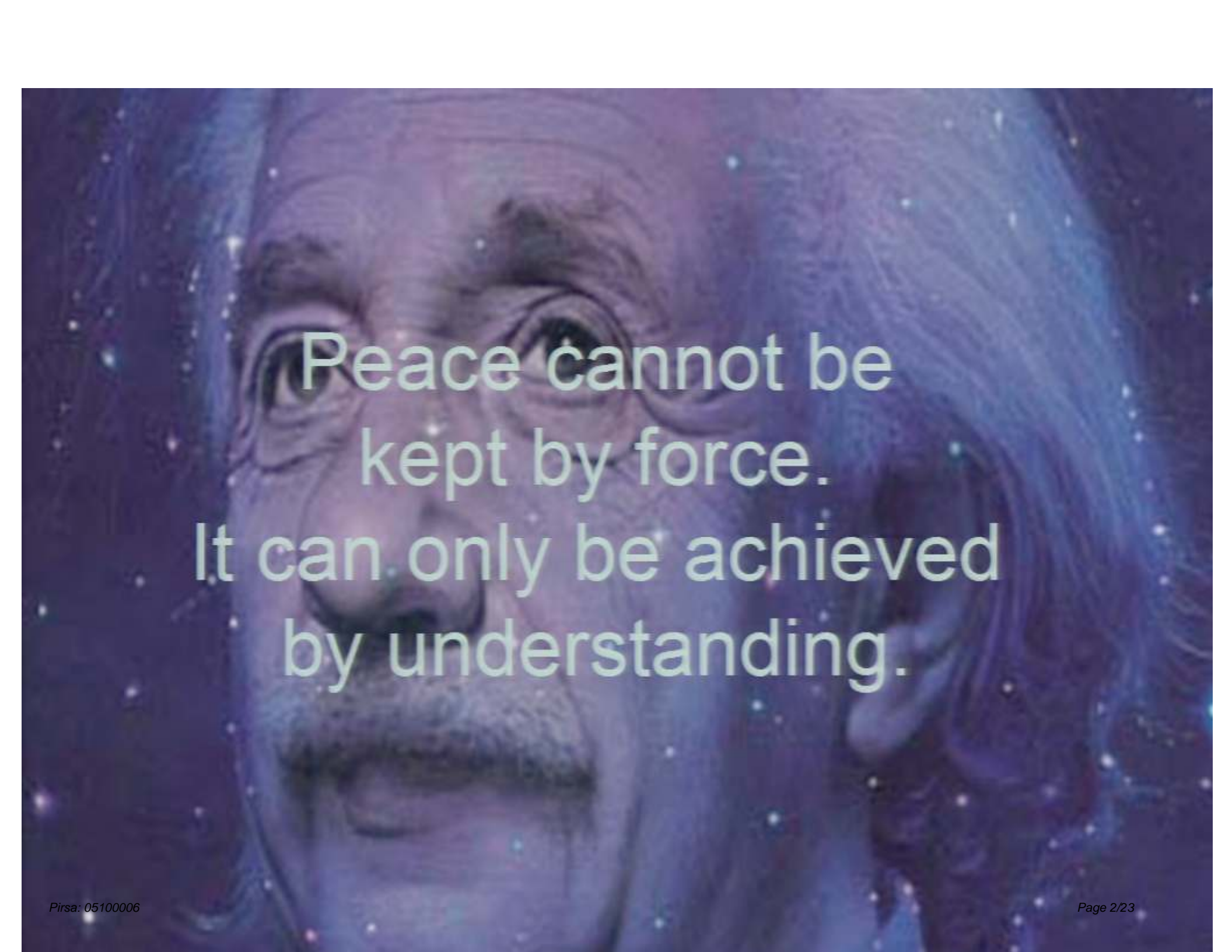


Title: June and September 1905: Reshaping Space, Time and Energy

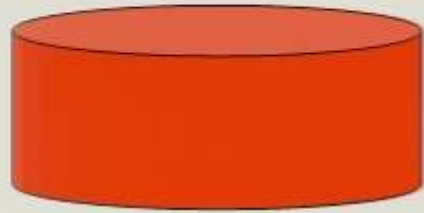
Date: Oct 02, 2005 02:00 PM

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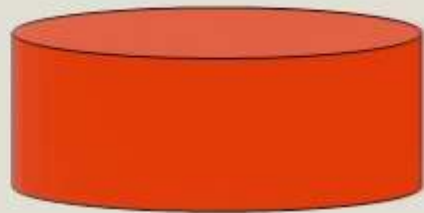
Abstract: Few, if any, papers have attracted as much attention as Einstein's June paper on the Special Theory of Relativity and no equation of physics has become part of common discourse except for the equation Einstein presented in his September paper: $E = mc^2$. The concepts of space and time are ubiquitous in physics and, since the Special Theory of Relativity fundamentally altered these concepts, the impact of the June paper on physics has been pervasive. With the additional assertion, made in the June paper, that the speed of light is a constant for all observers, time and space became relative. From his Theory of Relativity, Einstein produced his September surprise: ponderable mass and incorporeal energy are equivalent. Humans distinguish between mass and energy, but Nature does not. <kw> John S Rigden, Einstein, special relativity, space, time, general relativity, energy, mass, speed of light, </kw>

A close-up portrait of Albert Einstein, rendered in a blue monochrome palette. The image has a soft, ethereal quality with a starry or nebula-like background. The text is overlaid in a clean, white, sans-serif font.

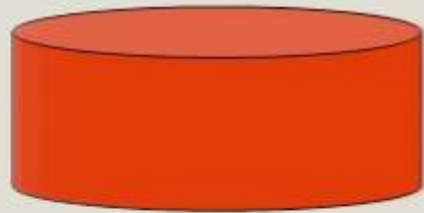
Peace cannot be
kept by force.
It can only be achieved
by understanding.



