Special Relativity (SR) tells us that space and time always conspire to make sure that the speed of light c is the same in all inertial frames of reference.

- $\Rightarrow$ Space and time transform linearly into one another
- $\Rightarrow$ Space and time can't live in different spaces $\mathbb{R}^3, \mathbb{R}$ (3 space; 1 time)
- $\Rightarrow$ Namely, we should live in a 4D space that obeys postulates of SR

This 4D vector space called **spacetime** (or Minkowski Spacetime).

Minkowski Spacetime Vs. $\mathbb{R}^3$

	Minkowski Space	$\mathbb{R}^3$
Vectors	$x = (t, x, y, z) = (t, \mathbf{x})$	$\mathbf{x} = (x, y, z)$
Vector Components	$x^\mu \ \ (\mu = 0, 1, 2, 3)$	$x^i \ \ (i = 1, 2, 3)$
Dot-Product	$x \cdot y = x^0 y^0 - \mathbf{x} \cdot \mathbf{y}$	$\mathbf{x} \cdot \mathbf{y}$
Metric	$\text{diag}(1, -1, -1, -1)$	$\text{diag}(1, 1, 1)$
Line element	$ds^2 = dt^2 - dx^2 - dy^2 - dz^2$	$ds^2 = dx^2 + dy^2 + dz^2$