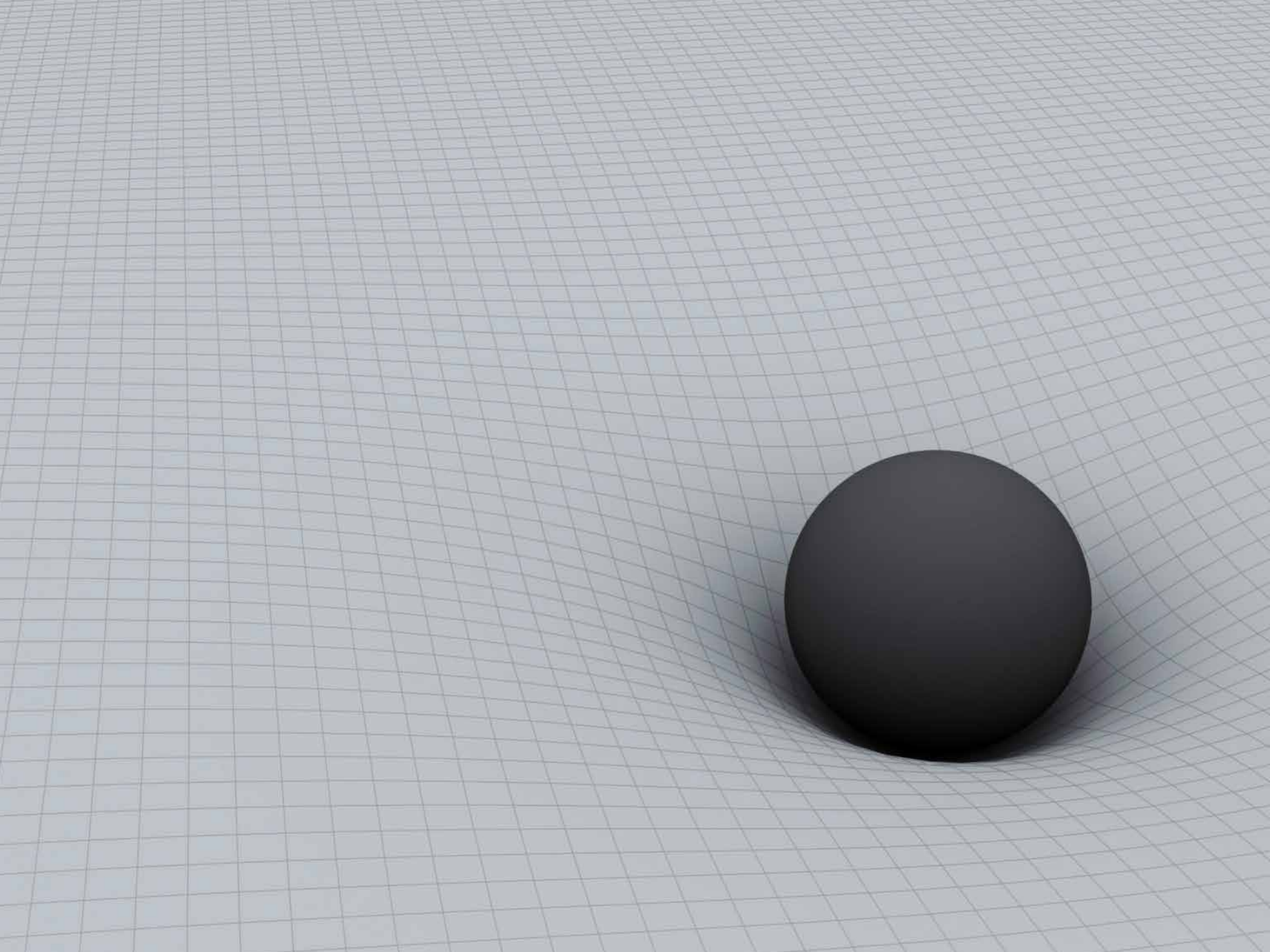
NEWTON's LAWS
also require the assumption that time is uniform + absolute.