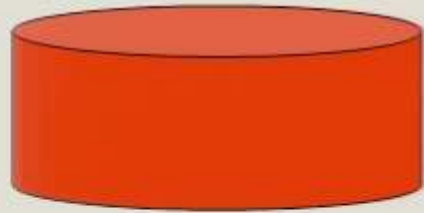
Light and Atoms



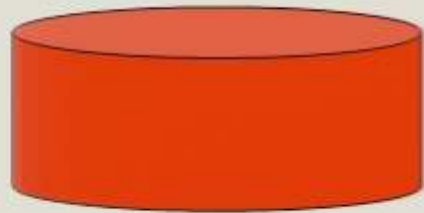
Thermodynamics and
Kinetic Theory



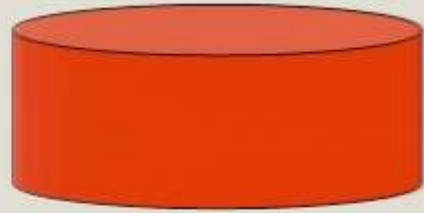
Mechanics, Thermo. and
Kinetic Theory



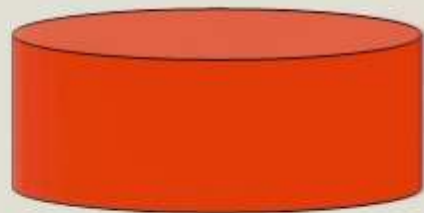
Light and the Ether



Mechanics and
Electromagnetism



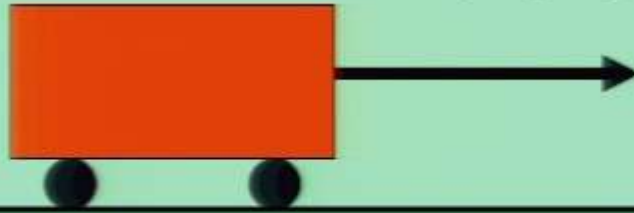
Light and the Ether



Mechanics and Electromagnetism



78 km/hr



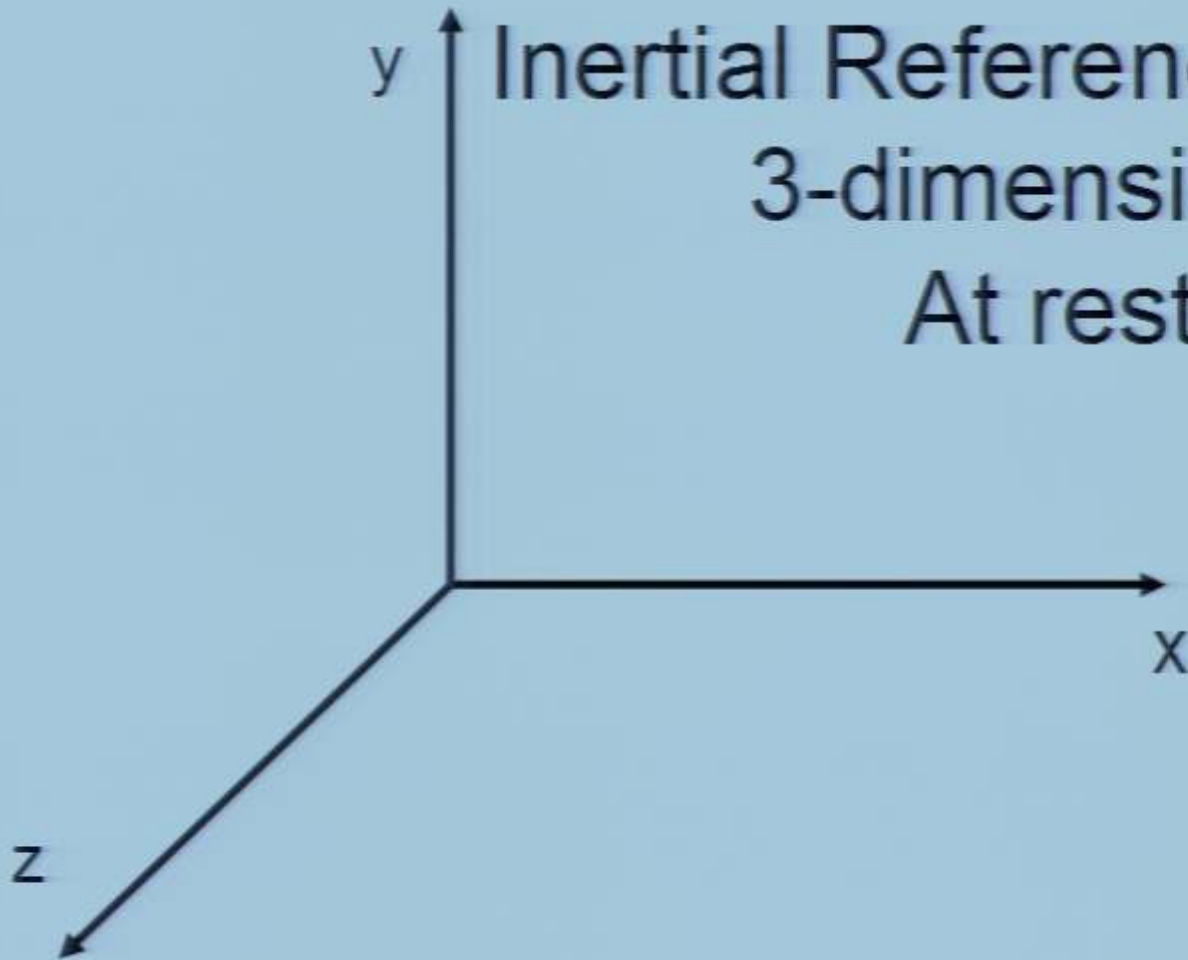
4 km/hr

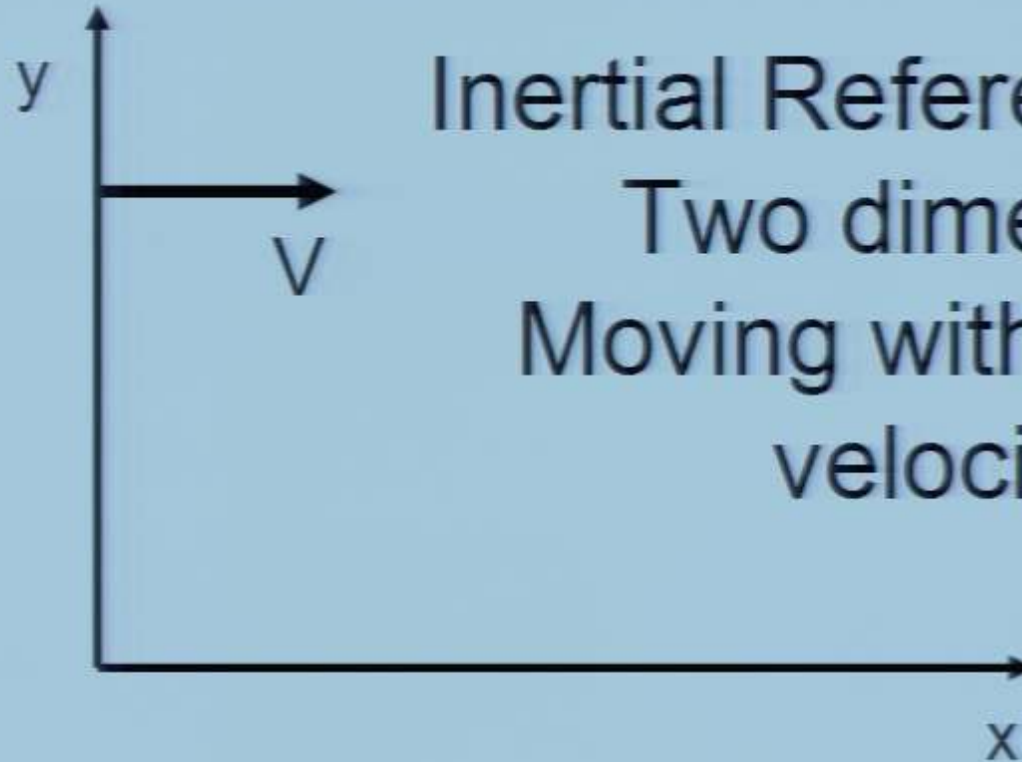


RAFT

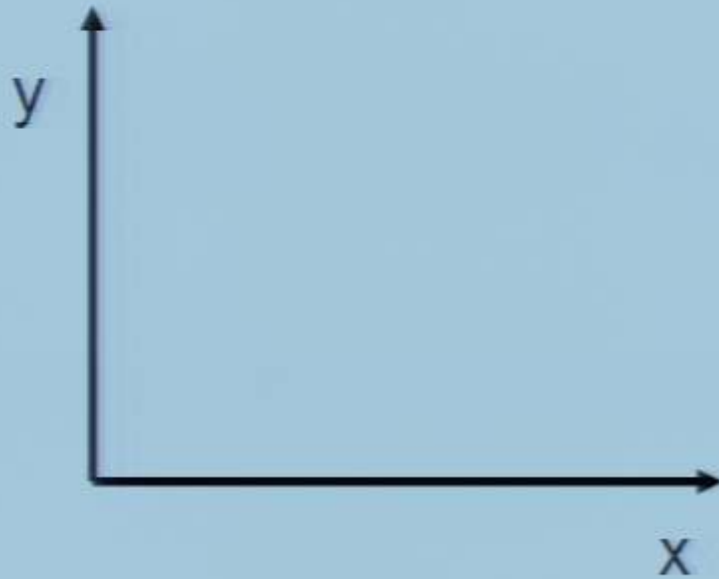
