

The Centre for Inquiry and the University
of Toronto Secular Alliance present:

THE GREAT TIME DEBATE

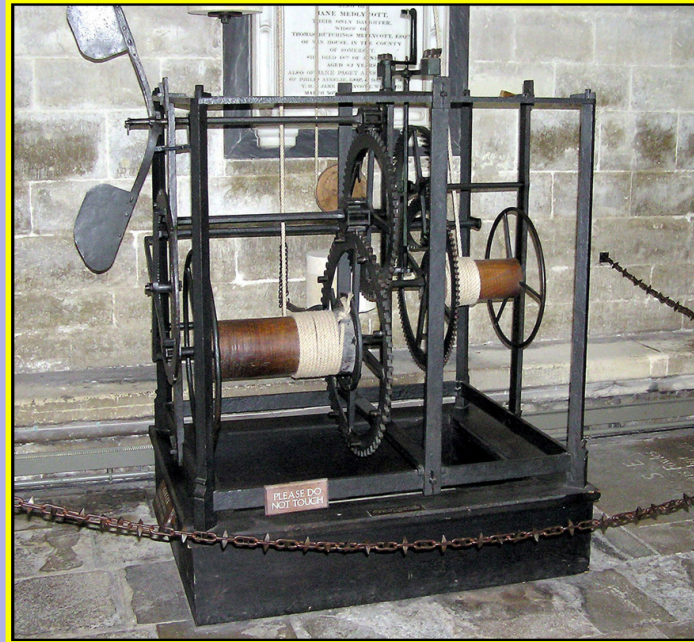
Tuesday, January 26, 2010



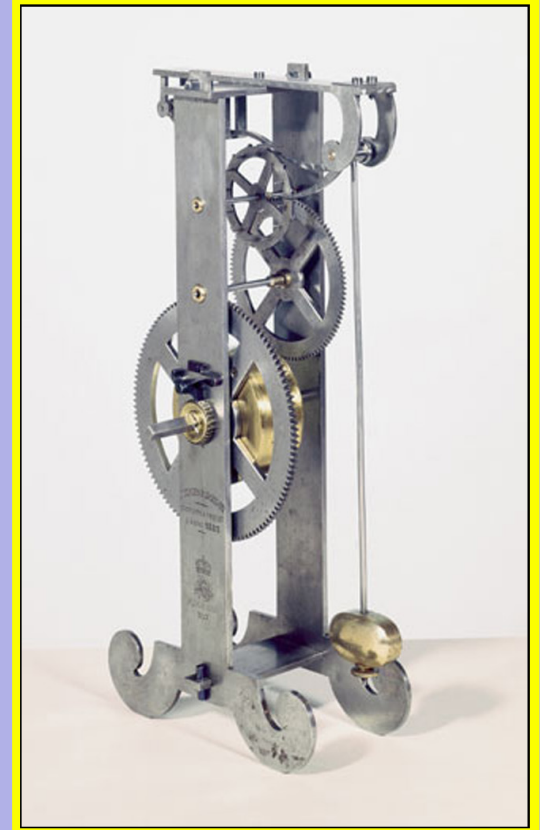




Sundial
~3500 BC



verge & foliot
~1300

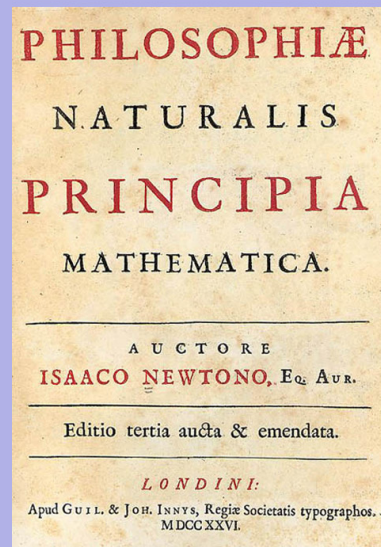


pendulum
~1650

Mechanical clocks

“Absolute, true, and mathematical time,
in and of itself and of its own nature,
without reference to anything external,
flows uniformly.”

