PRESENTATION AND DISCUSSION

PART 1: BI-DIRECTIONAL WAVELENGTH IN MOVING SYSTEMS

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IN COOPERATION WITH THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS)
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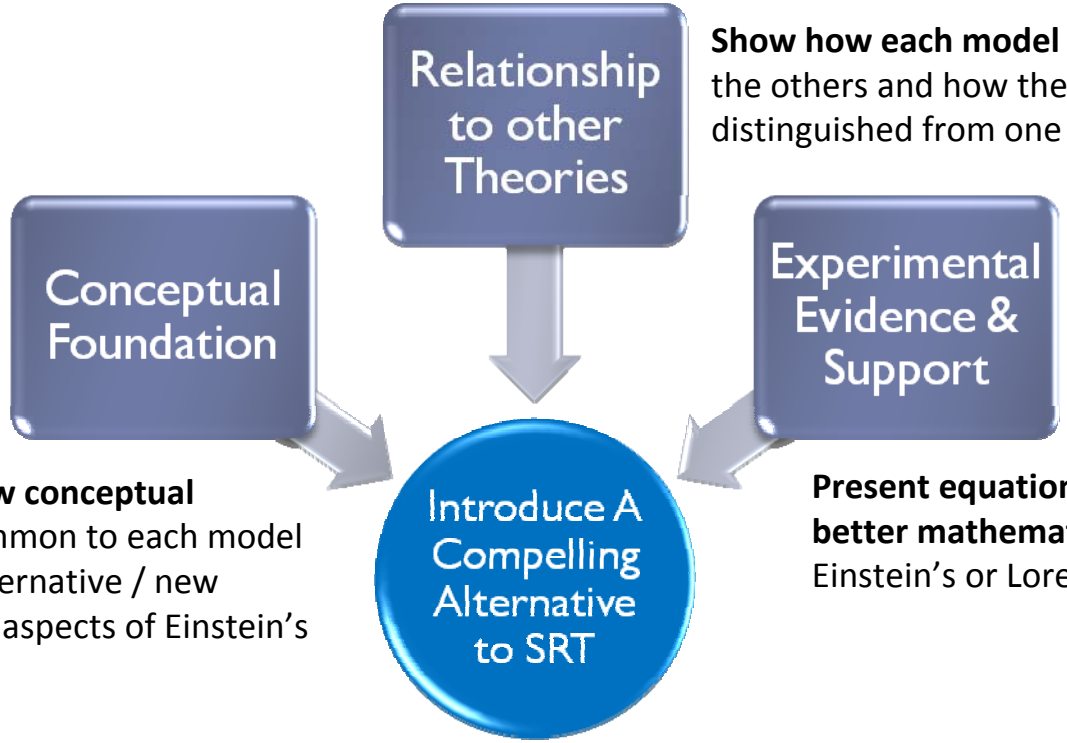
The Model of Complete and Incomplete Coordinate Systems

AGENDA



Show how each model is related to the others and how they are distinguished from one another

Describe new conceptual features common to each model and gives alternative / new meanings to aspects of Einstein's derivation

Present equations that produce better mathematical results than Einstein's or Lorentz's equations

Criteria

Any compelling alternative **must be rational and produce equal or better mathematical results** than SRT