Mississippi River Current = 5 km/hr

Inertial Reference Frame
3-dimensions
At rest

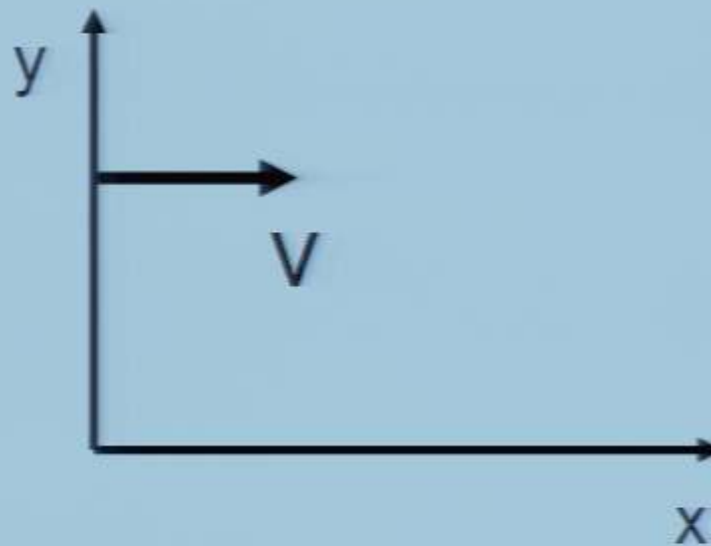


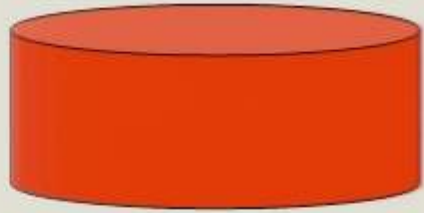


Inertial Reference Frame
Two dimensions
Moving with constant
velocity V

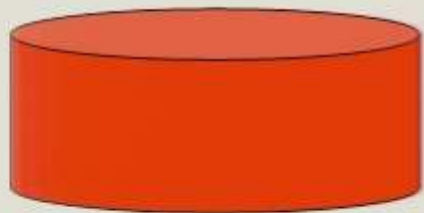


Identical Inertial
Reference Frames
One at rest and
one moving with
constant v

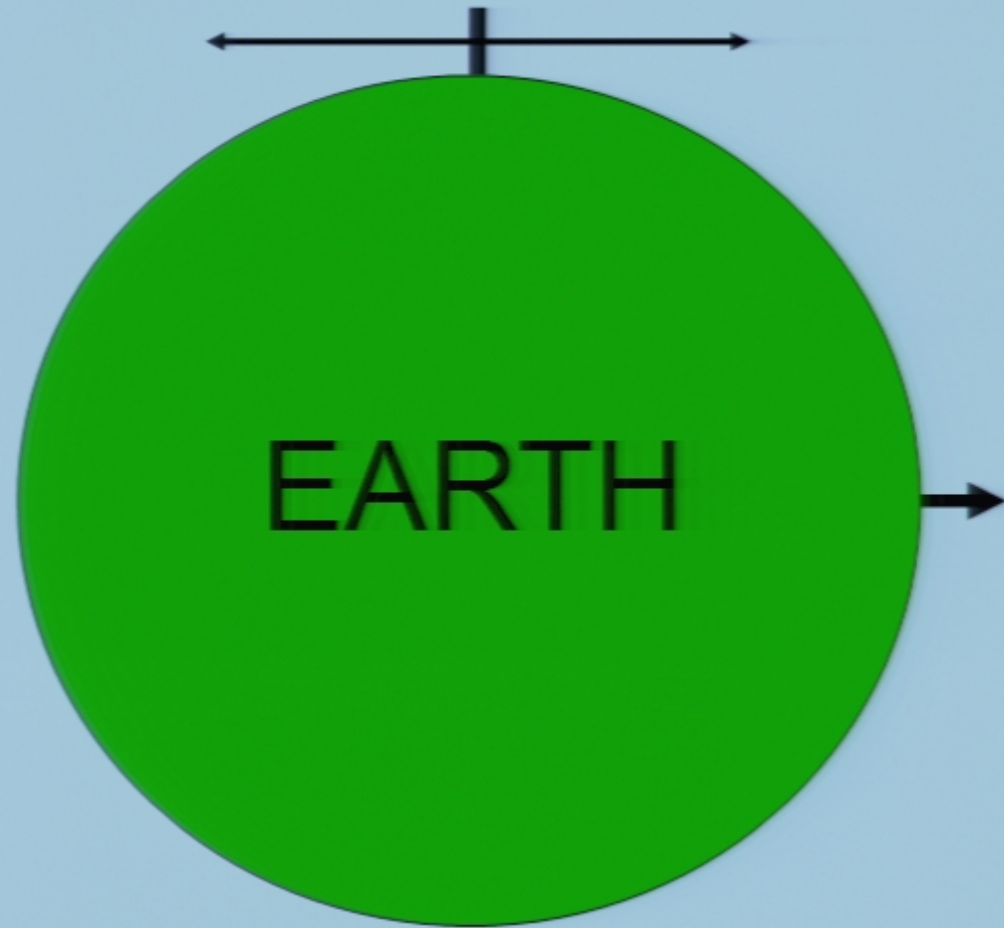


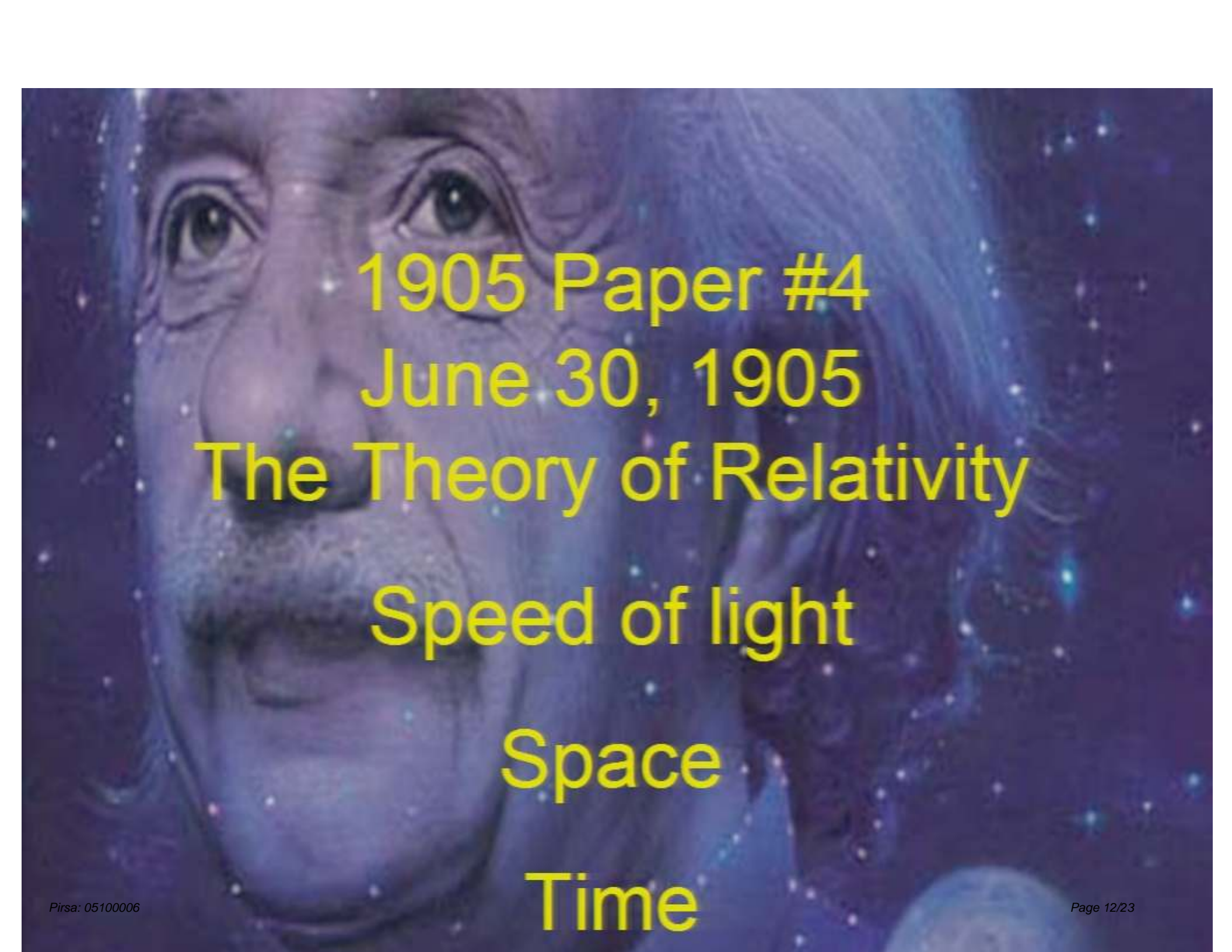


Light and the Ether



Mechanics and Electromagnetism





1905 Paper #4
June 30, 1905
The Theory of Relativity

Speed of light

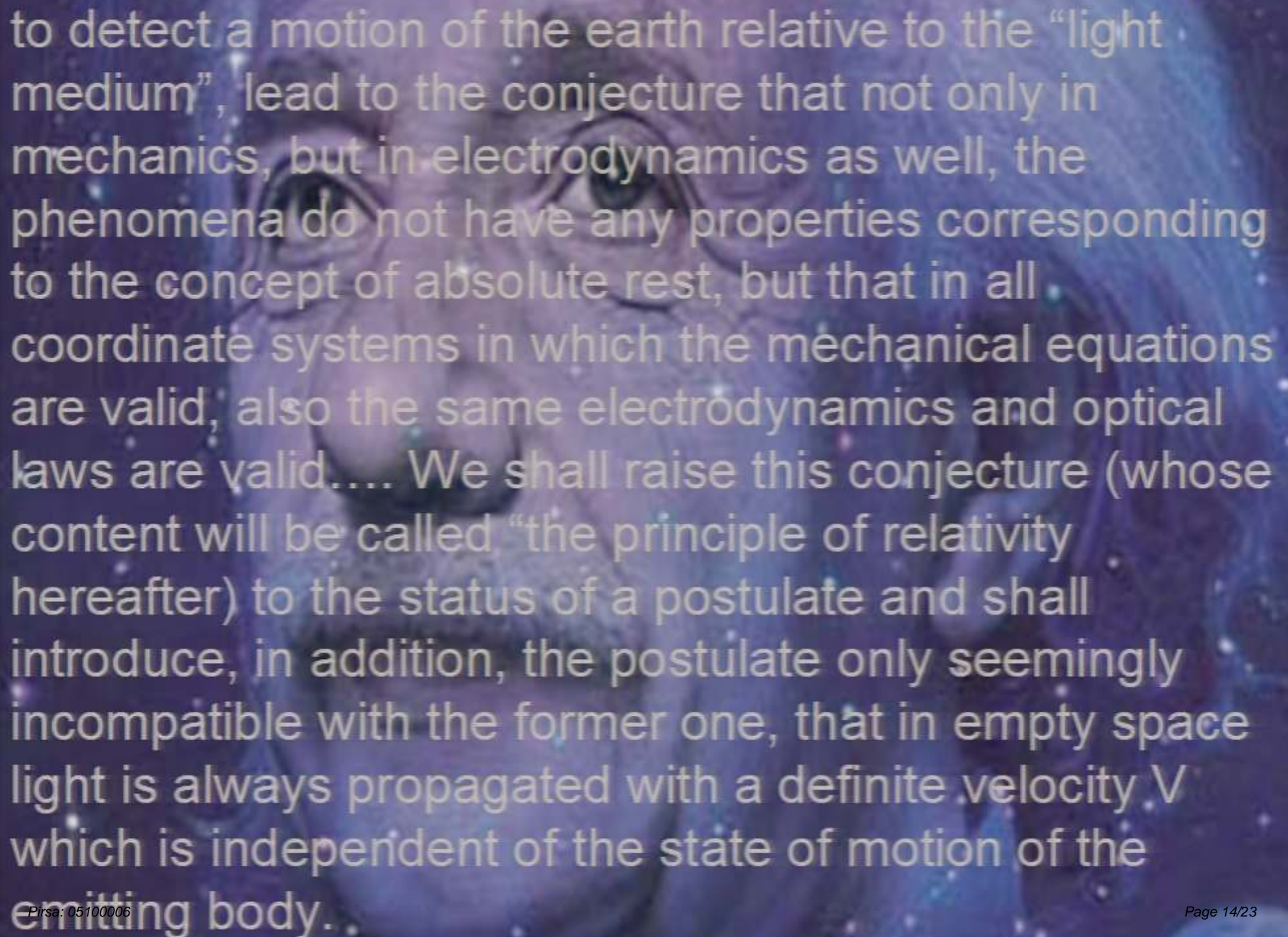
