

# **Summary of Unit One**

## **The Principle of Relativity**

### **Physics II Special Relativity**

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**<http://tiny.cc/RelativityAtCOA>**

# Events & Spacetime Coordinates

- An **event** is physical occurrence that can be thought of taking place at a definite point in space and a definite moment in time.
- Events are described by their **spacetime coordinates**, a list of four numbers. The first gives the time at which the event occurs, the next three numbers specify the position of the event.
- Ex. (15s, 50m, 10m, 2m)

# Reference Frames

- A reference frame is needed to measure spacetime coordinates
- Think of a reference frames as a lattice of clocks.
- An **inertial reference frame** is a reference frame in which Newton's first law holds.
- Inertial reference frames are at rest or moving at a constant velocity.

# Galilean Transformations

- Relate spacetime coordinates measured in two different frames.
- The primed frame is moving at a speed of  $\beta$  with respect to the un-primed frame.
- $t' = t$
- $x' = x - \beta t$
- $y' = y$
- To convert velocities
- $v' = v - \beta$
- Think of these equations as a “bi-lingual dictionary”.

# Time Galilean Transformations

- In classical physics, time is absolute, agreed upon by everyone.
- Newton: “Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external.”

# The Principle of Relativity

- **The laws of physics are the same in all inertial reference frames.**
- This does not mean that all measurements are the same in all reference frames.
- But, for example, the laws of conservation of energy and momentum are true in all reference frames.