

Relativistic Addition of Velocities

26.21 An electron moves to the right at  $.90c$  relative to an observer in the lab. A proton moves left at  $.70c$  relative to the electron. Find the speed of the proton relative to the observer. (.54c)

$$v_{ab} = (v_{ad} + v_{db}) / (1 + v_{ad} v_{db}/c^2)$$

26.23 A Klingon spaceship moves away from Earth at a speed of  $.800c$ . The starship Enterprise pursues at  $.900c$  relative to Earth. Observers on Earth see the Enterprise overtaking the Klingon ship at a relative speed of  $.100c$ . With what speed is the Enterprise overtaking the Klingons as seen by the Captain Kirk? (.357c)

26.24 A spaceship travels at  $.750c$  relative to Earth. If the ship fires a small rocket in the forward direction, how fast (relative to the ship) must it be fired to be perceived at  $.950c$  on earth?

26.27 Extra Credit. Spaceship I, which contains students taking a Mod Phys test, approaches Earth at  $.60c$ , while Spaceship II, with Mr. L moves away from the Earth at  $.28c$ . If Mr. L stops the exam after 50.0 minutes have passed on his clock, how long does the exam last for the students? ... to an Earth bound professor?