Space

Time

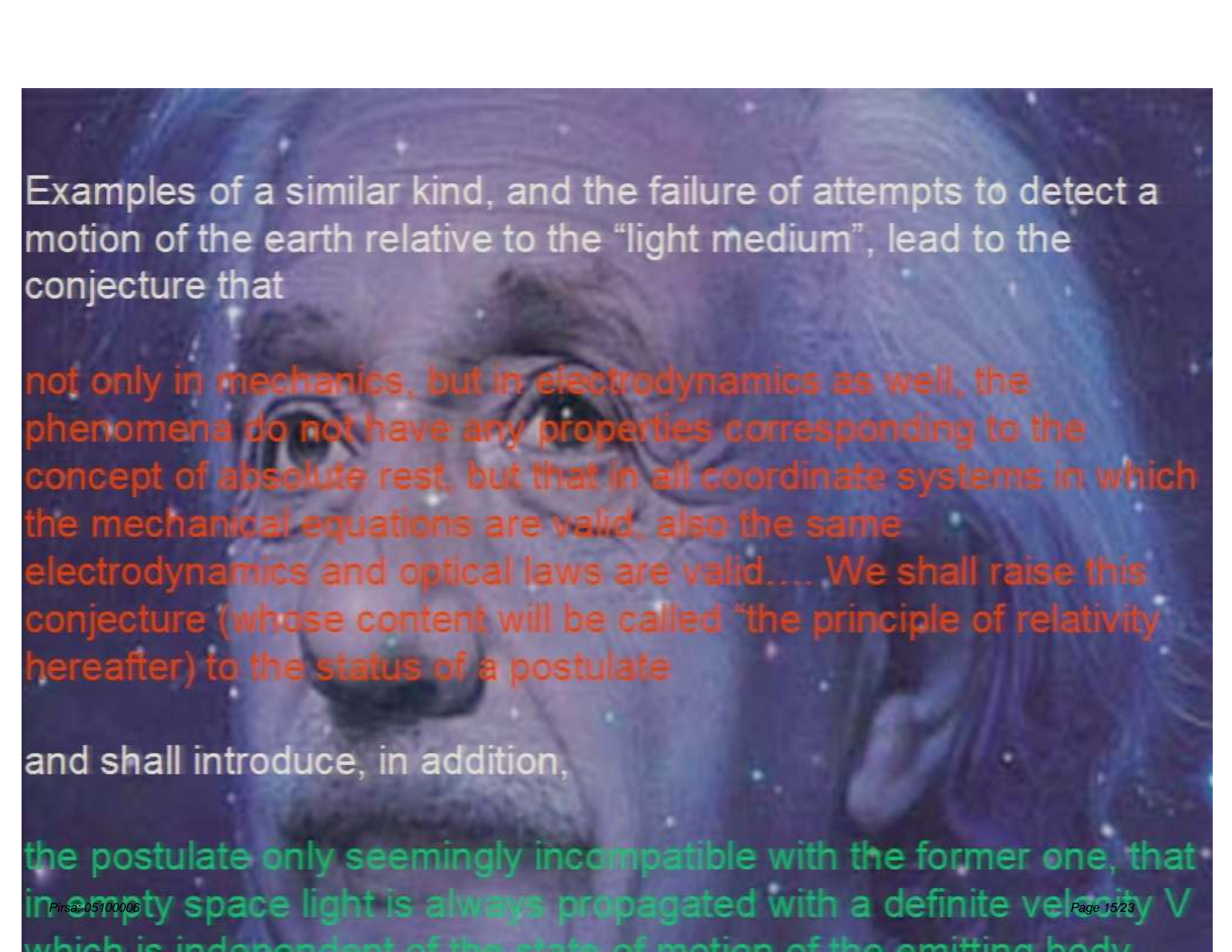


First sentence of the relativity paper

It is well known that Maxwell's electrodynamics...when applied to moving bodies, leads to asymmetries that do not seem to attach to the phenomena.

A portrait of Albert Einstein, looking slightly to the right, with a starry space background. The text is overlaid on the image in a light, semi-transparent font.

to detect a motion of the earth relative to the “light medium”, lead to the conjecture that not only in mechanics, but in electrodynamics as well, the phenomena do not have any properties corresponding to the concept of absolute rest, but that in all coordinate systems in which the mechanical equations are valid, also the same electrodynamics and optical laws are valid.... We shall raise this conjecture (whose content will be called “the principle of relativity hereafter) to the status of a postulate and shall introduce, in addition, the postulate only seemingly incompatible with the former one, that in empty space light is always propagated with a definite velocity V which is independent of the state of motion of the emitting body..

