

Baryogenesis via mesino oscillations

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Introduction to Baryogenesis

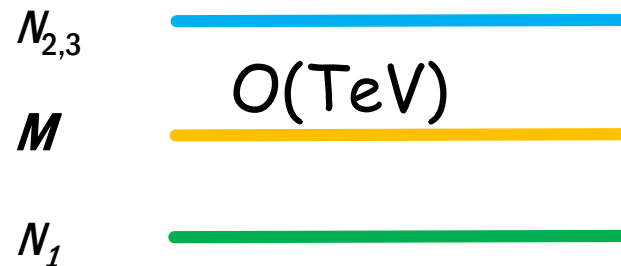
- ▶ Universe is made up of baryons $\eta = 5 \times 10^{-10}$
- ▶ Sakharov conditions
 1. Baryon number violation
 2. C and CP Violation
 3. Departure from thermal equilibrium
- ▶ Motivation to make baryogenesis work at low temperatures

Lagrangian and mass hierarchy

colored scalars singlet fermions

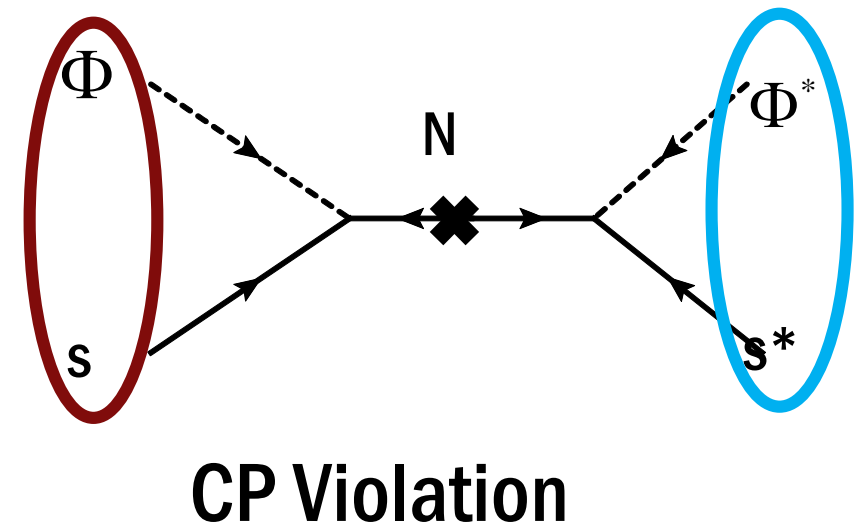
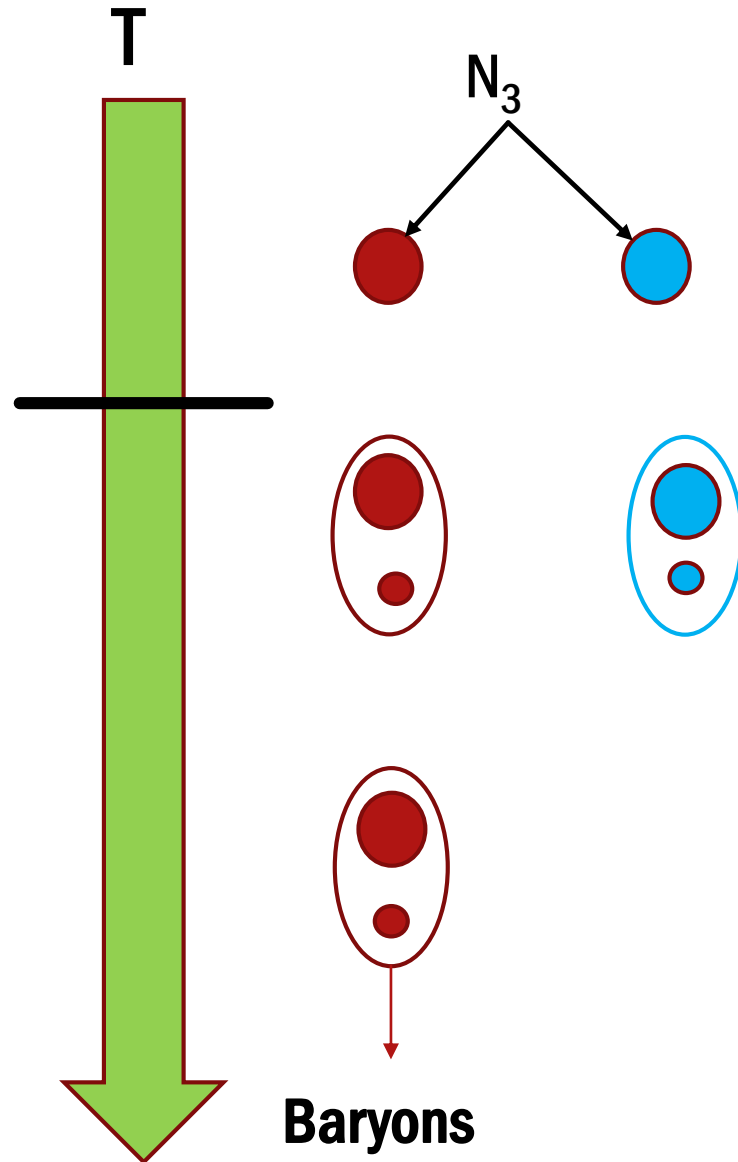
$$L = L_{SM} + y_{ij} \Phi \bar{d}_i N_j + m_{N_{ij}} N_i N_j + \alpha_{ij} \Phi Q_i Q_j + c.c$$