Newton's
Principia
(1687)



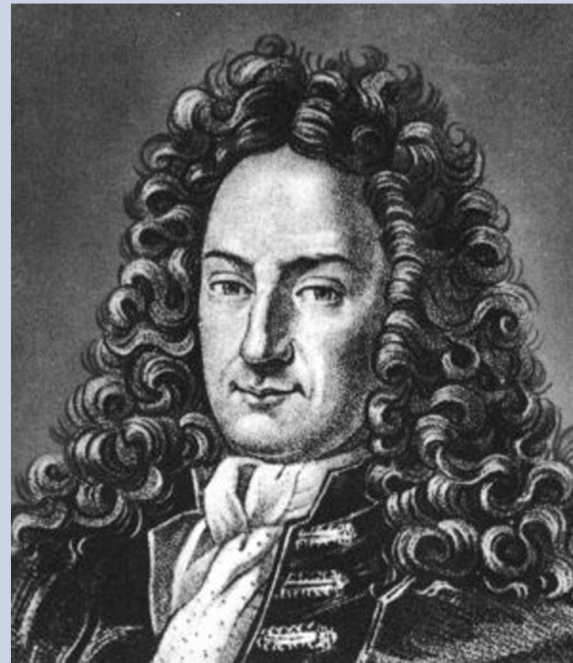
Isaac Newton
(1642-1727)

Objections

- Can time really be measured other than *in relation to* the motion of objects?

Newton says yes;
the “relationists”
say no!

Gottfried Leibniz
(1646-1716)



Objections

Was time passing before God created the universe?

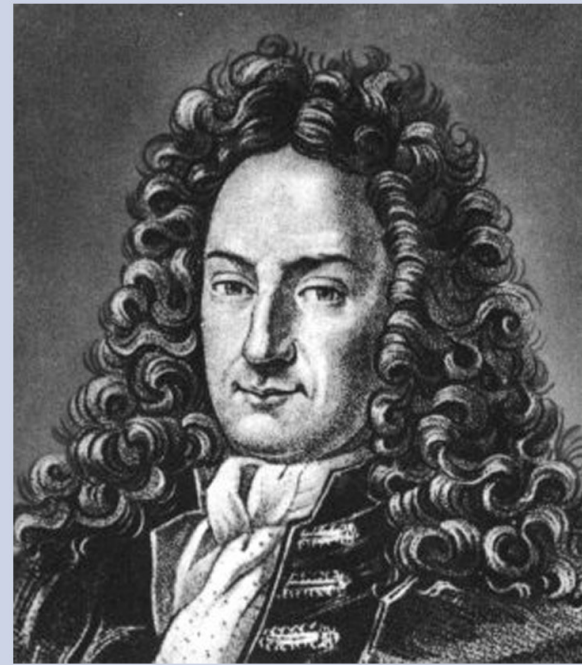


Objections

Was time passing before God created the universe?



Newton: "Sure."

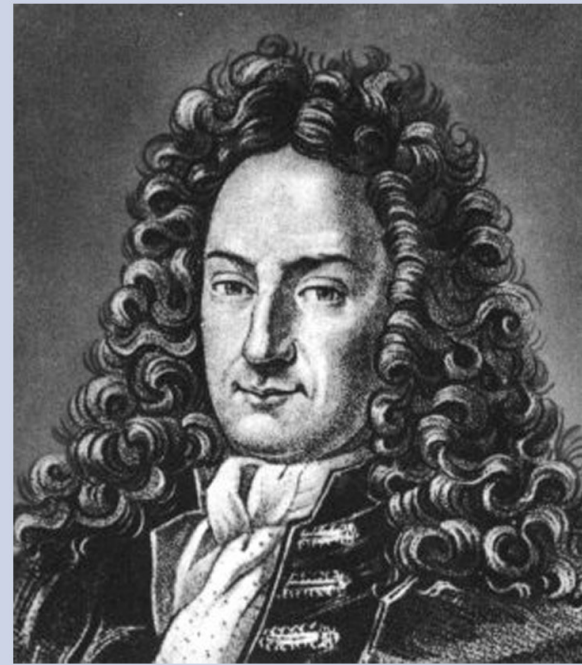


Leibniz: "That's crazy!"

Objections

Was time passing before God created the universe?

Surely God must
have created time
together with
the universe!