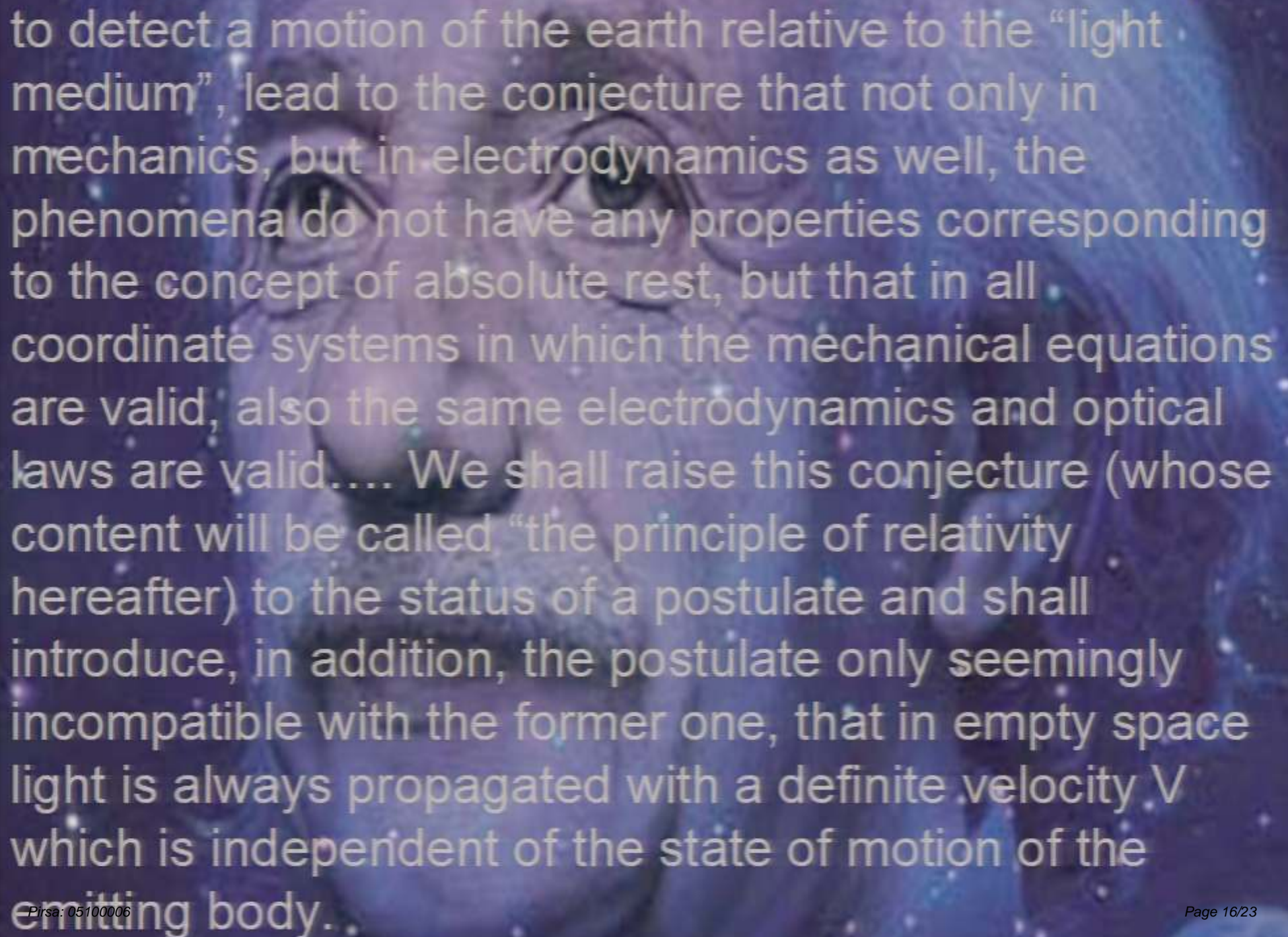


Examples of a similar kind, and the failure of attempts to detect a motion of the earth relative to the “light medium”, lead to the conjecture that

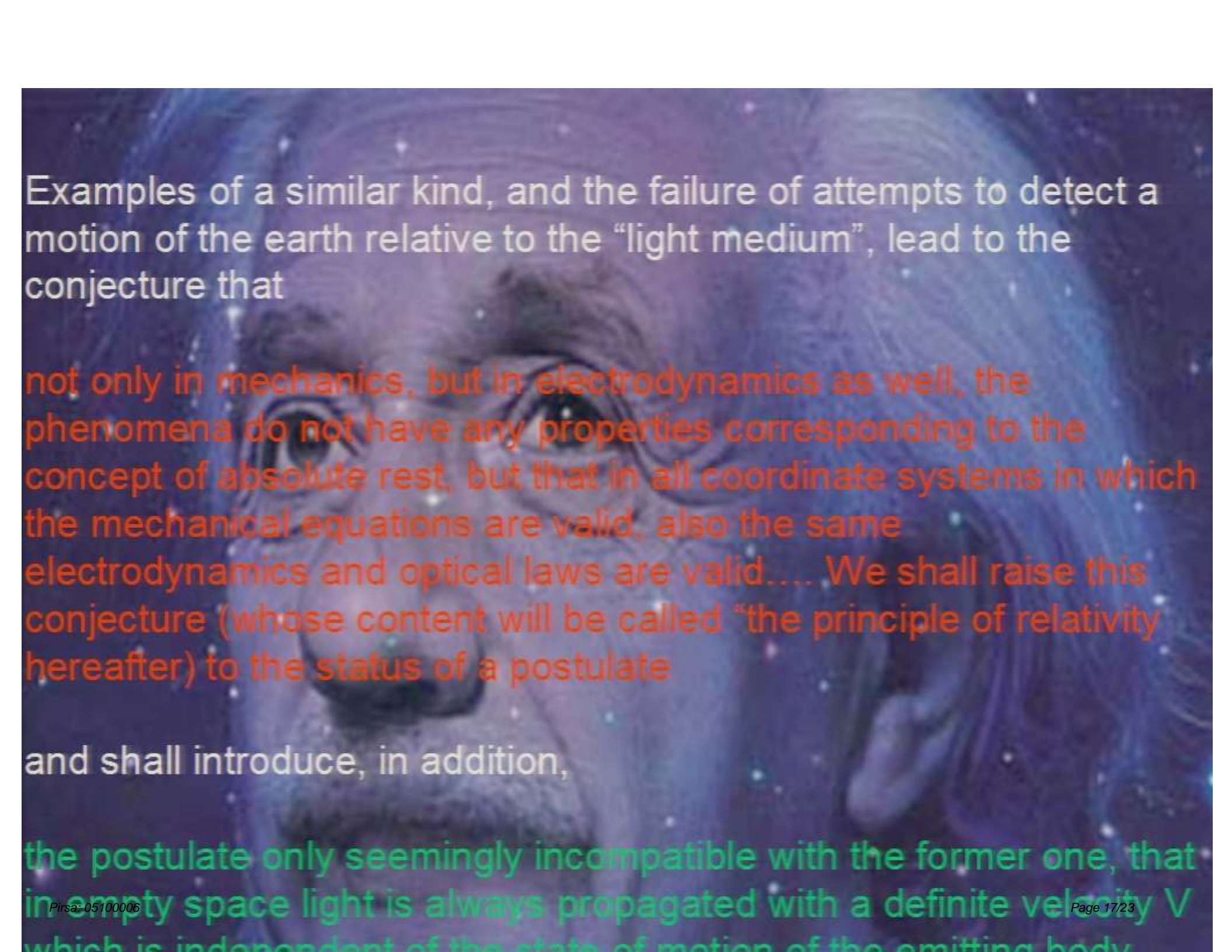
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A portrait of Albert Einstein, looking slightly to the right, with a starry space background. The text is overlaid on the image in a light, semi-transparent font.

