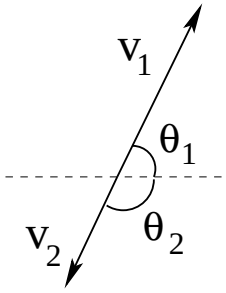
Decay of Particle II [mln103]

Particle in motion decays into two particles.

View from center-of-mass frame:

Momenta: $m_1\mathbf{v}_1 = -m_2\mathbf{v}_2$.

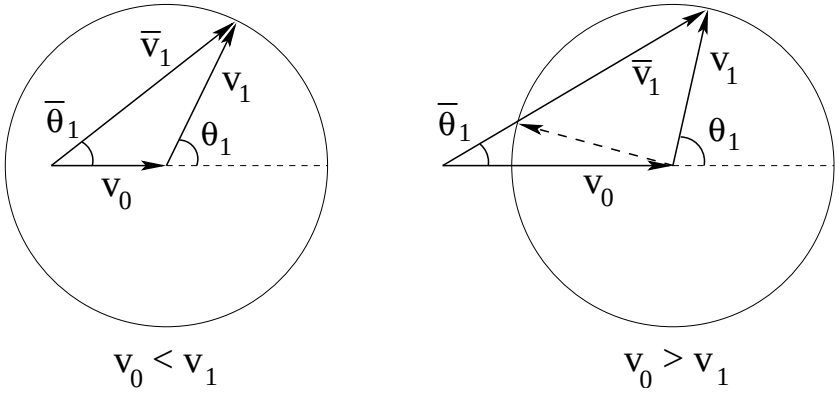
Directions of decay products: $\theta_1 + \theta_2 = \pi$.



View from laboratory frame:

Momentum of particle before decay: $(m_1 + m_2)\mathbf{v}_0$.

Directions of decay products: $\bar{\theta}_1, \bar{\theta}_2$.



Task #1: Find the relation between θ_1 and $\bar{\theta}_1$.

$$\tan\bar{\theta}_1 = \frac{v_1 \sin\theta_1}{v_1\cos\theta_1 + v_0}$$

$$\Rightarrow \quad \cos\theta_1 = -\frac{v_0}{v_1}\sin^2\bar{\theta}_1 \pm \cos\bar{\theta}_1\sqrt{1 - \frac{v_0^2}{v_1^2}\sin^2\bar{\theta}_1}.$$

Task #2: Find the relation between $\bar{\theta}_1$ and $\bar{\theta}_2$. →[mex238]

Task #3: Find the range of the angle $\bar{\theta} \doteq \bar{\theta}_1 + \bar{\theta}_2$. →[mex239]