**special relativity
1905**

**general relativity
1915**



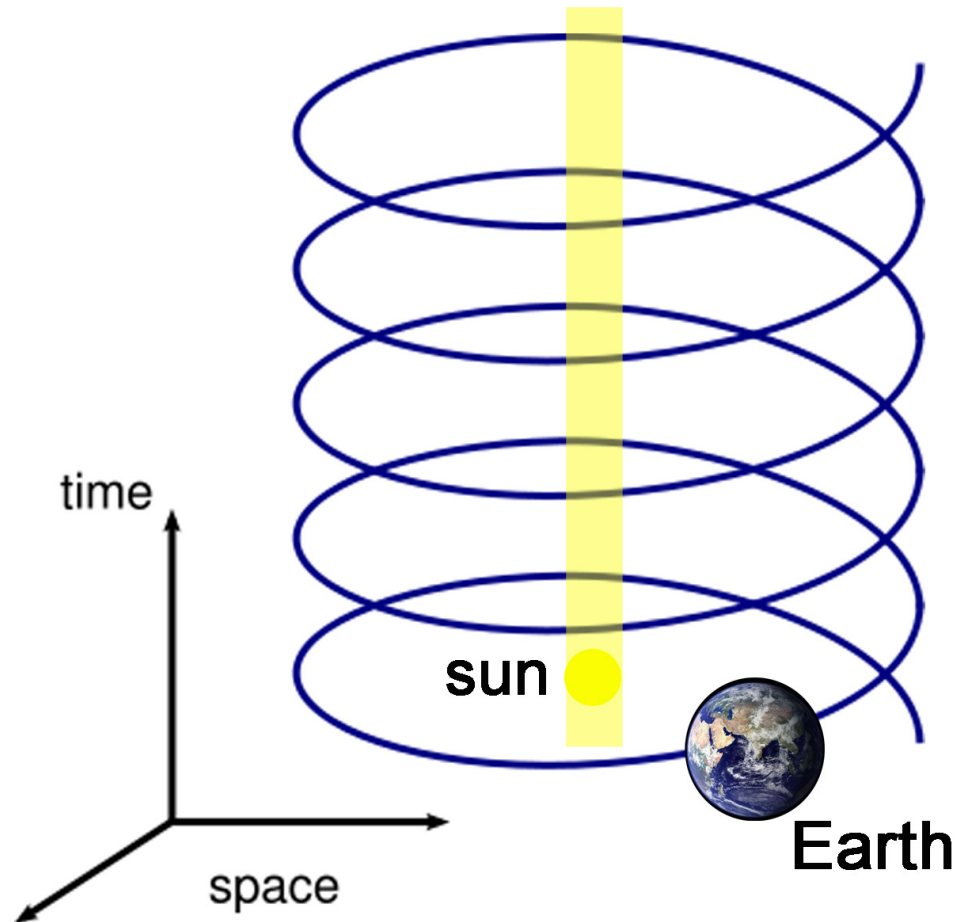
**Albert Einstein
(1879-1955)**

Implications of Einstein's theory:

- time and space linked (“spacetime”)
- time measurements depend on speed
- even twins can end up with different ages!
- gravity distorts spacetime



Picturing 4-dimensional spacetime: the Earth-Sun system



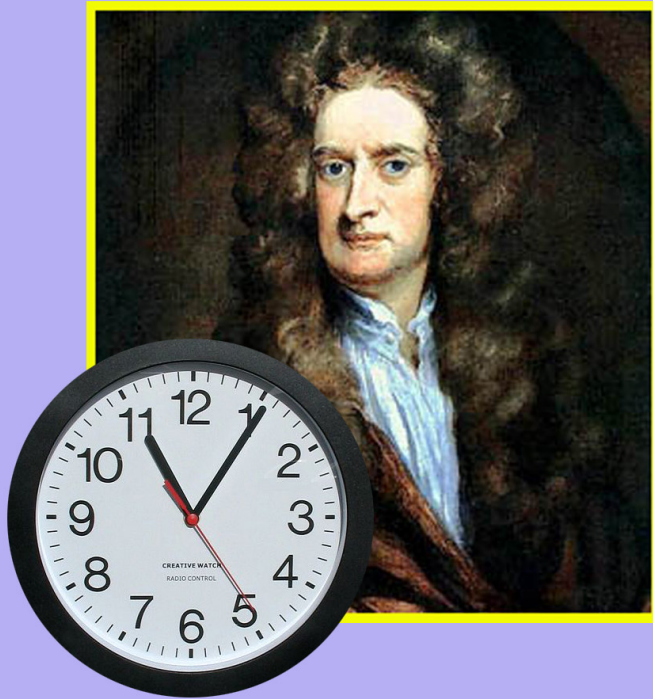
Another implication of Einstein's theory

No universal “now”



*“There is no audible tick-tock everywhere
in the world that can be considered ‘time.’”*

