

først har vi vores startligninger

$$\dot{\delta}^{(1)} = -\theta^{(1)} \quad \dot{\theta}^{(1)} = -\mathcal{H}\theta^{(1)} - \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(1)} - c_s^2 \nabla^2 \delta^{(1)} \quad (4.41)$$

$$\dot{\delta}_\nu^{(2)} = -2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \delta^{(1)} - 2\delta^{(1)} \theta^{(1)} - \theta^{(2)} \quad (4.42)$$

$$\dot{\theta}^{(2)} = -\mathcal{H}\theta^{(2)} - 2\left(\partial_i \partial_j \nabla^{-2} \theta^{(1)} \partial_i \partial_j \theta^{(1)}\right) - 2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \theta^{(1)} \quad (4.43)$$

$$- \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(2)} - c_s^2 \nabla^2 \delta^{(2)} \quad (4.44)$$

$$\ddot{\delta}^{(2)} = -2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \delta^{(1)} - 2\partial_j \nabla^{-2} \dot{\theta}^{(1)} \partial_j \dot{\delta}^{(1)} - 2\dot{\delta}^{(1)} \theta^{(1)} - 2\delta^{(1)} \dot{\theta}^{(1)} - \dot{\theta}^{(2)} \quad (4.45)$$

$$\ddot{\delta}_\nu^{(2)} = -2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \delta^{(1)} - 2\partial_j \nabla^{-2} \dot{\theta}^{(1)} \partial_j \dot{\delta}^{(1)} - 2\dot{\delta}^{(1)} \theta^{(1)} - 2\delta^{(1)} \dot{\theta}^{(1)} \quad (4.46)$$

$$+ \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(2)} + c_s^2 \nabla^2 \delta^{(2)} + 2\left(\partial_i \partial_j \nabla^{-2} \theta^{(1)} \partial_i \partial_j \theta^{(1)}\right) + 2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \theta^{(1)} + \mathcal{H}\theta^{(2)} \quad (4.47)$$

$$\ddot{\delta}^{(2)} = -2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \delta^{(1)} - 2\partial_j \nabla^{-2} \dot{\theta}^{(1)} \partial_j \dot{\delta}^{(1)} - 2\dot{\delta}^{(1)} \theta^{(1)} - 2\delta^{(1)} \dot{\theta}^{(1)} \quad (4.48)$$

$$+ \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(2)} + c_s^2 \nabla^2 \delta^{(2)} + 2\left(\partial_i \partial_j \nabla^{-2} \theta^{(1)} \partial_i \partial_j \theta^{(1)}\right) + 2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \theta^{(1)} \quad (4.49)$$

$$+ \mathcal{H}(-2\partial_j \nabla^{-2} \theta^{(1)} \partial_j \delta^{(1)} - 2\delta^{(1)} \theta^{(1)} - \dot{\delta}_\nu^{(2)}) \quad (4.50)$$

$$(4.51)$$

$$\ddot{\delta}^{(2)} = 2\partial_j \nabla^{-2} \delta^{(1)} \partial_j \delta^{(1)} + 2\partial_j \nabla^{-2} (\mathcal{H}\delta^{(1)} - \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(1)} - c_s^2 \nabla^2 \delta^{(1)})^{(1)} \partial_j \dot{\delta}^{(1)} \quad (4.52)$$

$$+ 2\dot{\delta}^{(1)} \dot{\delta}^{(1)} - 2\delta^{(1)} (\mathcal{H}\delta^{(1)} - \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(1)} - c_s^2 \nabla^2 \delta^{(1)}) \quad (4.53)$$

$$+ \frac{3}{2} \frac{H_0^2 \Omega_M}{a} \delta_M^{(2)} + c_s^2 \nabla^2 \delta^{(2)} + 2\left(\partial_i \partial_j \nabla^{-2} \delta^{(1)} \partial_i \partial_j \dot{\delta}^{(1)}\right) + 2\partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_j \dot{\delta}^{(1)} \quad (4.54)$$

$$+ \mathcal{H}(2\partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_j \delta^{(1)} + 2\delta^{(1)} \dot{\delta}^{(1)} - \dot{\delta}^{(2)}) \quad (4.55)$$

