

# 8.701

Introduction to Nuclear  
and Particle Physics

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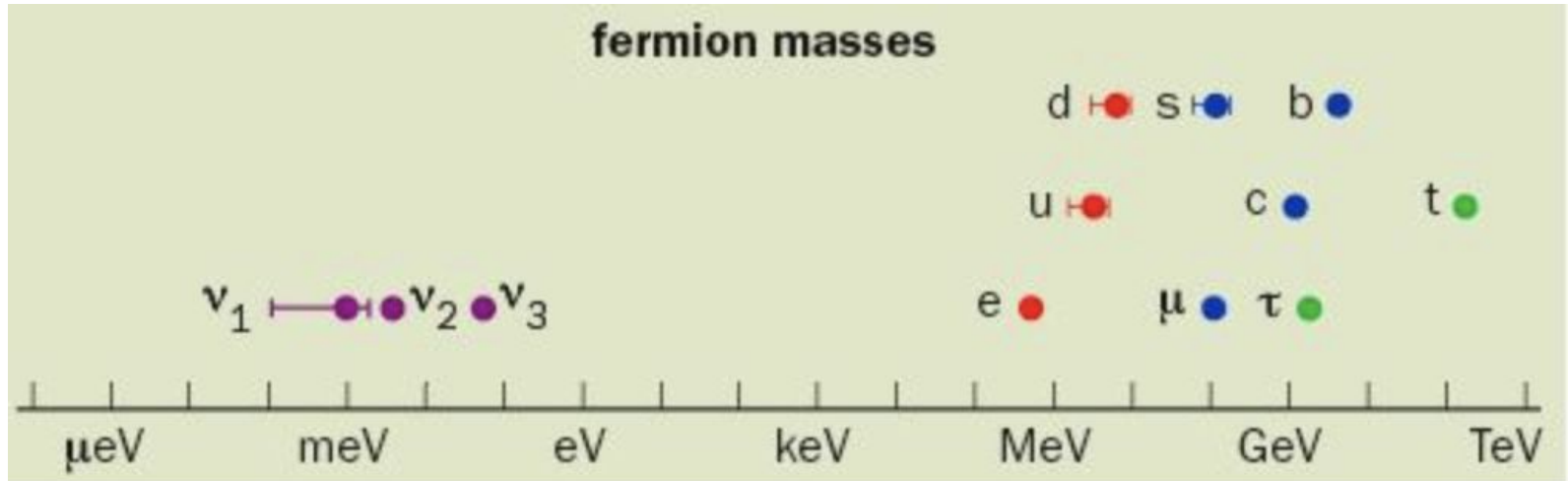
7. Higgs Physics

7.2 Fermion Masses



# Fermion Masses

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# Fermion Masses

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Fermion mass term in Lagrangian via coupling to the scalar field

$$\mathcal{L}_d = -\lambda_d \bar{Q}_L \Phi d_R + h.c.$$

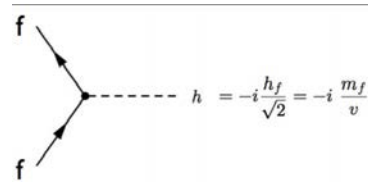
$$Q_L = \begin{pmatrix} u_{iL} \\ d_{iL} \end{pmatrix}$$

$$\mathcal{L}_u = -\lambda_u \bar{Q}_L \Phi_c u_R + h.c.$$

$$\Phi_c = i\sigma_2 \Phi^*$$

u, d : up and down type field,  $\lambda$ : Yukawa coupling

$$m_d = -\frac{\lambda_d v}{\sqrt{2}}$$



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