ASTR 425/525
Cosmology

Worksheet #15

Wednesday 10/22/2025

Question 1.

Big Bang Nucleosynthesis (BBN), together with the measured abundance of ^{4}He, is an excellent probe of whether the physics of the early Universe was the same as today. Consider the following changes to the physics of the early Universe and determine whether they would result in an increased or decreased ^{4}He abundance in the early Universe.

(a) A larger neutron lifetime τ_n.

(b) A larger value of $Q \equiv m_n - m_p$, the mass difference between a neutron and a proton.

(c) A larger value of $g_*(T)$ at all times.

(d) An increased value of the baryon-to-photon ratio, $\eta_{\rm b}$.