

$$S_{\text{Long}} = \int \frac{a^3 d^3 k dt}{(2\pi)^3} \frac{1}{2a^2} \left(\frac{a^2 m^2}{k^2 + a^2 m^2} |\partial_t A_L|^2 - m^2 |A_L|^2 \right)$$