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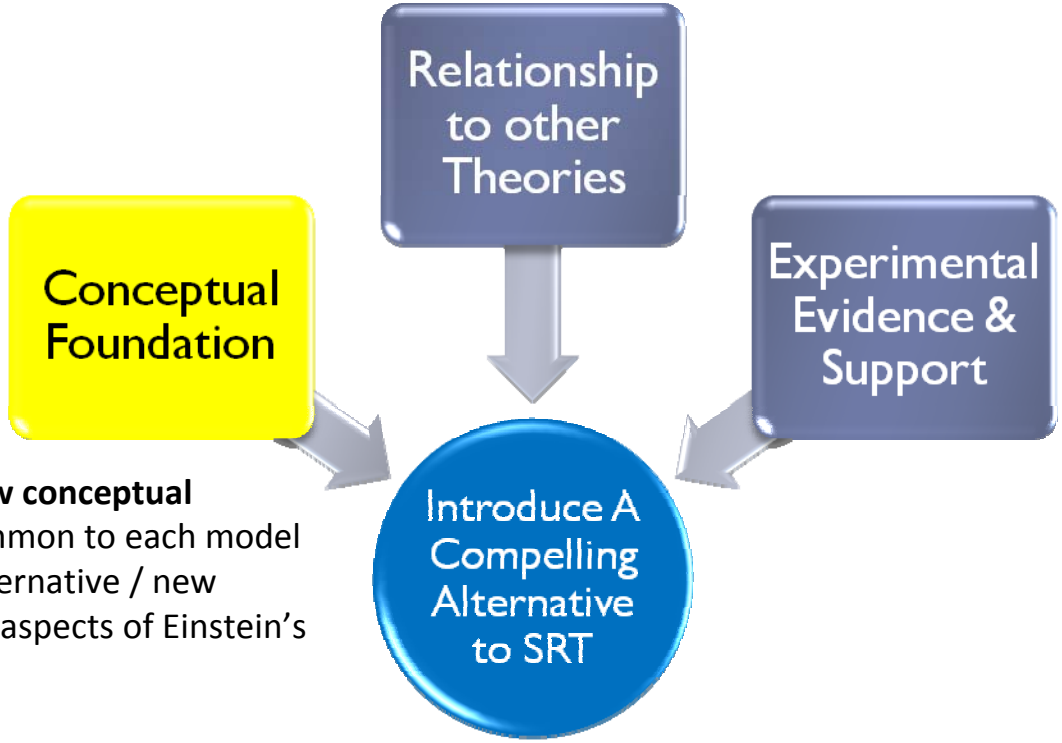

Describe new conceptual features common to each model and gives alternative / new meanings to aspects of Einstein's derivation

The Foundational Equation

The most important equation in understanding moving systems is the multiplication of time with velocity.

*answer = velocity * time*

$x = vt$ or $x=ct$ or $\xi = c\tau$

Critical Question

What does this equation produce?

a.A Length
b.A Point
c.A Length and a Point

Answer: It Depends

Coordinate Systems

Definition

A **Coordinate System** is something you can measure, typically in one, two, or three dimensions.

What makes Coordinate Systems interesting is when you move “things” with respect to them

- Other Objects or Phenomena
- Other Coordinate Systems

Lorentz's Conceptual Foundation

"*As Maxwell first remarked and as follows from a very simple calculation, the time required by a ray of light to travel from a point A to a point B and back to A must vary when the two points together undergo a displacement without carrying the ether with them.*"

- H. A. Lorentz, 1895

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- H. A. Lorentz, 1895

This is an **Incomplete** Coordinate System

Lorentz's Conceptual Foundation

"*As Maxwell first remarked and as follows from a very simple calculation, the time required by a ray of light to travel from a point A to a point B and back to A [does not] vary when the two points together undergo a displacement [while] carrying the ether with them.*"

- H. A. Lorentz, 1895 (adapted 2008)

This is a **Complete** Coordinate System

Lorentz's Conceptual Foundation

"*As Maxwell first remarked and as follows from a very simple calculation, the time required by a ray of light to travel from a point A to a point B and back to A must vary when the two points together undergo a displacement without carrying the ether with them.*"

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Lorentz's Conceptual Foundation

"*As Maxwell first remarked and as follows from a very simple calculation, the time required by a [person] to travel from a point A to a point B and back to A must vary when the two points together undergo a displacement without carrying the [ground] with them.*"

- H. A. Lorentz, 1895 (adapted 2008)