to detect a motion of the earth relative to the “light medium”, lead to the conjecture that not only in mechanics, but in electrodynamics as well, the phenomena do not have any properties corresponding to the concept of absolute rest, but that in all coordinate systems in which the mechanical equations are valid, also the same electrodynamics and optical laws are valid.... We shall raise this conjecture (whose content will be called “the principle of relativity hereafter) to the status of a postulate and shall introduce, in addition, the postulate only seemingly incompatible with the former one, that in empty space light is always propagated with a definite velocity V which is independent of the state of motion of the emitting body..

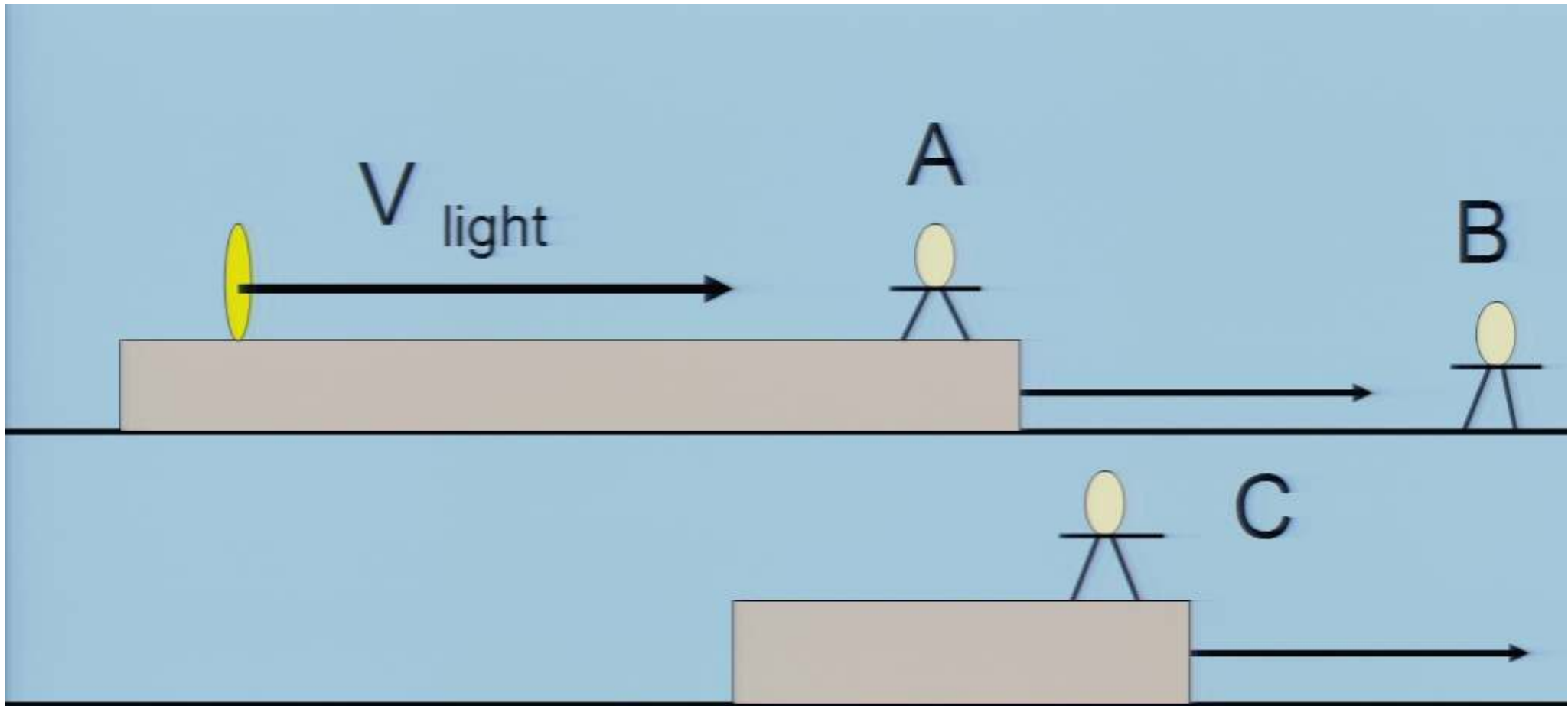
A portrait of Albert Einstein, looking slightly to the right, with a starry space background. The text is overlaid on the image in various colors.

Examples of a similar kind, and the failure of attempts to detect a motion of the earth relative to the “light medium”, lead to the conjecture that

not only in mechanics, but in electrodynamics as well, the phenomena do not have any properties corresponding to the concept of absolute rest, but that in all coordinate systems in which the mechanical equations are valid, also the same electrodynamics and optical laws are valid.... We shall raise this conjecture (whose content will be called “the principle of relativity hereafter) to the status of a postulate

