167.

Problem 21.21 (RHK)

Galaxy A *is reported to be receding from us with a speed of* 0.347 *c*. *Galaxy* B, *located precisely in the opposite direction, is also found to be receding from us at this same speed. We have to find* (a) *the recessional speed of our galaxy by an observer in galaxy* A; *and* (b) *the recessional speed of galaxy* B.

Solution:

(a)

Galaxy A is reported to be receding from our galaxy with speed of 0.347 *c*. The speed of our galaxy as observed from the galaxy A will be 0.367 *c* and our galaxy will be observed to be receding away from it by an observer on the galaxy A.

(b)

For calculating the speed of galaxy B as observed by an observer on galaxy A, we consider a frame of reference, S, at rest with respect to the galaxy A. Let us consider another frame of reference, S', which is at rest with

respect to us and will therefore be moving away with respect to S with speed 0.367 *c*. The speed of galaxy B in the frame $S'$is 0.367 *c*. By using the relativistic velocity addition relation we can find the speed of galaxy B measured by the galaxy A. It will be

$$v_{galaxyB} = \frac{0.347c + 0.347c}{1 + 0.347^2} = 0.619c.$$