PHYS 225 HW 1

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Due:Sep 5 Edit: September 5, 2024

1. Measure and find a mid point between the 2 lights, put a machine that will turn two clocks on when it detected that the light emitted from the bulb arrives. Turn on the bulb.

2. A travels at speed 4c/5 toward B, who is at rest. C is between A and B. How fast should C travel so that she sees both A and B approaching her at the same speed?

Set the speed of C as v_c, the direction to B is positive and B's position is origin. Therefore, we have: and the velocity of B and A approaching C in C's reference frame is u. Therefore, in C's reference frame, there is B moving toward C at u and in B's reference frame, A is moving toward B at $0.8c$, thus in C's reference frame, the speed of A to C need to apply relativistic addition.

$$u = \frac{-u + \frac{4}{5}c}{1 + \frac{-\frac{5}{4}uc}{c^2}}$$
$$u = \frac{1}{2}c$$

$u = v_c$ Therefore, $\boxed{v_c = \frac{1}{2}c}$

3. Relative speeds in different frames.

a) v_t as the torpedo's velocity in my reference frame and v_t' as the velocity of torpedo in star destroyer's reference frame.

$$\begin{aligned} v_t &= \frac{v_d + v_t'}{1 + \frac{v_d v_t'}{c^2}} \\ &= \frac{\frac{5}{6}c}{1 + \frac{c^2}{6c^2}} \\ &= \frac{\frac{5}{6}c}{1 + \frac{1}{6}} \\ &= \frac{5}{7}c \end{aligned}$$

$$v_c - v_t = \frac{3}{4}c - \frac{5}{7}c = \boxed{\tfrac{1}{28}c} > 0$$

Thus the Corvette does escape.

b) See the reference frame moving at $-v_d$ toward the Star destroyer. Thus:

$$\begin{aligned} v_c' &= \frac{-v_d + v_c}{1 + \frac{-v_d v_c}{c^2}} \\ &= \frac{\frac{1}{4}c}{1 - \frac{3}{8}} \\ &= \frac{2}{5}c \end{aligned}$$

$$v_c' - v_t' = \frac{2}{5}c - \frac{1}{3}c = \boxed{\tfrac{1}{15}c} > 0$$

Therefore, the Corvette does escape.