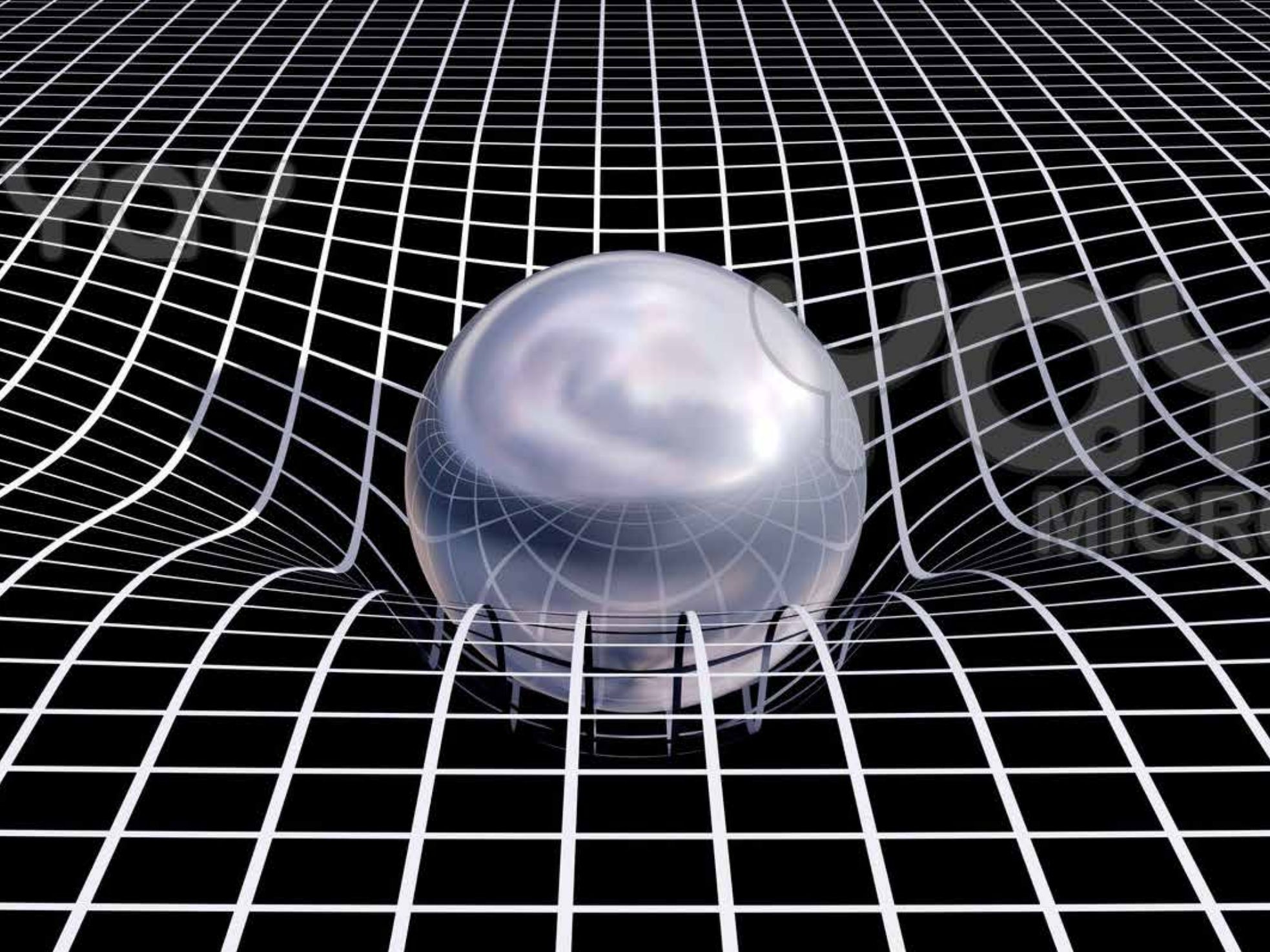
RELATIVITY
does not.

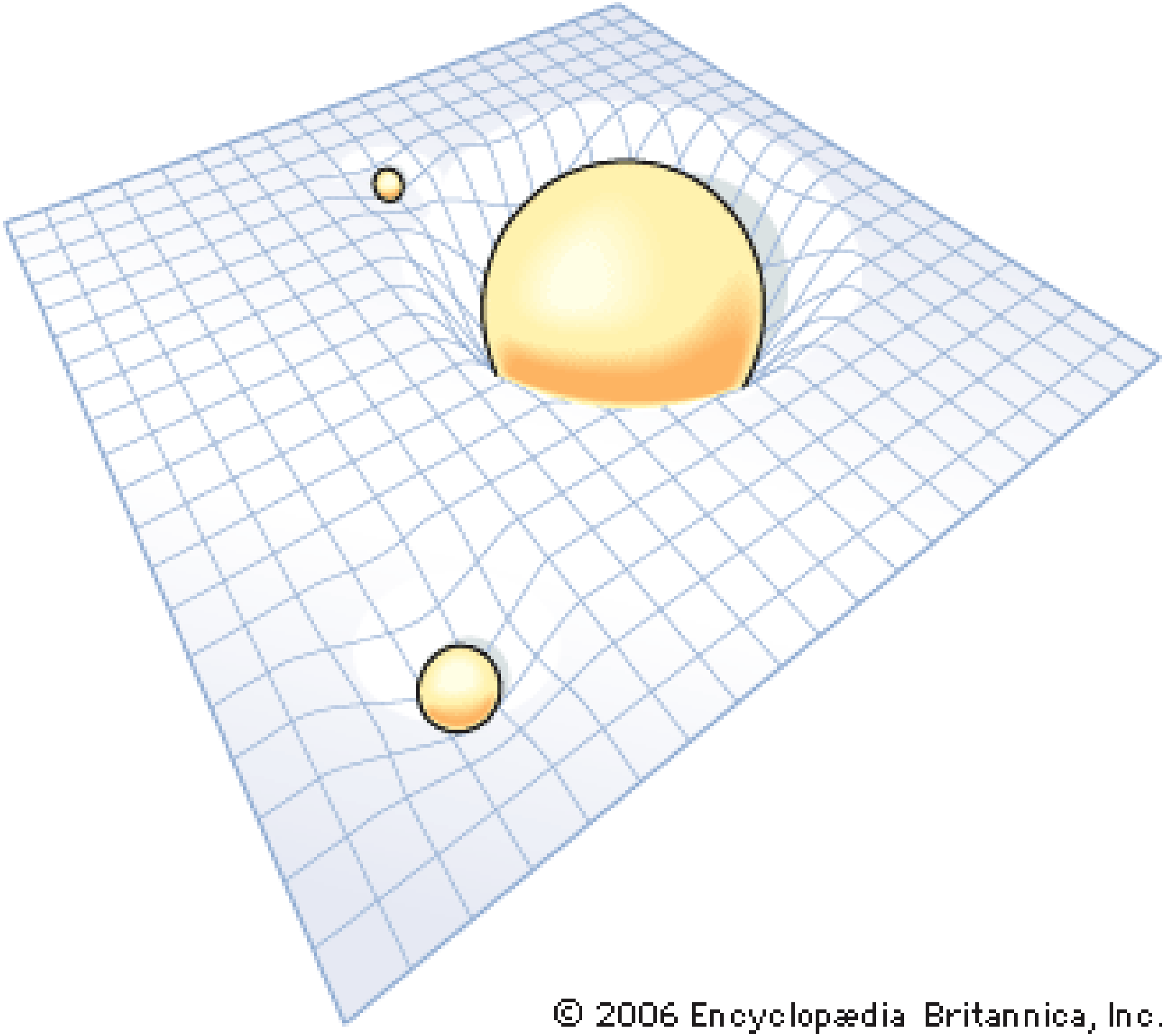
in Relativity,
SPACE and TIME
are not separate
entities ...

