

$$\rho(t) = \int d\ln k \, \frac{1}{2a^2} \left(\frac{a^2 m^2}{k^2 + a^2 m^2} \mathcal{P}_{\partial_t A_L}(k, t) + m^2 \mathcal{P}_{A_L}(k, t) \right) ,$$