CP violation B violation



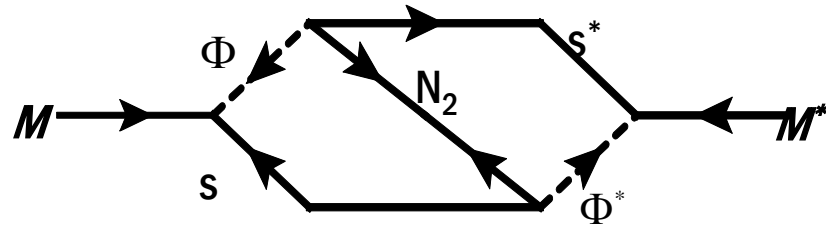
General Idea

$T = 200 \text{ MeV}$



Oscillations

Off shell diagrams

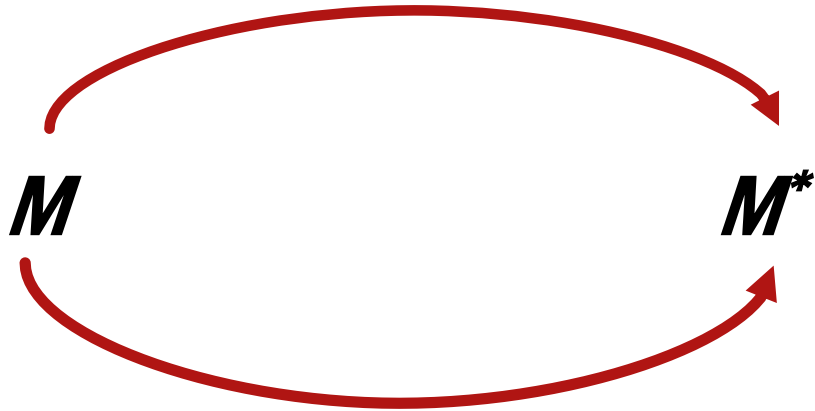
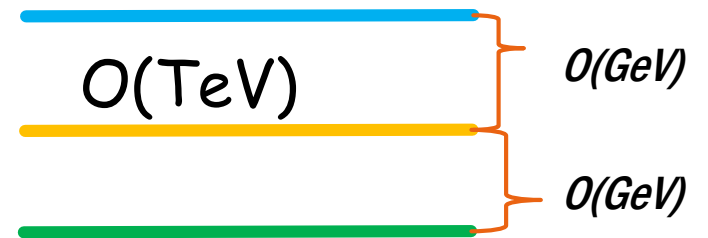


