

Exercise Sheet

Question 1: What is the power per area, i.e. total energy per area and per time, of dark matter at Earth?

How much of this power can be harvested (in theory) by typical detection strategies for WIMPs and Axions?

Question 2: Estimate today's velocity of dark matter axions far outside from galaxies in a scenario (similar to the postinflationary one) where the relevant fluctuations are of the order of the Hubble scale at the time when the field starts oscillating. Do so for a constant mass. And neglect the change in the number of degrees of freedom.

Question 3: In the lecture we noted that,

$$\Omega_a h^2 = \kappa_a \left(\frac{f_a}{10^{12} \text{ GeV}} \right)^{7/6} \theta_i^2, \quad (1)$$

This is actually the behaviour for sufficiently small values of f_a . At what scale of f_a do you expect a change in the dependence on f_a ?