SPACETIME

SPACETIME
continuum



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Main Laws of Relativity

This is known in the physics world as “special relativity” – there is also “general relativity” … they are related but not identical, but that isn’t important for our basic understanding …

1. **The laws of physics are the same for all observers in uniform motion relative to one another***

aka, principle of relativity

SIMPLE DEFINITION:

The same rules must hold for everything – regardless of speed, location, size, shape, etc.

2. The speed of light in a vacuum is the same for all observers, regardless of their relative motion or of the motion of the source of the light.

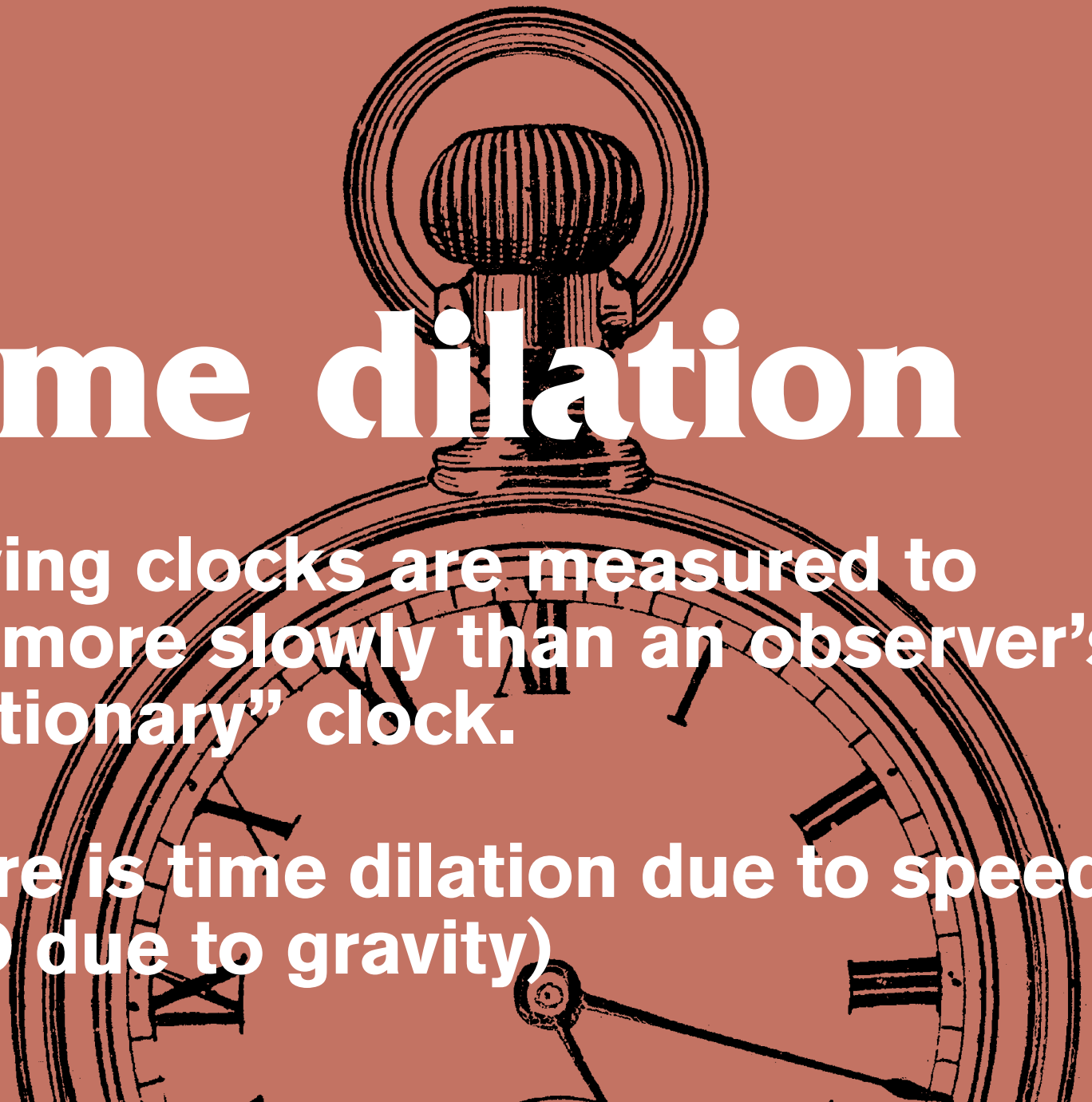
SIMPLE DEFINITION:

