

Interpreting the Electron Electric Dipole Moment (eEDM) Constraint

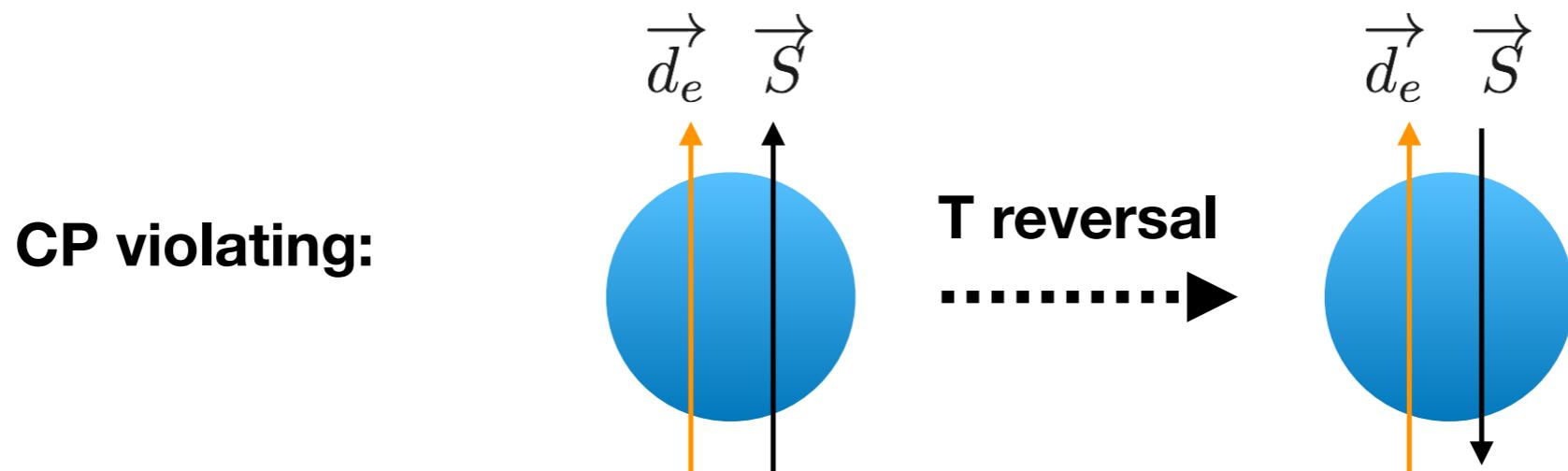
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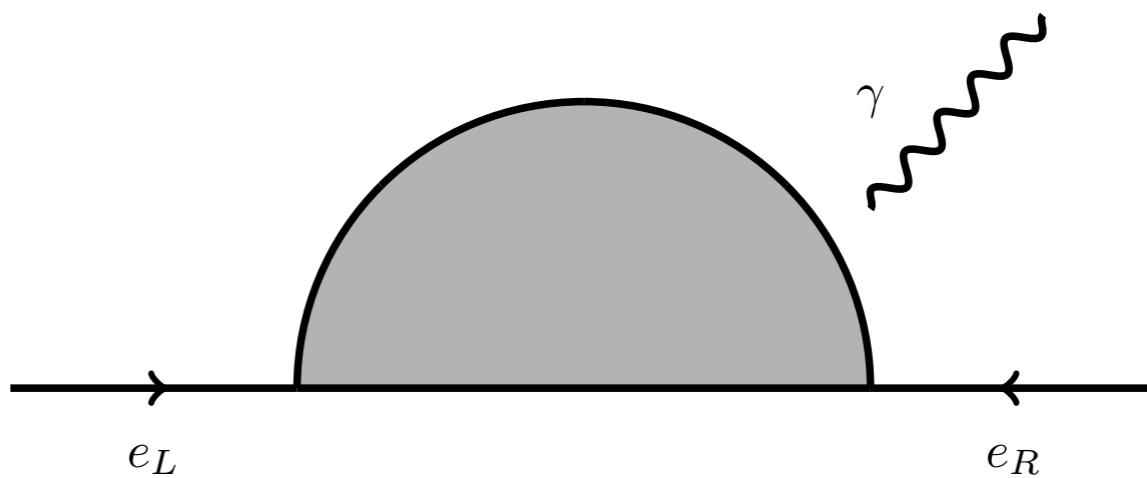
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What is eEDM

$$\mathcal{L} = -i \frac{d_e}{2} \bar{\psi}_e \gamma^5 \sigma_{\mu\nu} \psi_e F^{\mu\nu} \xrightarrow{\text{non rel.}} H = -d_e \frac{\vec{S}}{S} \cdot \vec{E} \equiv -\vec{d}_e \cdot \vec{E}$$