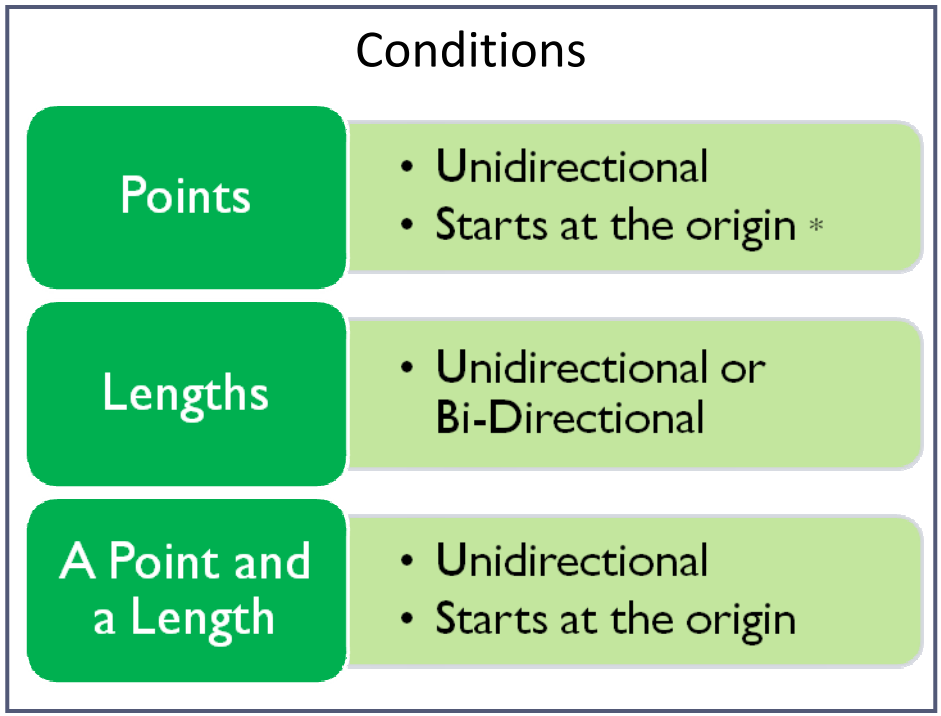
Demonstration / Simulation

The simulation will help us create the "Foundational Equations" inherent in each of the Moving Systems models.

Go to a time before Einstein (e.g. 1888)	• Understand "why" people came up with Relativity in the first place
Concepts you already understand	• May not have viewed the concepts in the same way before • Start from scratch to "get everyone on the same page"
Makes Sense	• Makes more assumptions explicit • Makes sense: Successfully "piloted" using an Elementary School Student!

Lengths in Moving Systems

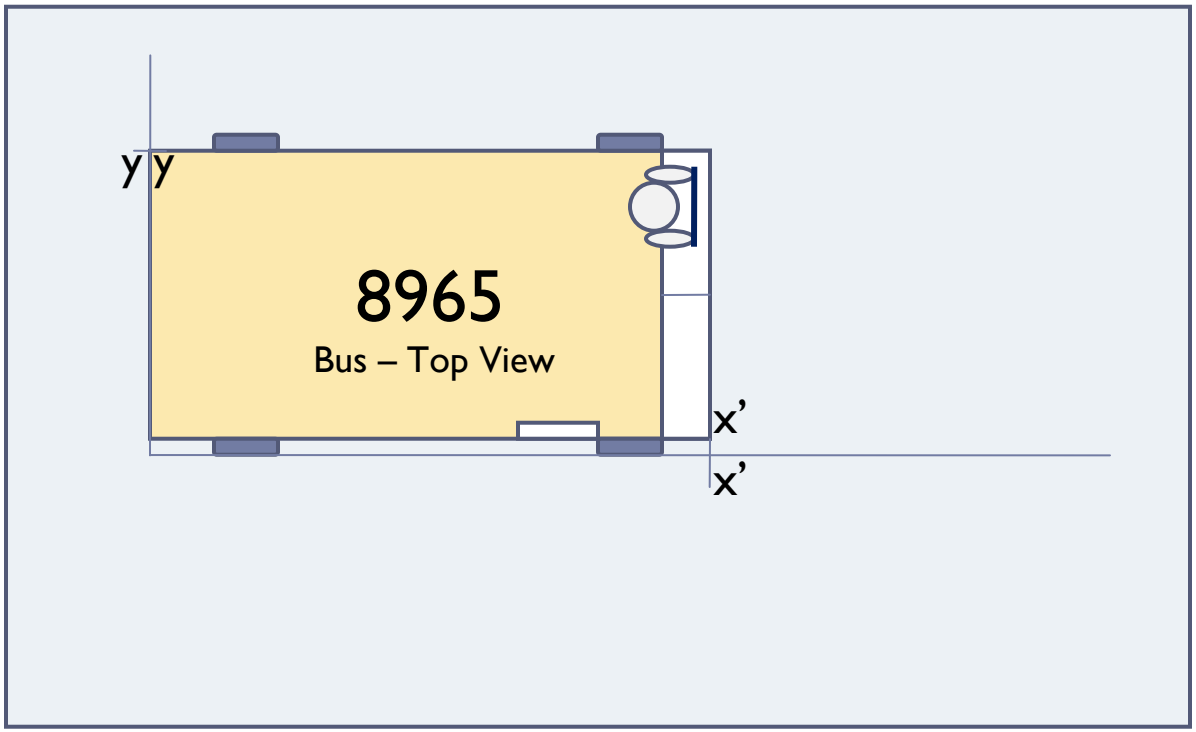
If x=vt is bi-directional or does not start at the origin, then the result of the equation will be a length, not a point.



