we obtain

$$m_0 \gg \left[\left(g^2\Gamma_\varphi\right)^{n+1}\sqrt{\lambda}\,M_P\right]^{\frac{1}{n+2}} \tag{4.139}$$

ϕ_* Case A

The energy density of ϕ during primordial inflation is

$$\rho_{\phi,\mathrm{inf}} = \left(-\frac{1}{2}m_0^2 + h^2\frac{\psi_*^{2\alpha}}{M_P^{2\alpha-2}}\right)\langle\phi\rangle^2 + \lambda\frac{\langle\phi\rangle^{2n+4}}{M_P^{2n}} \tag{4.140}$$

$$\sim -\frac{1}{2}m_0^2\langle\phi\rangle^2 + \lambda\frac{\langle\phi\rangle^{2n+4}}{M_P^{2n}} \tag{4.141}$$

with the second line coming from Eq. (4.77) regarding the dynamics of thermal inflation. Therefore, with the energy density of the Universe being $\sim M_P^2 H_*^2$, we require

$$m_0\langle\phi\rangle \ll M_P H_* \tag{4.142}$$

and

$$\sqrt{\lambda}\,\langle\phi\rangle^{n+2} \ll M_P^{n+1}H_* \tag{4.143}$$

Substituting $\langle\phi\rangle$, Eq. (4.7), into Eq. (4.142) gives the same constraint as from substituting $\langle\phi\rangle$ into Eq. (4.143). This constraint is

$$m_0 \ll \left(\sqrt{\lambda}\,M_P H_*^{n+1}\right)^{\frac{1}{n+2}} \tag{4.144}$$

However, for all viable parameter values in our model, this constraint is never the dominant constraint when we consider it alongside all of the other con-