Cause correction
to electron mass:



Why study eEDM

Powerful probe of new physics at collider scale

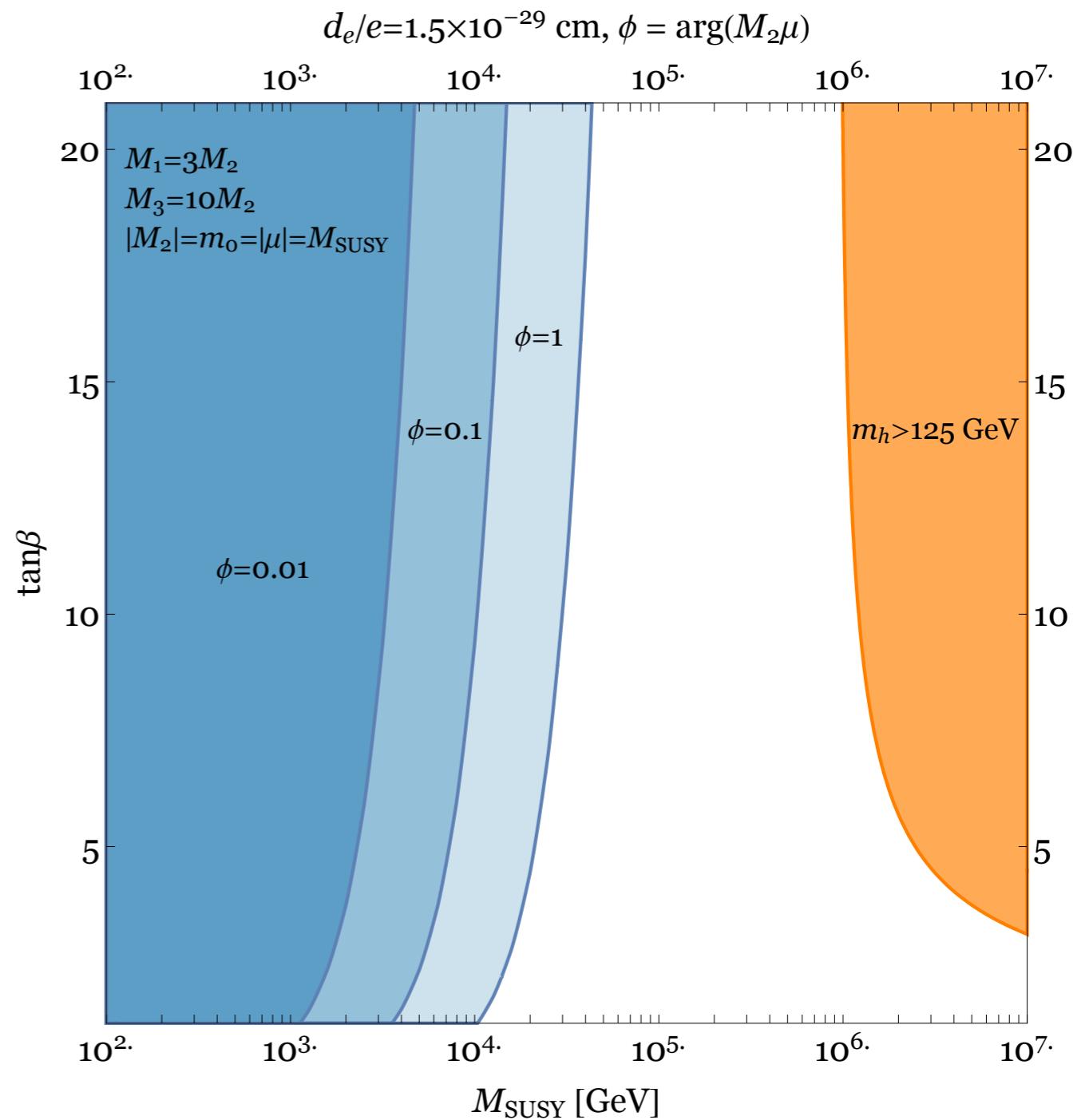
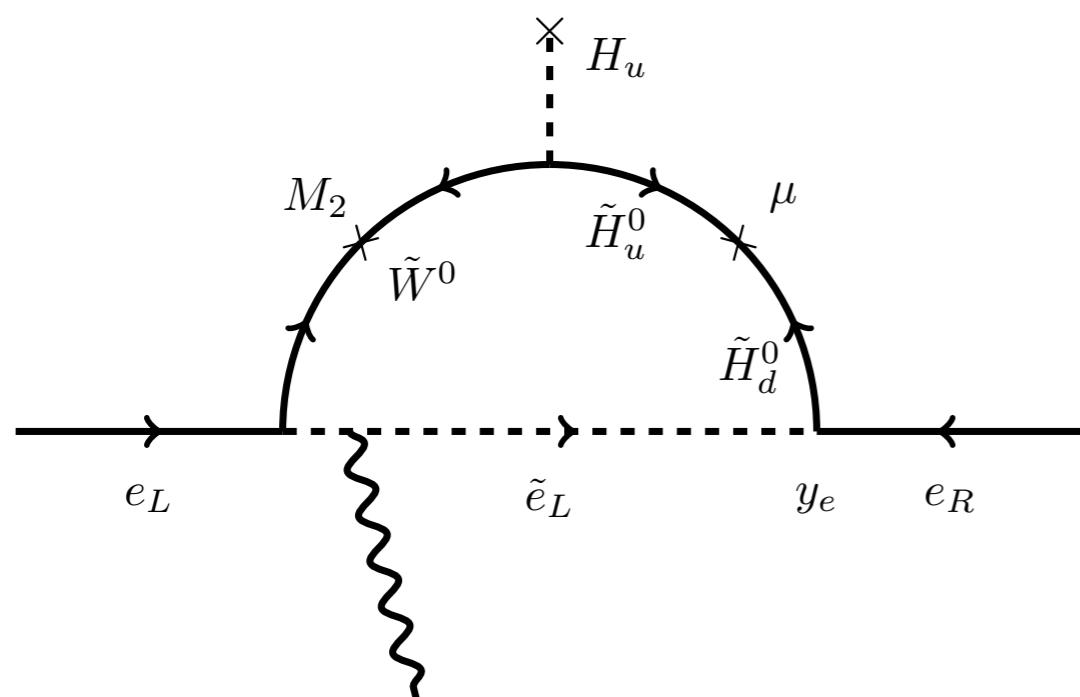
ACME II constraint is not yet published; all following discussion assumes a hypothetical value