* Can be performed with a transformation

Length in an Incomplete Coordinate System

The bi-directional movement along the **Y (or Z axis) is symmetrical** while the bi-directional movement along the **X axis is asymmetrical**.



Note: The same equations that apply to the Y axis also apply to the Z axis.

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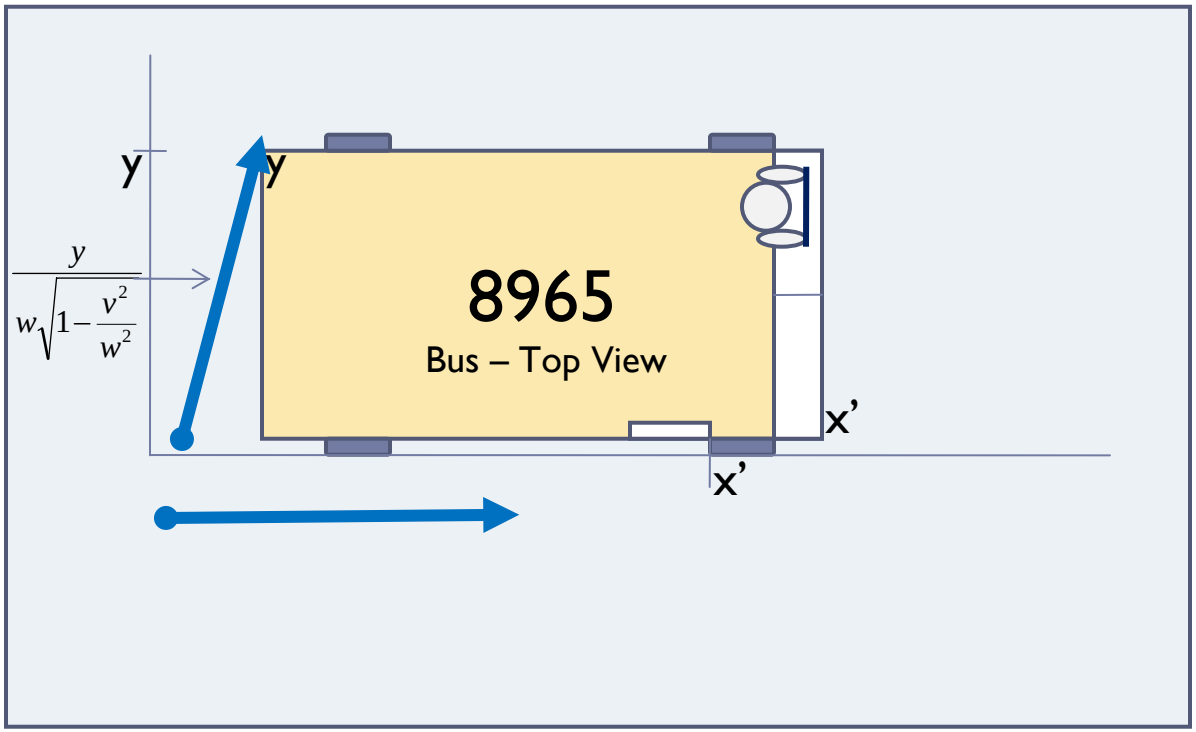