If you are trying to measure the speed of light, even if you are travelling nearly the speed of light yourself, it will still be the speed of light...

Other Cool Bits and Issues of/ with Relativity

Relativity of simultaneity

Two events, simultaneous for one observer, may not be simultaneous for another observer if the observers are in relative motion.



Time dilation

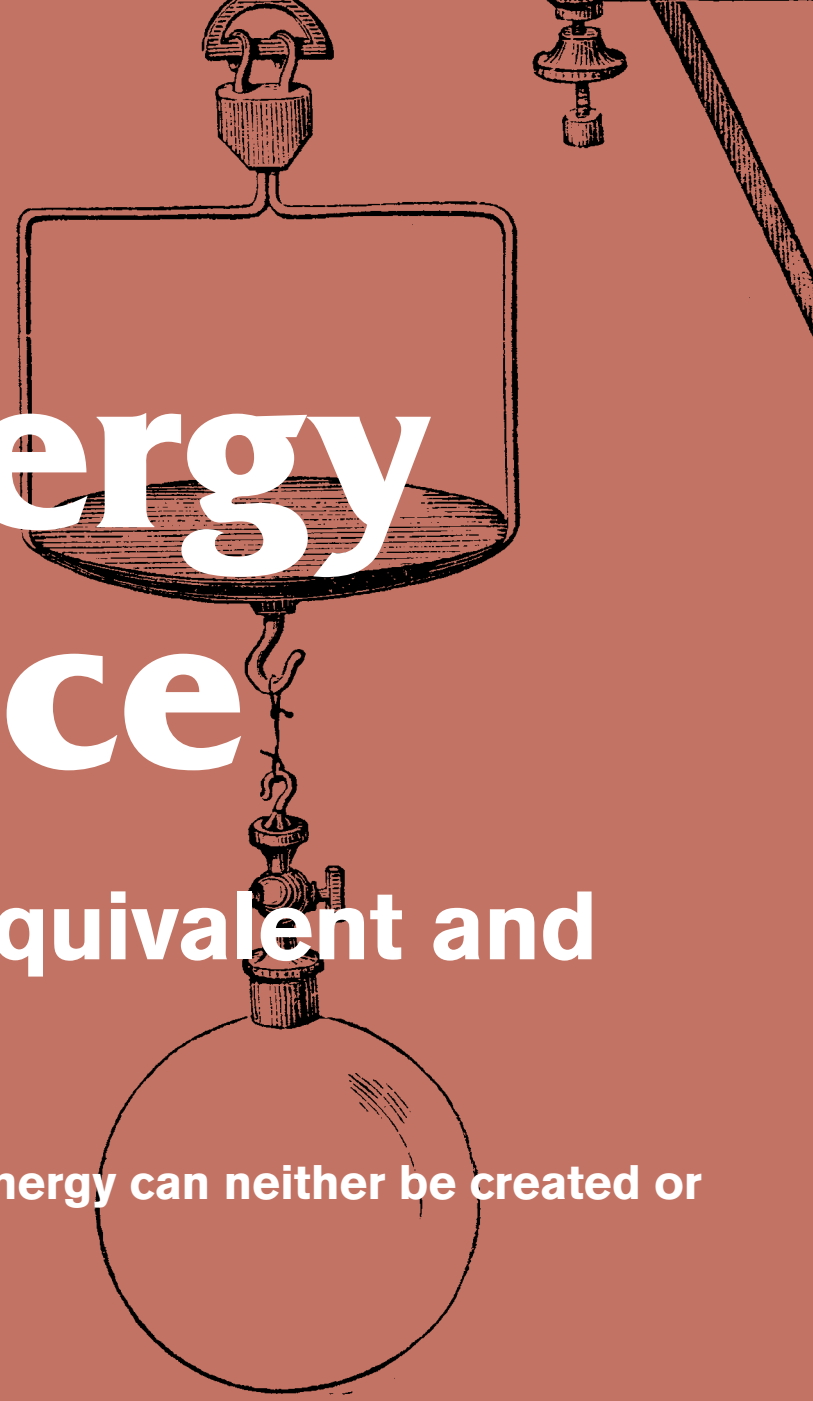
Moving clocks are measured to tick more slowly than an observer's "stationary" clock.