$|d_e| < 1.5 \times 10^{-29}$ e cm; (ACME 2014 gives $|d_e| < 8.7 \times 10^{-29}$ e cm)

Scaling analysis:

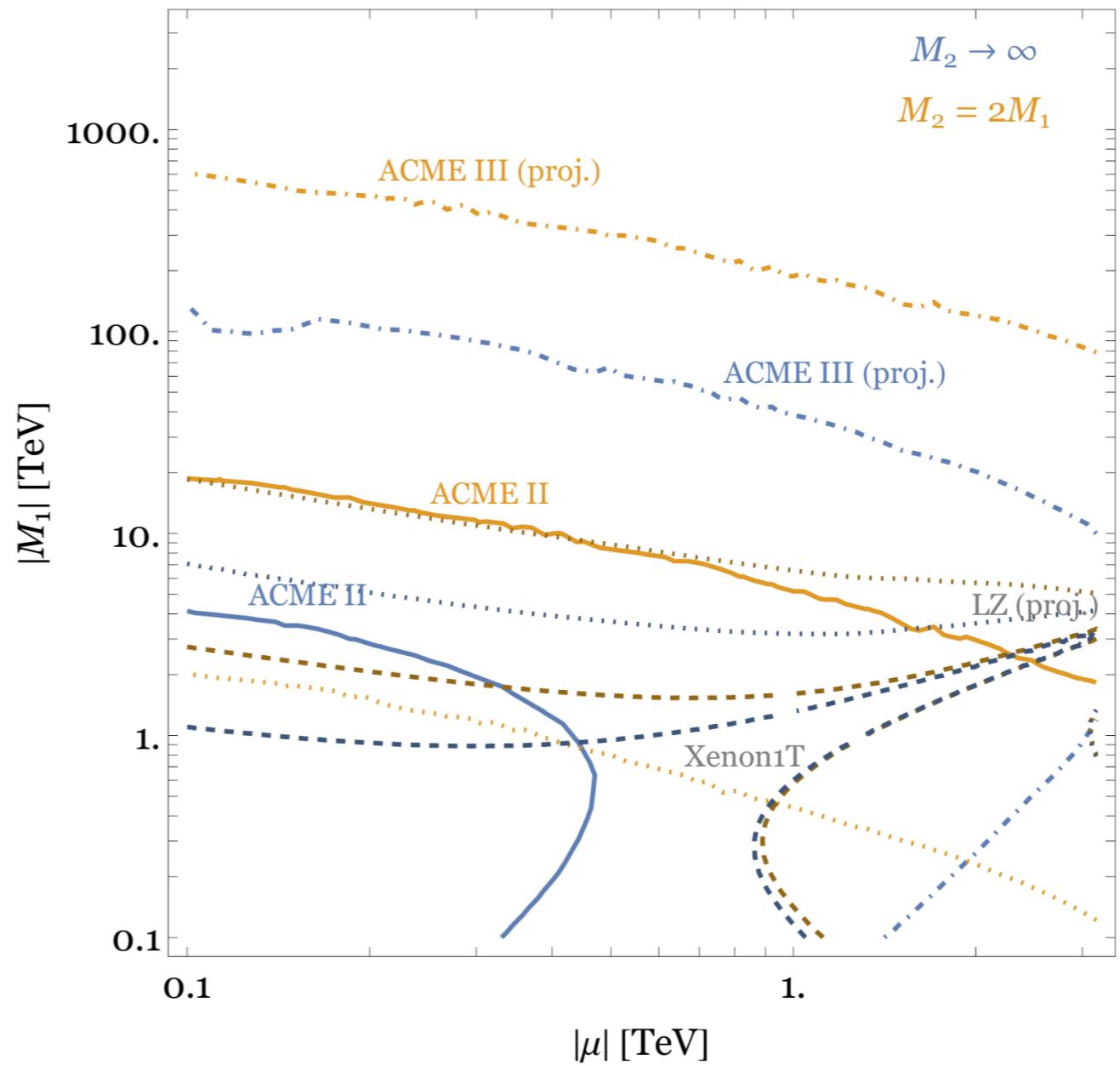
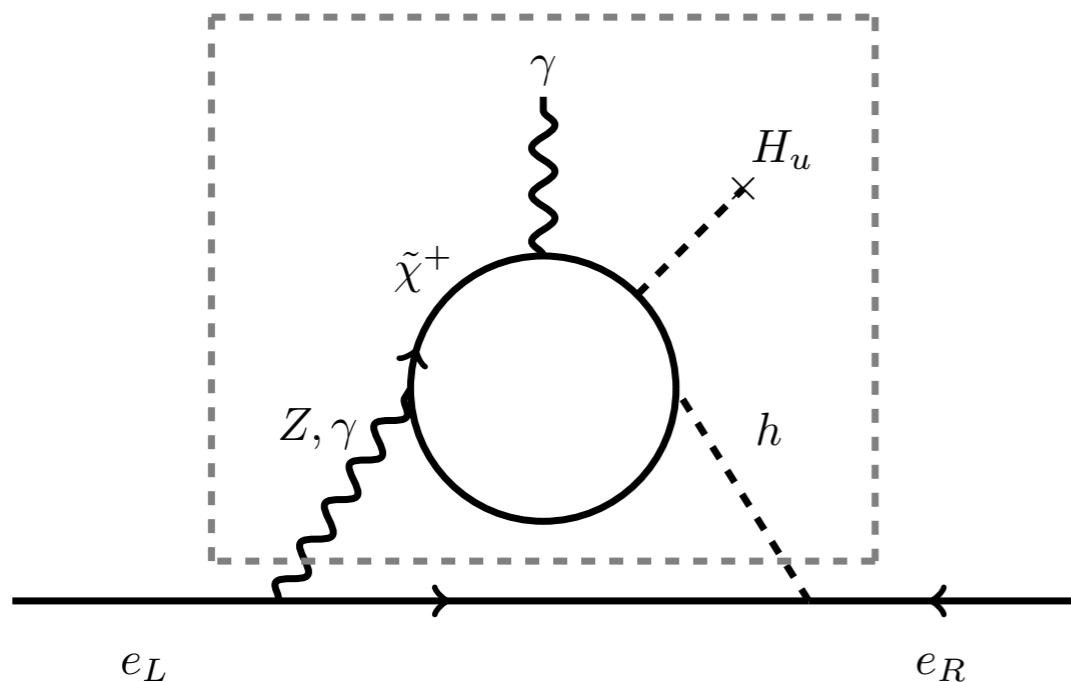
$$d_e = \delta_{\text{CPV}} \left(\frac{\lambda}{16\pi^2} \right)^k \frac{m_e}{M^2}$$
$$\Rightarrow M > \begin{cases} 800 \text{ TeV} & (\text{0 loop}) \\ 40 \text{ TeV} & (\text{1 loop}) \\ 2 \text{ TeV} & (\text{2 loop}) \end{cases}$$