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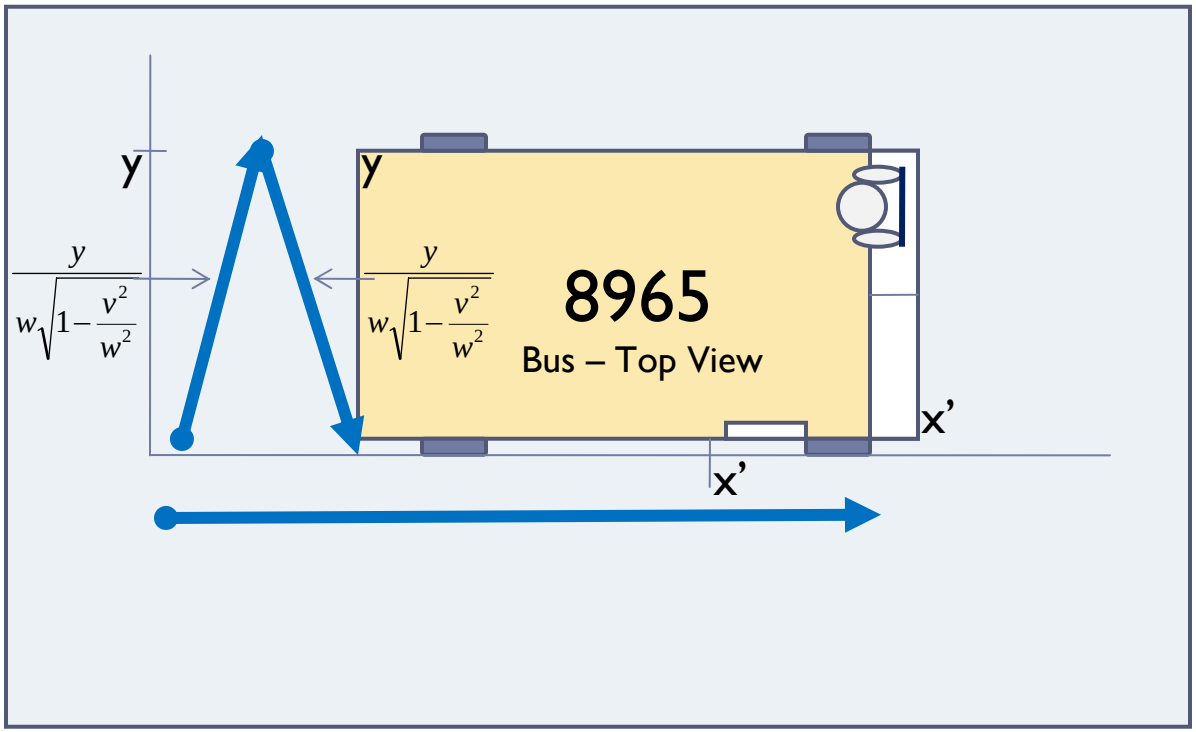

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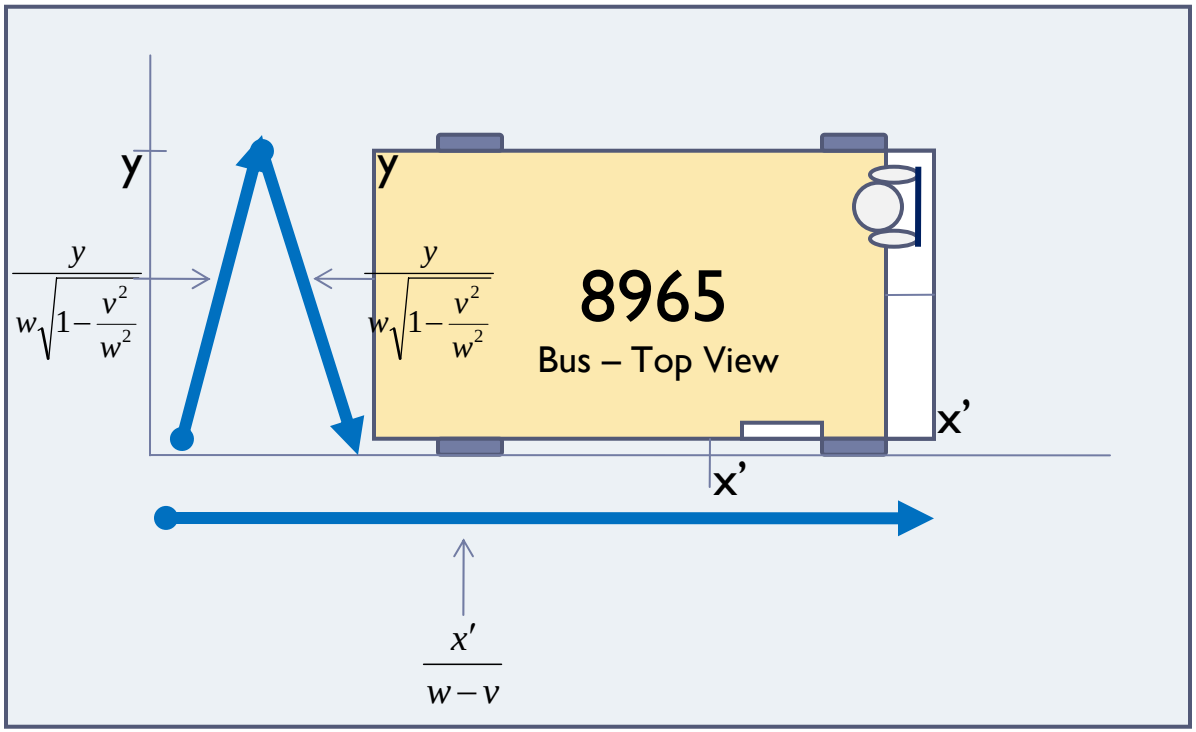