(there is time dilation due to speed AND due to gravity)

Length Contraction

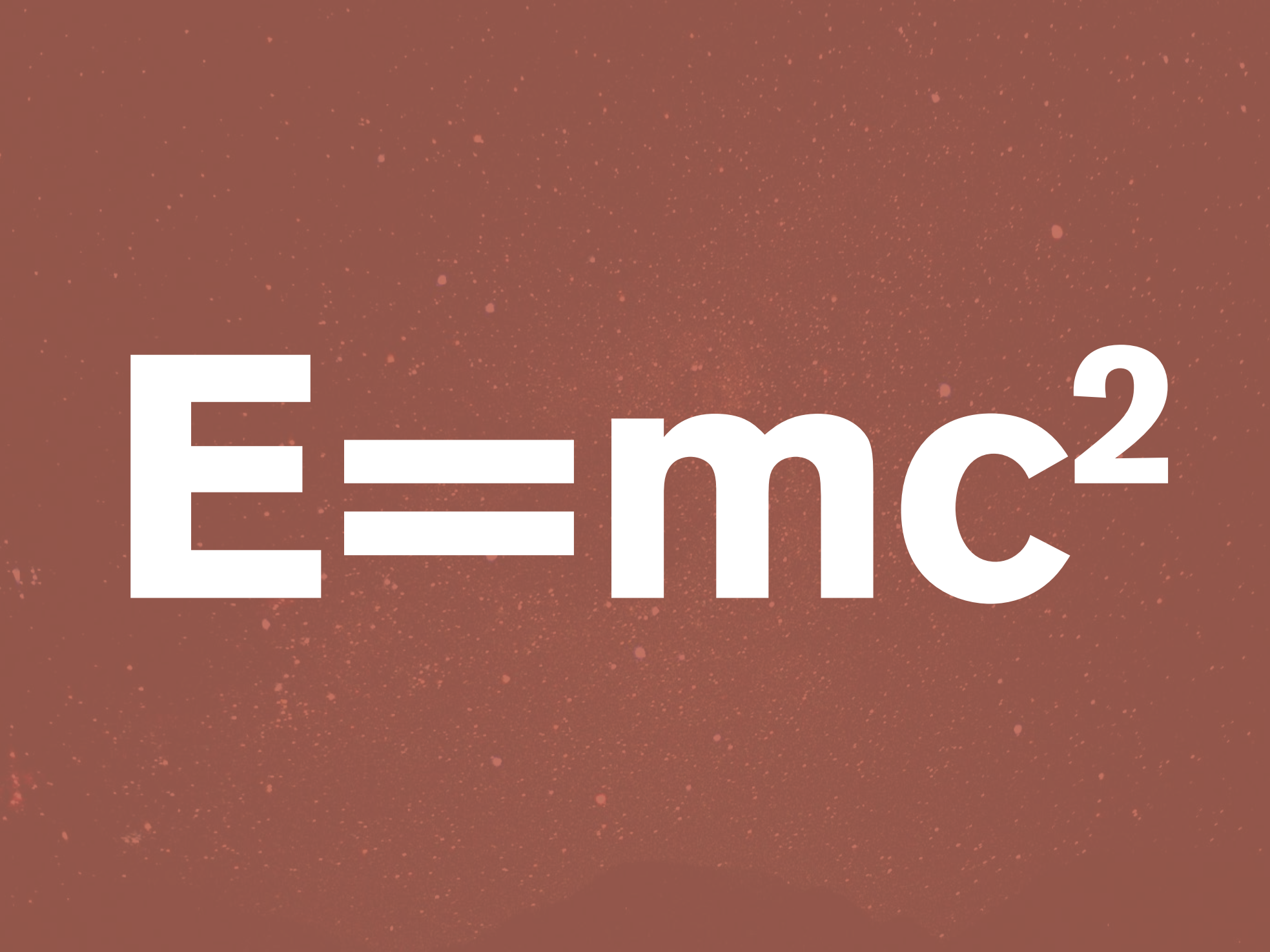
Objects are measured to be shortened in the direction that they are moving with respect to the observer.

Mass–energy equivalence



energy and mass are equivalent and transmutable.

(has useful application in thermodynamics, energy can neither be created or destroyed, merely changes forms)


