A bridge between the Galileo and Lorentz transformations of velocities

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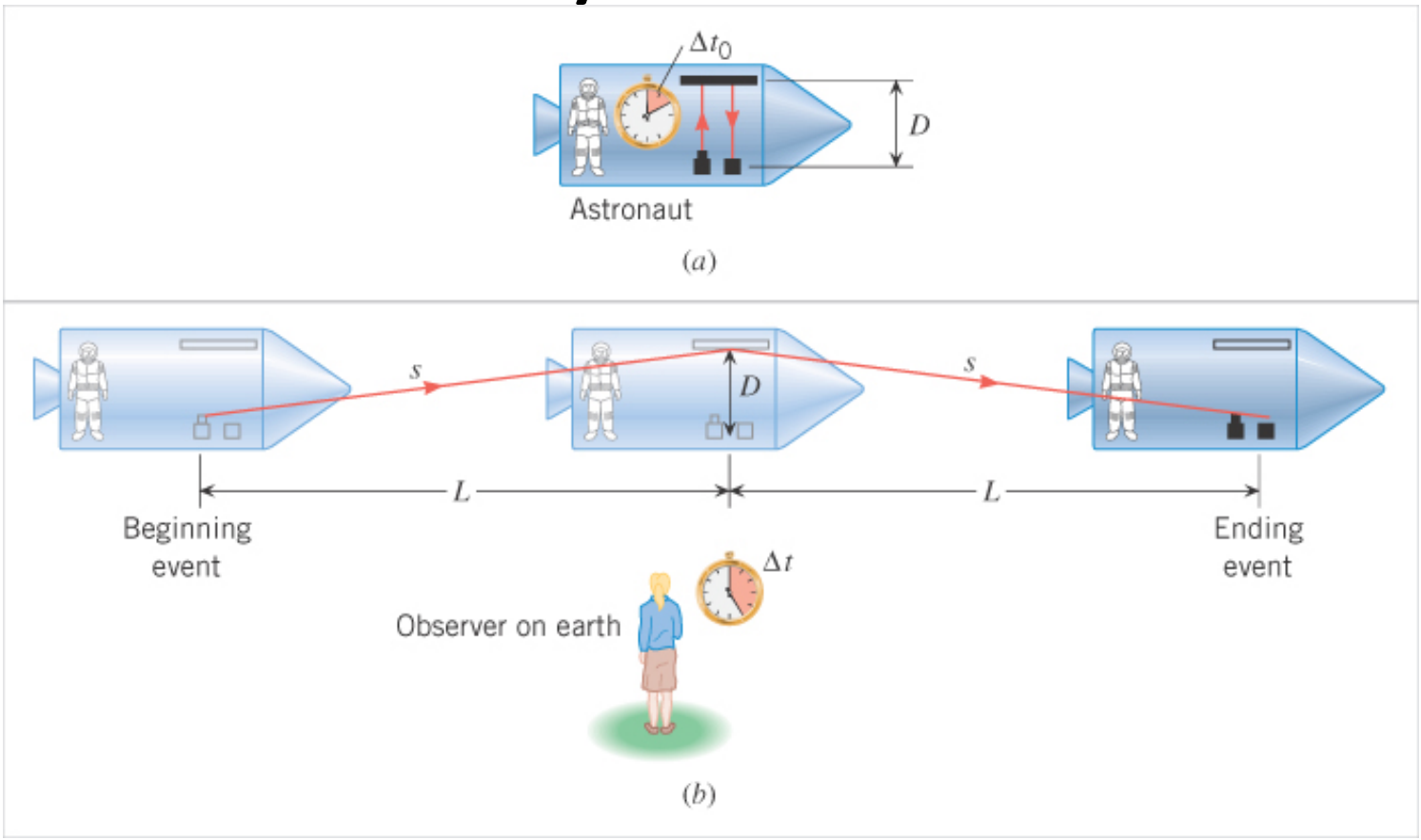
Velocity Transformation