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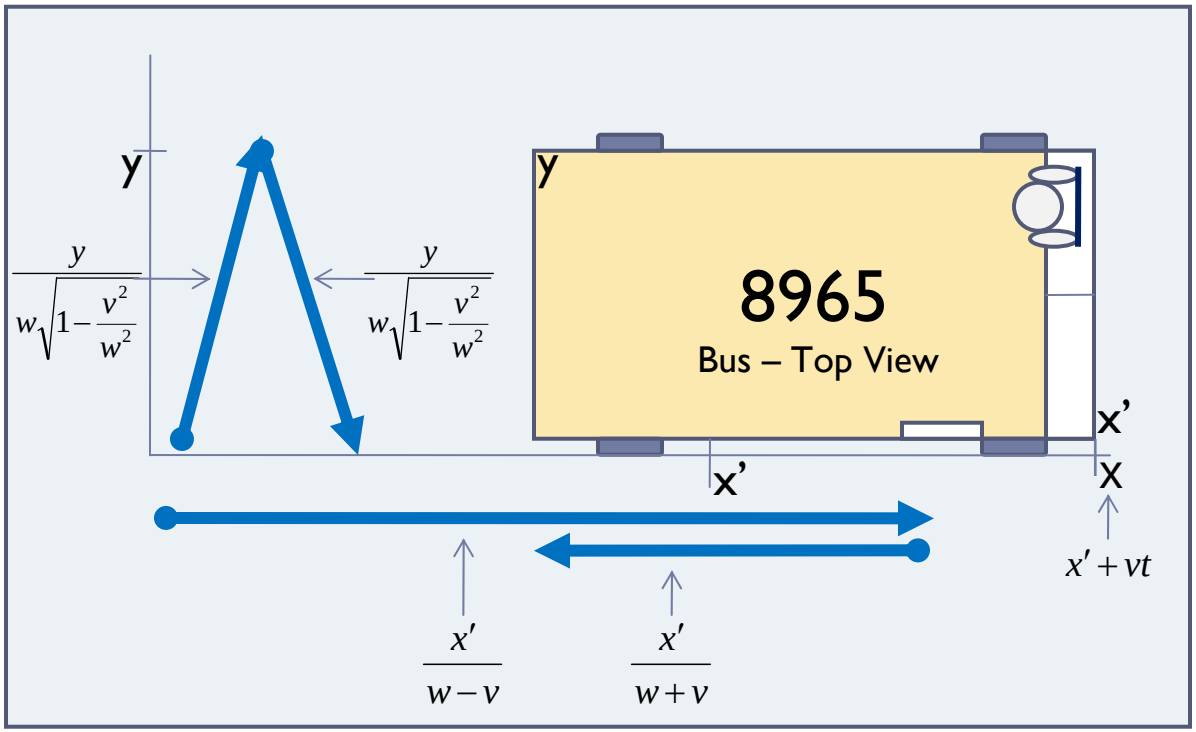

- Each axis has its own Time Equation
- In the equations, x', y, and z represent ½ a wavelength, not a full wavelength
- X-axis equation is derived bi-directionally
  - Transformations apply to lengths
- Consistent with our understanding of electronics, oscillation, and Radio Frequency generation

Note: The same equations that apply to the Y axis also apply to the Z axis.