eEDM from SUSY (1 loop)

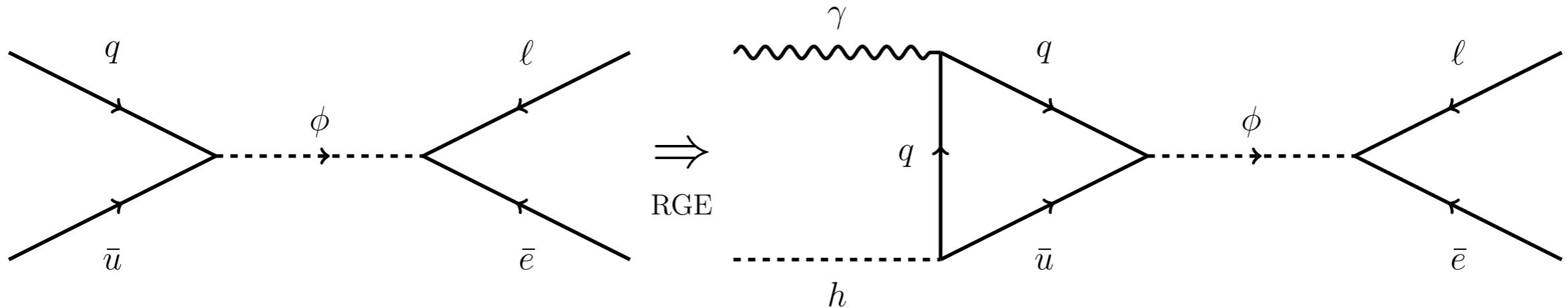


eEDM from SUSY (2 loop)

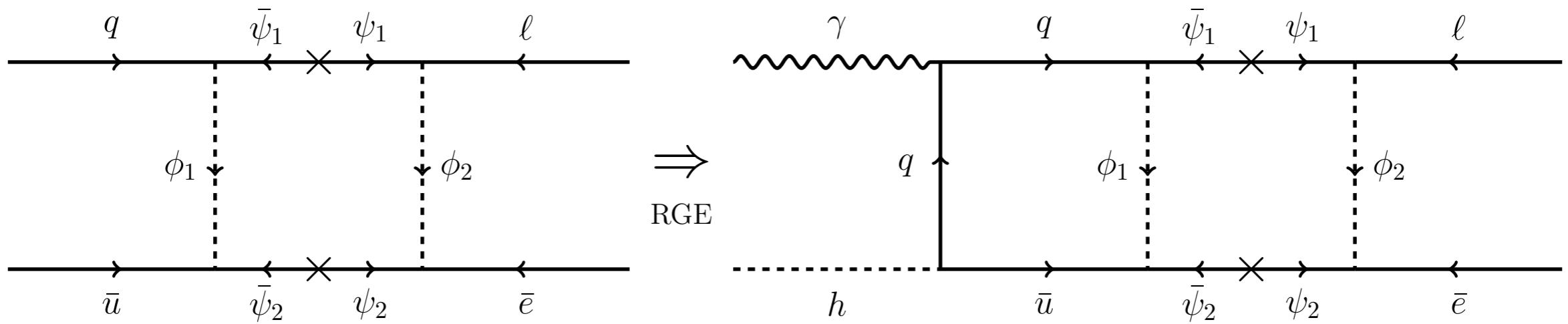
$$\arg(M_1\mu) = \frac{\pi}{4}, \tan\beta = 2$$



eEDM from QULE



tree-level QULE, one-loop eEDM [Arnold, Fornal, Wise arXiv:1304.6119v2]
 • quantum number of intermediate scalar fixed



one-loop QULE, two-loop eEDM:
 • contain many different scenarios of new physics

eEDM from QULE

