**182.**

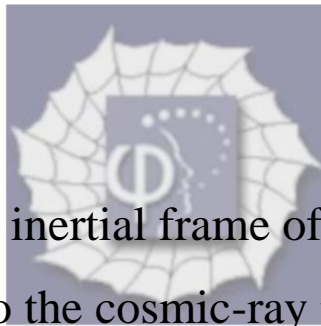<u>**Problem 2.33 (R)**</u>

*One cosmic-ray particle approaches the Earth along its axis with a velocity of 0.8 c toward the North Pole and another with a velocity 0.6 c toward the South Pole. We have to find the relative speed of approach of one particle with respect to the other.*

<u>**Solution:**</u>

Let us consider an inertial frame of reference which is at rest with respect to the cosmic-ray particle which to an observer on Earth is approaching it along its axis toward the North Pole. Let us call this frame of reference S. with respect to this frame of reference the inertial frame of reference in which the Earth is stationary, $S'$, will be moving toward it with velocity $v = 0.8 \ c$ . In $S'$ another cosmic ray particle is observed moving in the direction of the south-north axis with velocity $u = 0.6 \ c$.

We have to calculate the speed of the other cosmic-ray particle, $u'$, as measured by an observer in $S$. This speed will be the relative speed between the two cosmic-ray particles.

According to the velocity addition theorem

$$u' = \frac{u+v}{1+uv/c^2} = \frac{0.6+0.8}{1+0.6\times 0.8}\,c = 0.946\,c.$$