

$$E_{\text{R}} = \frac{1}{2} m_{\chi} v^2 \frac{4 m_{\chi} m_{\mathcal{N}}}{(m_{\chi} + m_{\mathcal{N}})^2} \left( \frac{1 - \frac{v_{\text{t}}^2}{2v^2} - \sqrt{1 - \frac{v_{\text{t}}^2}{v^2}} \cos \theta}{2} \right), \quad \left\{ \begin{array}{l} v_{\text{t}} = 0 \\ v_{\text{t}} = \sqrt{\frac{2\delta}{\mu_{\chi\mathcal{N}}}} \neq 0 \end{array} \right.$$