Length in an Incomplete Coordinate System

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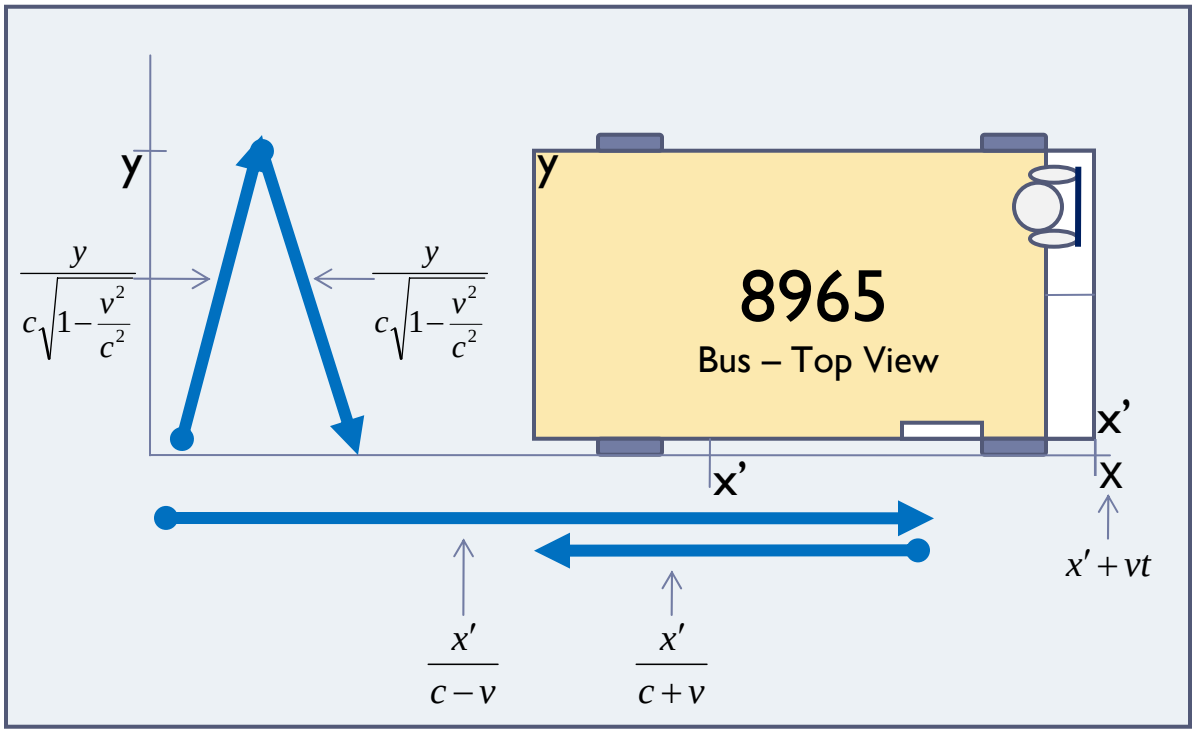

Note: Change the notation to give w a specific velocity, in this case c for the speed of light

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Spotting Bi-Directional Activity

Textual and mathematical statements can be used to determine if the equation is unidirectional or bi-directional.

Look For

1. Statements of bi-directional activity
2. Mathematical use of v and –v in the same derivation

Let a ray of light start at the "A time" t_A from A towards B, let it at the "B time" t_B be reflected at B in the direction of A, and arrive again at A at the "A time" t'_A.

.....

$$\frac{1}{2}\left[\tau(0,0,0,t)+\tau\left(0,0,0,t+\frac{x'}{c-v}+\frac{x'}{c+v}\right)\right]=\tau\left(x',0,0,t+\frac{x'}{c-v}\right)$$

