Special Relativity

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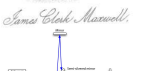
At the train station,
can you tell if it is your train or
the train on the next platform
that is moving???

This effect is called "Relativity" or "Relativity of motion"

Galileo Galilei (1564 – 1642)
was the first to study
the relativity of motion.

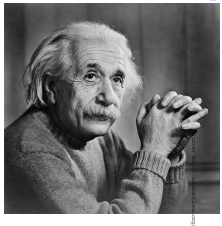
From the mast of a boat
he let a ball fall and showed
that the ball always fall at the
foot of the mast.
He also noticed that someone
in the hold could not feel
the motionof the ship.

Galileo proposed the "principle of relativity"
Motion is always relative to a given object (frame)
The ball fallswith respect to the boat.
The person in the hold is not moving with respect to the ship.



In 1865 Maxwell published
a theory stating the the
speed of light must always
be the same.
This was contradictory with
Galileo's theory of relativity.

Maxwell proposed that this is
true in only one special frame
containing a substance called
luminiferous Aether.

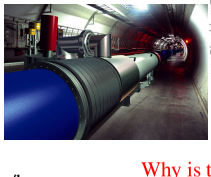


In 1905 Albert Einstein (1879–1955)
proposed a new theory of relativity
where the speed of light is
always constant but where at low speed
the rules of Galilean relativity
remain correct.
When the speed of an object becomes
close to the speed of light
its mass increases and
time seems to slow down for this object.
It thus becomes more and more difficult to
accelerate it.
To reach the speed of light, it is necessary
to give an infinite boost to this object...
The size of this object seems to be reduced.
This is called "Length compression".

Source: http://en.wikipedia.org/wiki/Image:Michelson-morley.png

Michelson and Morley
performed an expirement to
Their expriment concluded that
identify this frame but,
there is no such frame!
The speed of light is
the same in all frames.

Where is it possible to observe relativistic effects?



Particle accelerators accelerate
small particles to very high speed.
When they reach a speed close fro
the speed of light it becomes much
harder to give them more speed as
hey become heavier and heavier
each time they are accelerated.

In the stars, particles are also sometimes
accelerated to a speed close from the speed of
light. Sometimes these particles reach the earth.

But do rocket or sport cars become
heavier when they reach high speeds?

No even at 1000km/h or 10000km/h
the speed of these vehicles remains
very small compared to the speed of light.

The speed of light is roughly 1 milliard km/h
(1 000 000 000km/h)
Only comparable speeds it is possible
to see the effects of Einstein's relativity!

Why is the theory of relativity "special"?

The theory of "Special relativity" is limited to some special cases.
In 1915 Einstein published another theory called "General relativity"
where it addresses the effects of stars and planets.
It is more complex than the theory of "Special relativity".

Summary:

The theory of relativity explains how to transform the speed of an object
from a frame to another. It also explains why it is not possible
to accelerate an object to a speed greater than the speed of light.
This theory has been verified experimentally several times.

Further reading on the web: http://en.wikipedia.org/wiki/Principle_of_relativity