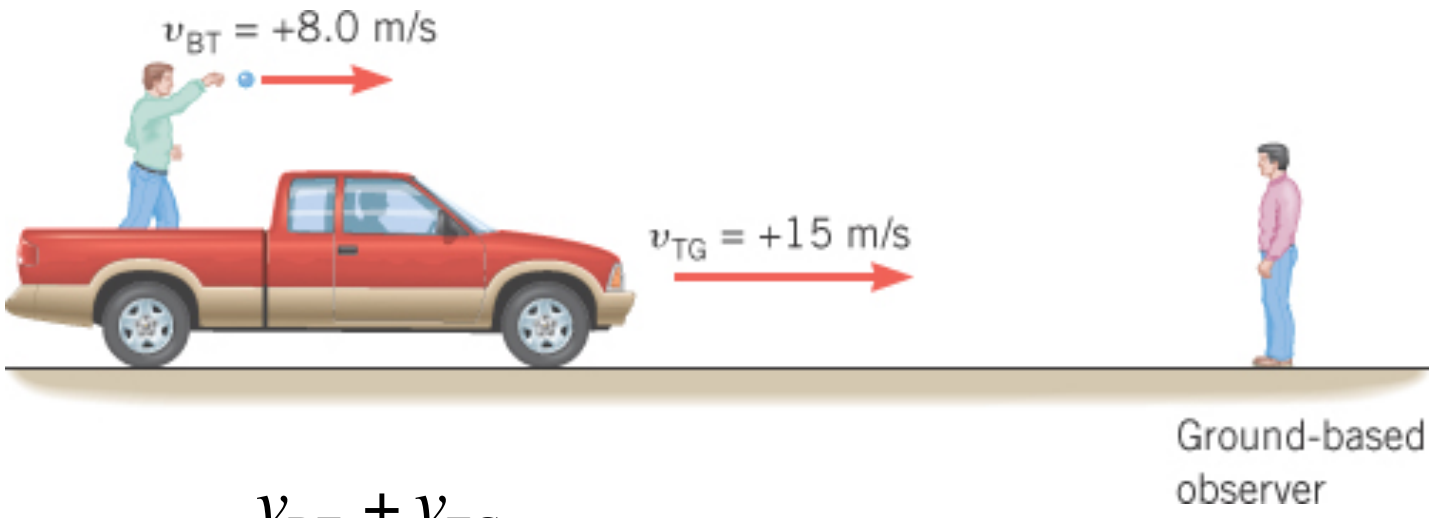


$$2s = 2\sqrt{D^2 + L^2} = 2\sqrt{D^2 + (\frac{v\Delta t}{2})^2}$$

$$\Delta t = \frac{\Delta t_o}{\sqrt{1 - v^2/c^2}}$$

From Physics by Cutnell and Johnson, 8ed. Wiley

28.7 The Relativistic Addition of Velocities



$$v_{BG} = \frac{v_{BT} + v_{TG}}{1 + \dfrac{v_{BT} v_{TG}}{c^2}}$$

$$v_{BG} = \frac{0.5c + 0.8c}{1 + \dfrac{(0.5c)(0.8c)}{c^2}} = 0.93c$$

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Velocity transformation

$$(v_{\mathrm{BG}}/c) = \frac{(v_{\mathrm{BT}}/c) + (v_{\mathrm{TG}}/c)}{1 + (v_{\mathrm{BT}}/c)(v_{\mathrm{TG}}/c)}$$

$$\tanh(a+b) = \frac{\tanh(a) + \tanh(b)}{1 + \tanh(a)\tanh(b)}$$

$$(v_{\mathrm{BG}}/c) = \frac{(v_{\mathrm{BT}}/c) - (v_{\mathrm{TG}}/c)}{1 - (v_{\mathrm{BT}}/c)(v_{\mathrm{TG}}/c)}$$

$$\tanh(a-b) = \frac{\tanh(a) - \tanh(b)}{1 - \tanh(a)\tanh(b)}$$

Relativistic –Classical Physics Bridge

Relativistic		Classic		Relativistic
u	v	t_1 $\tanh^{-1}(u/c)$	t_2 $\tanh^{-1}(v/c)$	$\tanh(t_1 - t_2)$
.75 c	.5 c	.9729550745	.5493061443	.4
90	60	$0.3\ 10^{-6}$	$0.2\ 10^{-6}$	$0.1\ 10^{-6}$

u'=c tan(t_1-t_2)

Relativistic –Classical Physics Bridge

Relativistic		Classic		Relativistic
v	u'	t_1 $\tanh^{-1}(v/c)$	t_2 $\tanh^{-1}(u'/c)$	$\tanh(t_1+t_2)$
0.9 c	.8 c	1.47221949	1.098612289	0.988372093
30	60	0.1×10^{-6}	0.2×10^{-6}	0.3×10^{-6}

$u = c \tan(t_1 + t_2)$