Einstein 1905

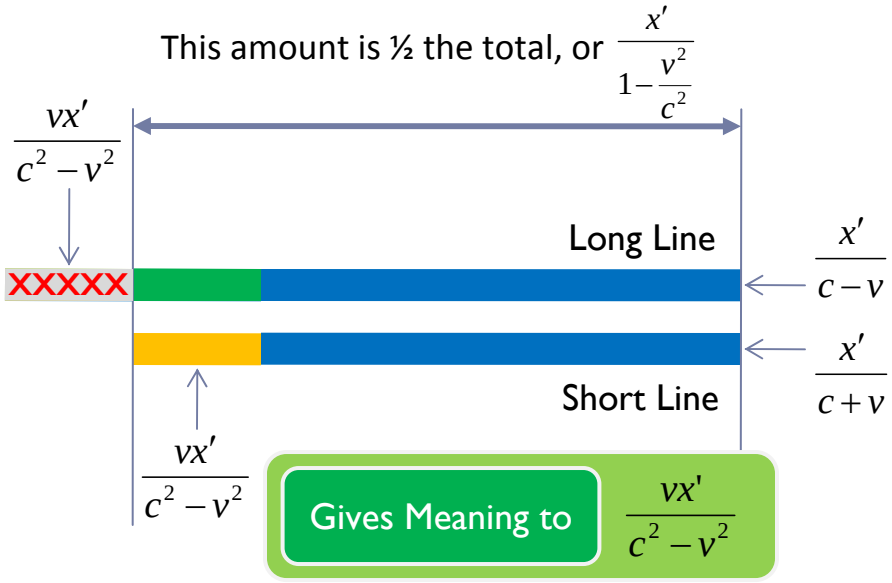
$$\frac{c^2}{c^2-v^2}=\beta^2$$

Lorentz 1904

Note $c\frac{1}{2}\left[\frac{1}{c-v}+\frac{1}{c+v}\right]=\frac{c^2}{c^2-v^2}$

Answering "How far is half way"?

There are three ways to mathematically answer the question: *"How long does it take to travel ½ the total round-trip distance?"*



1. Subtract the short line from the long line
2. Divide remainder into two equal parts
3. Either subtract from long line or add to short line

Note: The Model of Complete and Incomplete Coordinate Systems uses *w* to represent the velocity of the moving phenomena. This graphical relationship and the mathematical equations hold for objects oscillating at any specified velocity, not just at the speed of light as is indicative of using **c** (as given above)

- Three ways to find ½ the total round trip time:
  - Add $\frac{x'}{c+v}$ to $\frac{x'}{c-v}$ and divide by 2
  - Subtract $\frac{vx'}{c^2-v^2}$ from $\frac{x'}{c-v}$
  - Add $\frac{vx'}{c^2-v^2}$ to $\frac{x'}{c+v}$
- When you multiply a "bi-directional" time by velocity, you get a length

Key Finding

Einstein answers the questions **"How far is ½ the total round trip distance"?** when he states:

$$\xi = c\left[\frac{x'}{c-v} - \frac{vx'}{c^2-v^2}\right] = \frac{x'c^2}{c^2-v^2}$$

Foundational Equations

Each Moving Systems model is based on the same set of foundational equations that answer the question: *what is ½ the distance*?

Foundational Equations

$$x\ axis = \frac{x'}{1-\frac{v^2}{c^2}}$$

$$y\ axis = \frac{y}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$z\ axis = \frac{z}{\sqrt{1-\frac{v^2}{c^2}}}$$

Full wavelength based

- **Michelson & Morley** use the equations unchanged, but use x instead of x'
- **Lorentz** multiplies these equations by $\sqrt{1-v^2/c^2}$ and uses x instead of x'
- **Einstein** multiplies these equations by $\sqrt{1-v^2/c^2}$ and replaces x' with x-vt

½ wavelength based

- **Bryant** uses the equations unchanged, and uses c as a specific case of w

Critical Question

What is x'?

a.A full wavelength

b.½ a full wavelength

Answer: b. ½ a full wavelength

Summary of Key Findings

We have given specific meanings to two terms in Einstein's 1905 derivation and have established a new conceptual framework using Bi-Directional movement.

New Mathematical Explanations

1. Gives specific meaning to the term $\frac{vx'}{c^2 - v^2}$
2. Explains the meaning of $\xi = \frac{x'c^2}{c^2 - v^2}$ in Einstein's derivation
3. Establishes the "Foundational Equations" that answers the question: *What is ½ of the total?*

Revised Foundational Concepts

- **A difference between Lengths and Points**
- Highlights the **Bi-Directional assumption** in Einstein's and Lorentz's derivations
- Defines **two types of Coordinate Systems**, Complete and Incomplete

Thank You

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