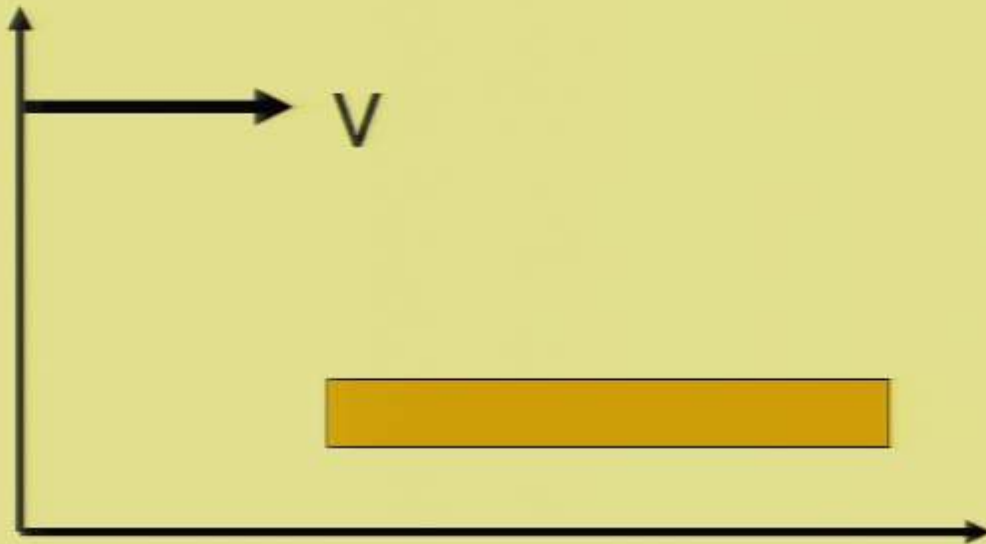
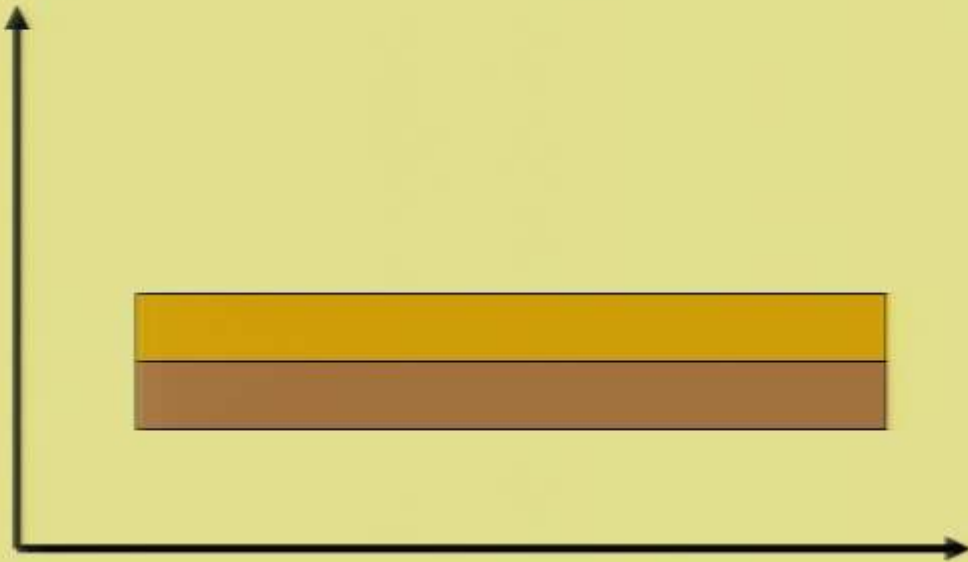
and shall introduce, in addition,

the postulate only seemingly incompatible with the former one, that in empty space light is always propagated with a definite velocity V which is independent of the state of motion of the emitting body.

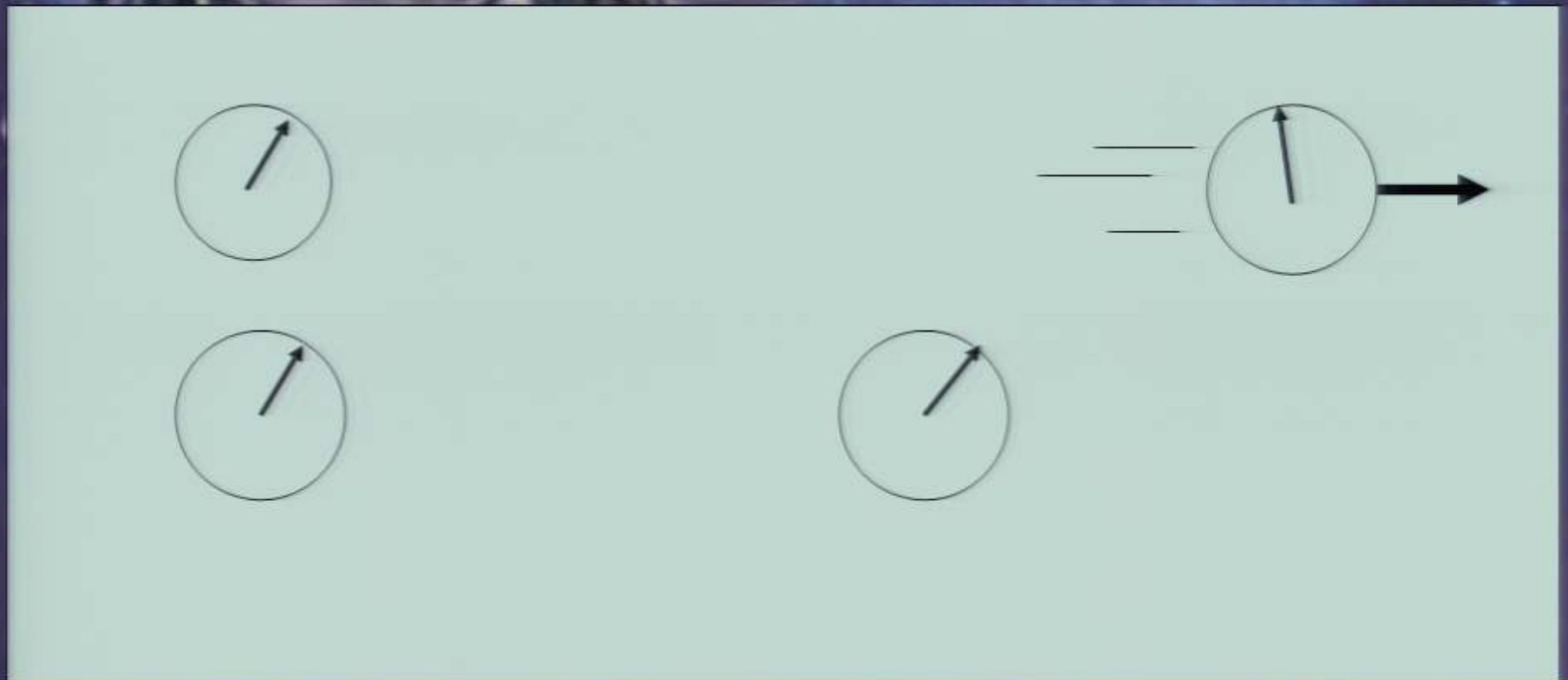


$$V_B > V_A > V_C$$

Length is
relative



Moving clocks slow down relative to stationary clocks



$L = 1000\text{-cm}$ steel beam

$V = 0.1c$ $L = 995\text{ cm} - 5\text{ cm}$

$V = 0.5c$ $L = 866\text{ cm} - 34\text{ cm}$

$V = 0.9c$ $L = 436\text{ cm} - 564\text{ cm}$

Note: $0.1c = 30,000\text{ km/s}$



1905 Paper #5
September 26, 1905

Mass
Energy

$$E = mc^2$$

Einstein points to
energy inherent in the atom