- Einstein



Newton:
One “master clock”
for the universe



Newton:
One “master clock”
for the universe

Einstein:
Everyone has their *own* clock
-- and they can disagree

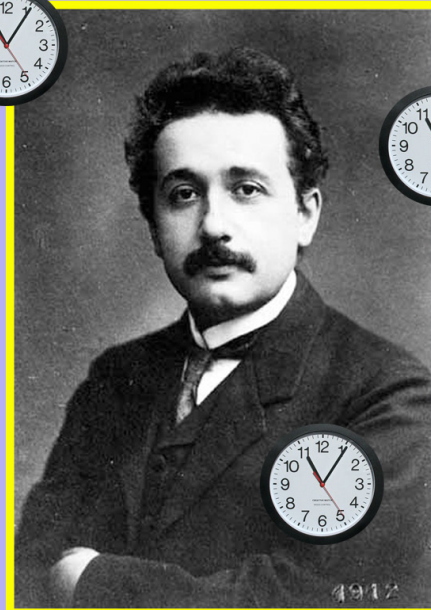




Newton:
One “master clock”
for the universe

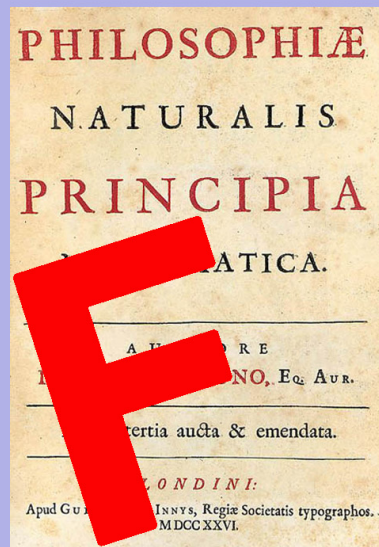


Einstein:
Everyone has their *own* clock
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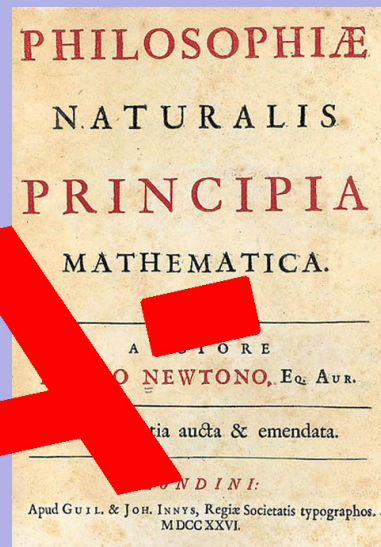
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*Excellent, but your
definitions need work.*



Isaac Newton
(1642-1727)

One more implication...



**...the universe may
have had a beginning!**

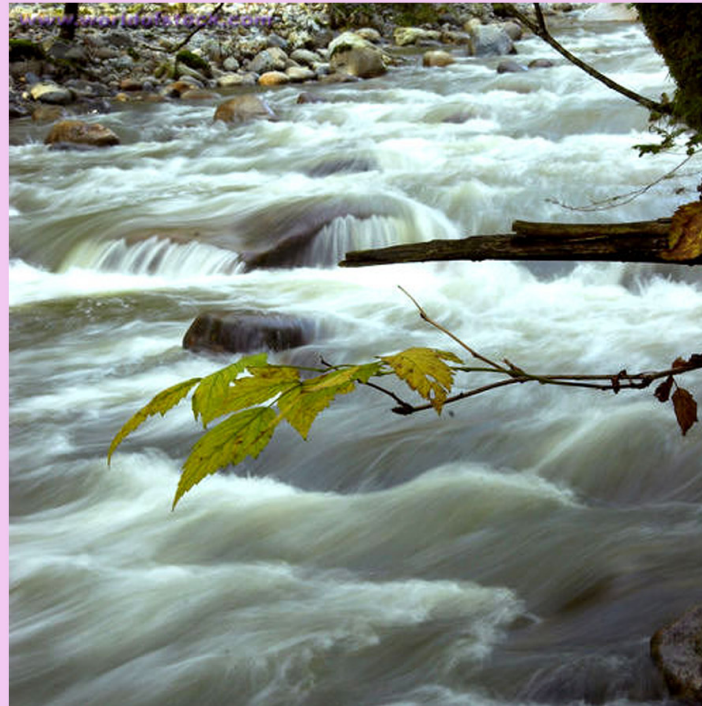


But...

What came before
the Big Bang?

(Did “time” exist...?)

We say that time “flows like a river”...



...Does it really?

If time doesn't flow, then what's going on?

- Many “nows”
- no “flow” to connect them
(just a static array – “Platonia”)

*“Time is... a mistake the mind has made.
I would say of time what Laplace said to
Napoleon about God: ‘I have no need
of that hypothesis.’”*

Julian Barbour



***“Time ‘flows’ only in the sense in which a line flows
or a landscape ‘recedes into the west.’ That is, it is an
ordered extension. And each of us proceeds through time
only as a fence proceeds across a farm.”***

D.C. Williams
philosopher
(1899-1983)



Is time more than
just “motion” or “change”?

Was the big bang the
beginning of time?

Why does time seem
so different from space?

Is the future as “real” as
the present or the past?

Could the flow of time
be an illusion?

What happens if I travel through a navigable
wormhole into my own past and (let's say
accidentally) kill my grandfather?

