Relativistic versus Newtonian Mechanics [mln49]

Common requirement:
The laws of mechanics are universal in inertial systems.

Newtonian mechanics

- Instantaneous signals are available.
- Rigid bodies (ruler, compass) exist to map out absolute (3D) Euclidean space.
- Universal clocks exist to measure absolute (1D) time.
- Clocks can be synchronized between any two points within the same inertial system and between two points anywhere in different inertial systems.

Relativistic mechanics

- The speed of light c is universal.
- The speed of any signal cannot exceed c.
- Absolute entities exist only in (4D) space-time. Projections onto (3D) space and (1D) time are relative.
- Instruments exist to measure proper times, lengths, and angles within any inertial system,
- Clocks can be synchronized between any two points within the same inertial system but only locally between points in relative motion.

Einstein's signature clock
uses a light signal
bouncing between flat mirrors.

Time period of cycle
(in rest frame of clock):
$\Delta\tau = 2\ell_0/c$.