$E=mc^2$

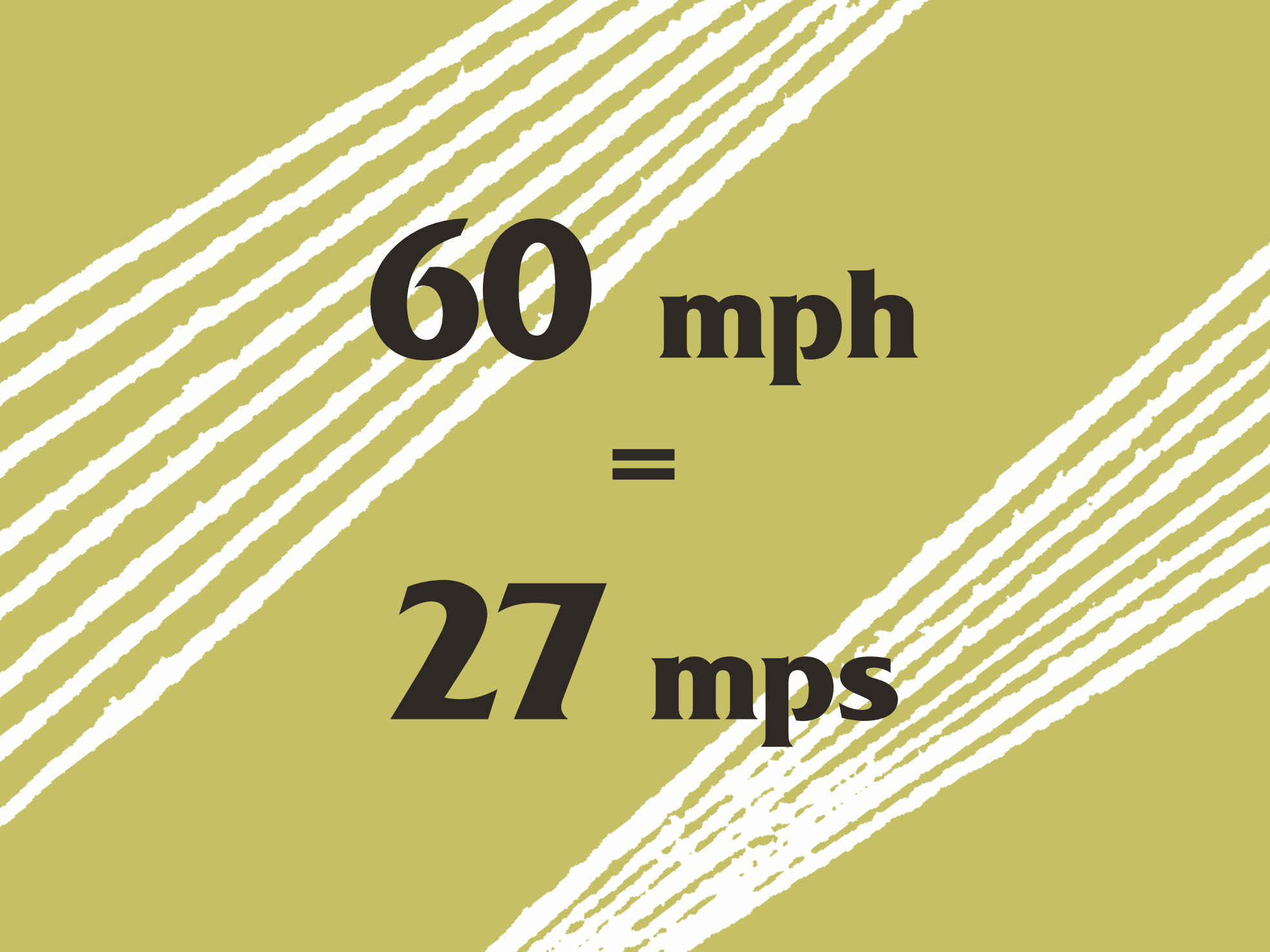
Maximum speed is finite

No physical object, message or field line can travel faster than the speed of light in a vacuum.