$$M_{12} = 2f_M^2 \sum_j y_{sj}^2 \frac{m_{Nj}}{m_{Nj}^2 - m_M^2}$$

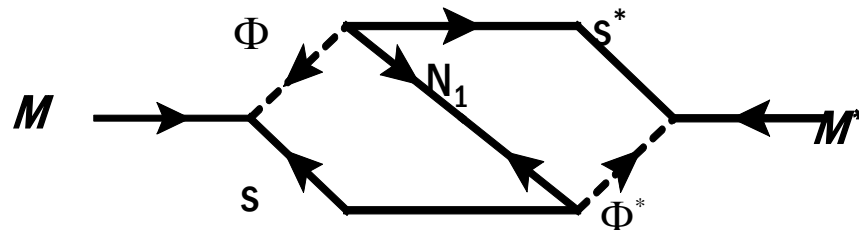
N_2

M

N_1



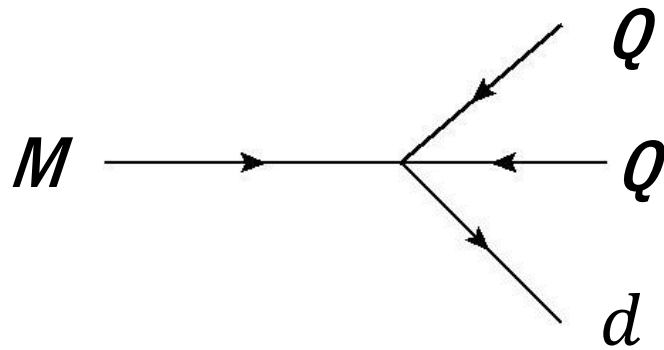
On shell diagrams via
common final states



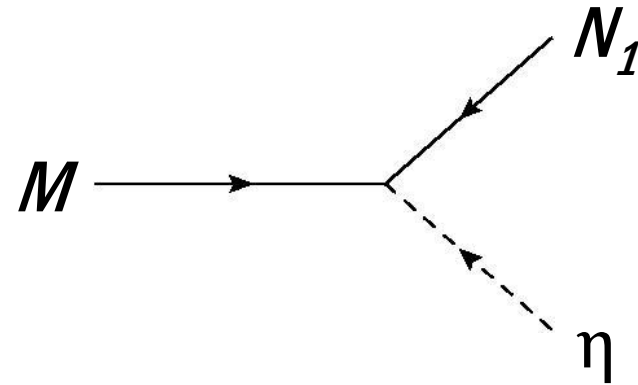
$$\Gamma_{12} = \frac{1}{4\pi} y_{s1}^2 F^2(m_{N1}^2) m_M$$

Decays and Annihilations

► Decays

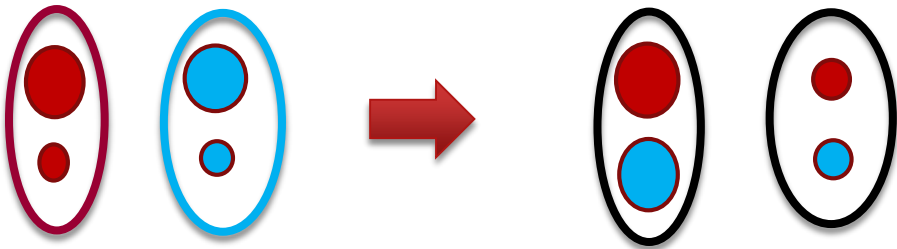


$$\Gamma_{M \rightarrow \text{baryonic}} = \frac{1}{8\pi} |\alpha_{ab}|^2 m_M$$



$$\Gamma_{M \rightarrow N_1 \eta} = \frac{1}{4\pi} |y_{s1}|^2 F^2(m_{N_1}^2) m_M$$

► Annihilations



$$\Gamma_{\text{geometric}} = \frac{n_M}{2} \frac{1}{\Lambda_{\text{had}}^2} \left(\frac{T_b}{\text{GeV}} \right)^{\frac{1}{2}}$$

Maximum possible baryogenesis

- ▶ The baryogenesis is given by

$$\frac{n_b}{n_\gamma} = \eta = (\text{no. of strange mesinos}) \times (\text{entropy dilution}) \times F_{CP}$$

- ▶ Maximum baryogenesis is given by

$$\eta \leq 2.5 \times 10^{-6}$$

Conclusions and Future Work

- ▶ This model gives us baryogenesis
- ▶ Baryogenesis happens at MeV scale, hence don't have to rely on a high reheating temperature
- ▶ Energy scales around TeV so interesting for collider physics
- ▶ Might be observable in Kaon anti Kaon oscillation
- ▶ Mechanism can be used to generate asymmetric DM

Baryon Violation

Mesino Oscillation

Baryogenesis