bedre opskrivning

$$\ddot{\delta}^{(2)} + \mathcal{H}\dot{\delta}^{(2)} = \frac{3}{2} \frac{H_0^2}{a} \left(2\partial_j \nabla^{-2} \delta_M^{(1)} \partial_j \delta^{(1)} + 2\delta^{(1)} \delta_M^{(1)} + \delta_M^{(2)}\right) \quad (4.56)$$

$$+ c_s^2 \left(2\partial_j \delta^{(1)} \partial_j \delta^{(1)} + 2\delta^{(1)} \nabla^2 \delta^{(1)} + \nabla^2 \delta^{(2)}\right) \quad (4.57)$$

$$4\partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_j \dot{\delta}^{(1)} + 2\dot{\delta}^{(1)} \dot{\delta}^{(1)} + 2\partial_i \partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_i \partial_j \nabla^{-2} \dot{\delta}^{(1)} \quad (4.58)$$

$$\ddot{\delta}^{(2)} + \mathcal{H}\dot{\delta}^{(2)} = \frac{3}{2} \frac{H_0^2}{a} \left(2\partial_j \nabla^{-2} \delta_M^{(1)} \partial_j \delta^{(1)} + 2\delta^{(1)} \delta_M^{(1)} + \delta_M^{(2)}\right) \quad (4.59)$$

$$+ 4\partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_j \dot{\delta}^{(1)} + 2\dot{\delta}^{(1)} \dot{\delta}^{(1)} + 2\partial_i \partial_j \nabla^{-2} \dot{\delta}^{(1)} \partial_i \partial_j \nabla^{-2} \dot{\delta}^{(1)} \quad (4.60)$$

$$a = \frac{1}{4} H_0^2 \tau^2 \quad \delta^{(1)} = D\tilde{\delta} \quad \delta_M = a\tilde{\delta}_M \quad \mathcal{H} = H_0/\sqrt{a} = \frac{2}{\tau} \quad (4.61)$$

$$(4.62)$$

Vi indsætter og ser hvad der sker,

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2 \nabla^2 \delta^{(2)} - \frac{6}{\tau^2} \delta_M^{(2)} = \frac{6}{\tau^2} \left( 2\partial_j \nabla^{-2} a \tilde{\delta}_M^{(1)} \partial_j D \tilde{\delta}^{(1)} + 2D \tilde{\delta}^{(1)} a \tilde{\delta}_M^{(1)} \right) \quad (4.63)$$

$$+ 4\dot{D}^2 \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\dot{D}^2 \tilde{\delta}^{(1)} \tilde{\delta}^{(1)} + 2\dot{D}^2 \partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \quad (4.64)$$

$$+ c_s^2 \left( 2\partial_j D \tilde{\delta}^{(1)} \partial_j D \tilde{\delta}^{(1)} + 2D \tilde{\delta}^{(1)} \nabla^2 D \tilde{\delta}^{(1)} \right) \quad (4.65)$$

reducere

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2 \nabla^2 \delta^{(2)} - \frac{6}{\tau^2} \delta_M^{(2)} = aD \frac{6}{\tau^2} \left( 2\partial_j \nabla^{-2} \tilde{\delta}_M^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \tilde{\delta}_M^{(1)} \right) \quad (4.66)$$

$$+ 4\dot{D}^2 \left( \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \tilde{\delta}^{(1)} + 2\partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \right) \quad (4.67)$$

$$+ c_s^2 D^2 \left( 2\partial_j \tilde{\delta}^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \nabla^2 \tilde{\delta}^{(1)} \right) \quad (4.68)$$

$$\ddot{\delta}^{(2)} + \frac{2}{\tau}\dot{\delta}^{(2)} - c_s^2 \nabla^2 \delta^{(2)} - \frac{6}{\tau^2} \delta_M^{(2)} = D \frac{3}{2} H_0^2 \left( 2\partial_j \nabla^{-2} \tilde{\delta}_M^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \tilde{\delta}_M^{(1)} \right) \quad (4.69)$$

$$+ 4\dot{D}^2 \left( \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \tilde{\delta}^{(1)} + 2\partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \partial_i \partial_j \nabla^{-2} \tilde{\delta}^{(1)} \right) \quad (4.70)$$

$$+ c_s^2 D^2 \left( 2\partial_j \tilde{\delta}^{(1)} \partial_j \tilde{\delta}^{(1)} + 2\tilde{\delta}^{(1)} \nabla^2 \tilde{\delta}^{(1)} \right) \quad (4.71)$$