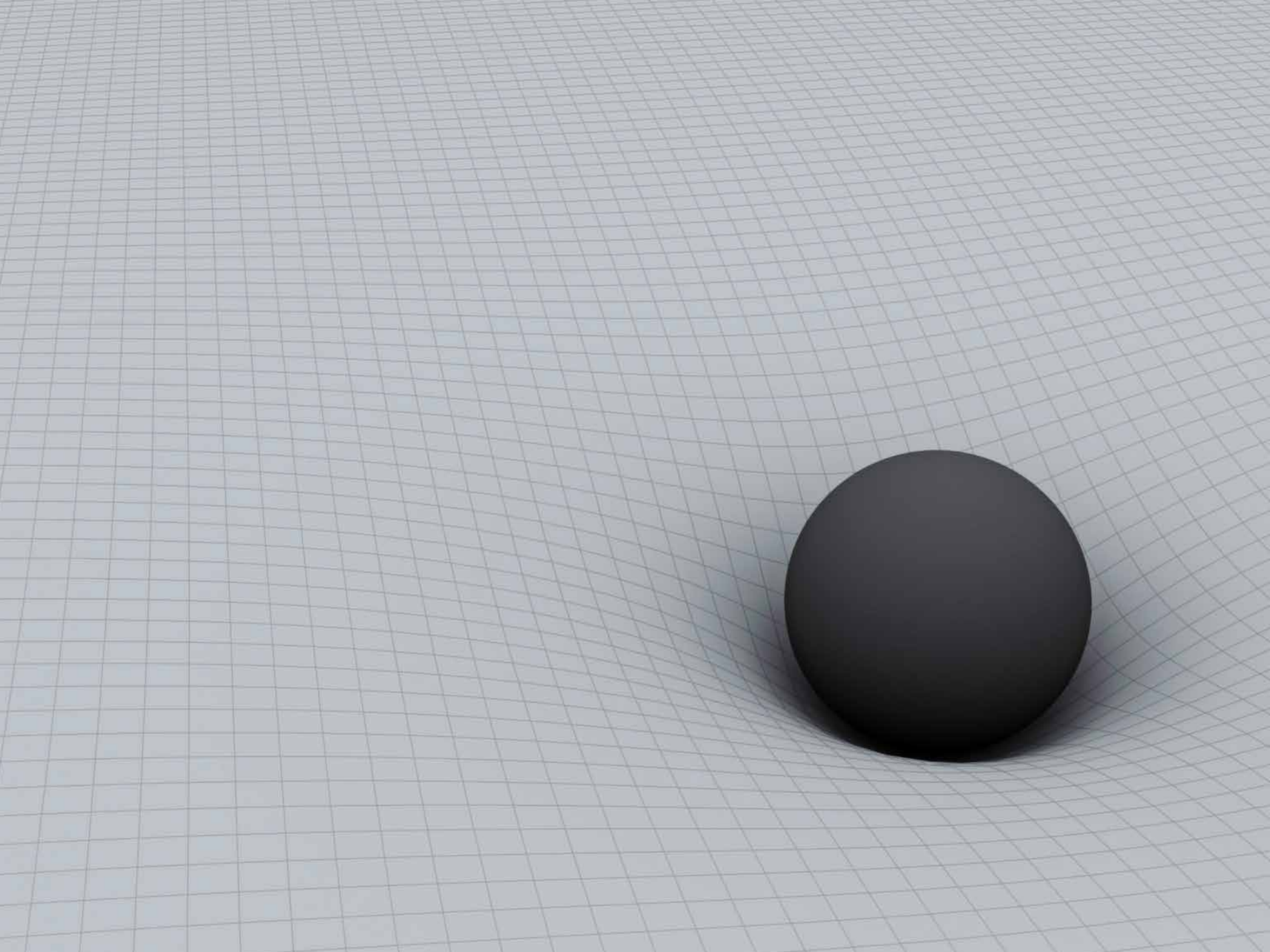
The Speed of Light

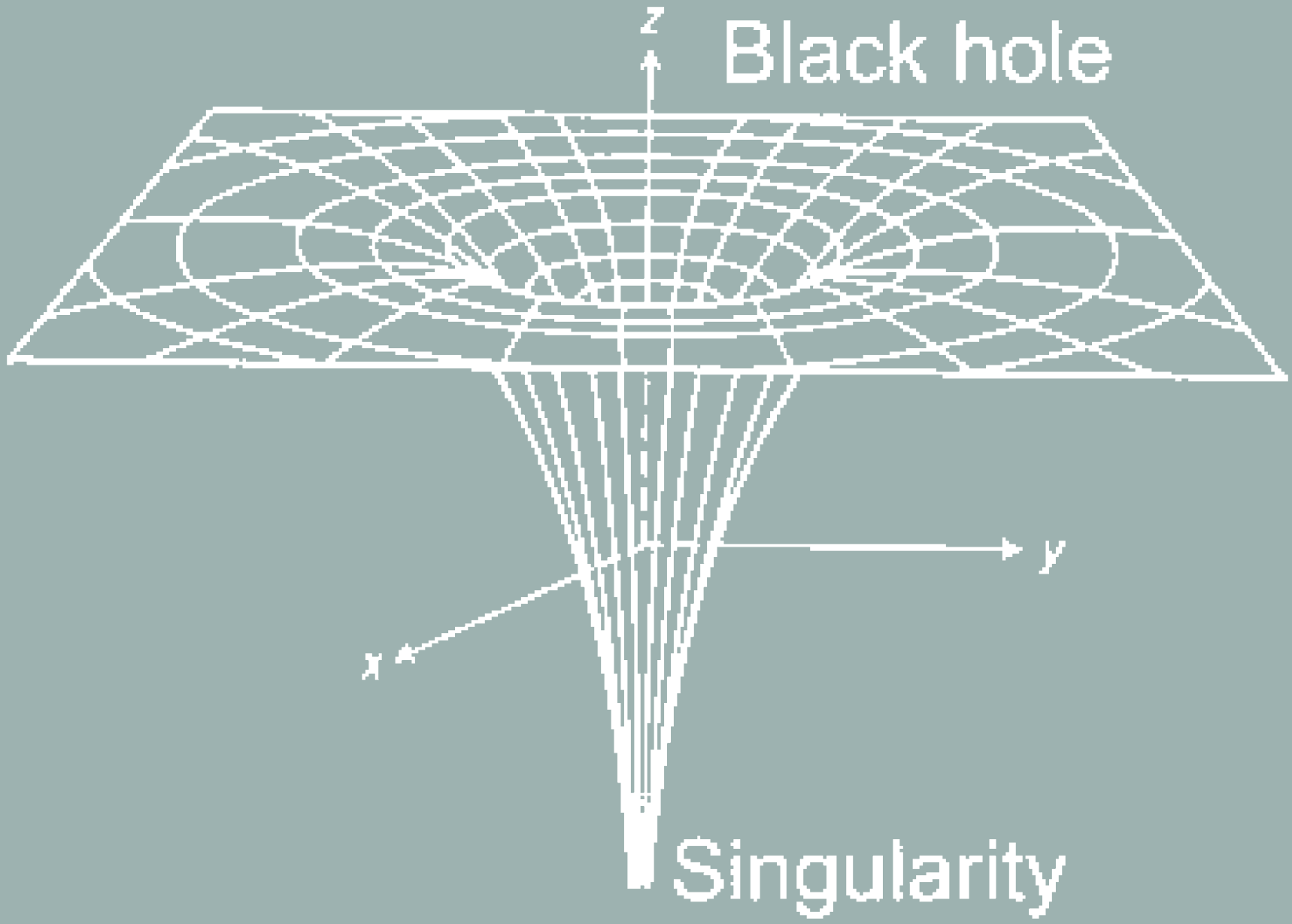
299,792,458

meters per second


60 mph
=
27 mps

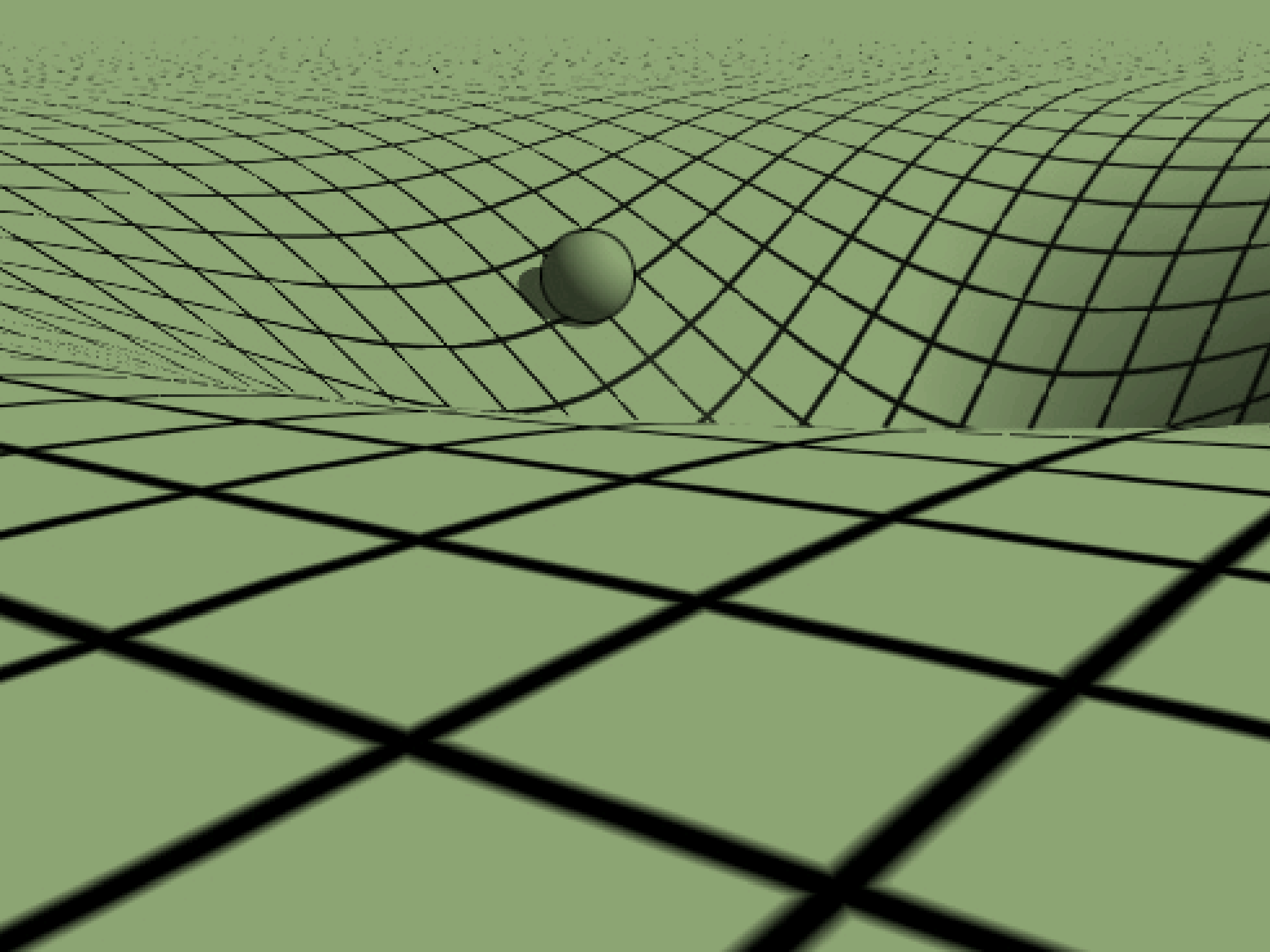
Black Holes.




z
Black hole
y
x
Singularity

Time Travel.


STEVEN SPIELBERG PRESENTS
BACK TO THE FUTURE
PG
A ROBERT ZEMECKIS FILM
DUTATINE



Paradox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