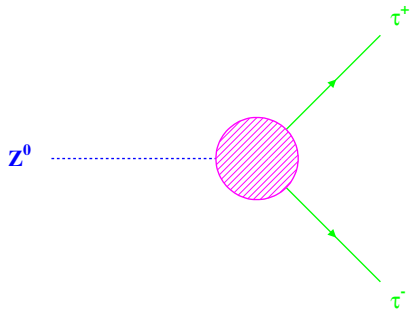
Dipole & Magnetic Moments / CP Violation



Tree Level

$$e \quad \{ \quad \gamma^\mu (v_\tau - a_\tau \gamma^5)$$
$$+ \quad \sigma^{\mu\nu} (i \frac{a_\tau^w}{2m_\tau} + \frac{d_\tau^w}{e} \gamma^5) q_\nu \Big\}$$

(similar for $\gamma \to \tau^+ \tau^-$)

$a_\tau^w (a_\tau^\gamma)$ = Anomalous Magnetic Dipole Moments

1. a_τ^γ : $e^+e^- \to \tau^+\tau^-\gamma$
2. a_τ^w : T,N Polarization of τ

$\Rightarrow \mathcal{CP}$-Conserving

$d_\tau^w (d_\tau^\gamma)$ = Weak (Electric) Dipole Moments

1. d_τ^γ : $e^+e^- \to \tau^+\tau^-\gamma$
2. d_τ^w : $\Delta\Gamma(Z \to \tau\tau)$
3. d_τ^w : T,N Pol of τ
4. $Re(d_\tau^w)$ $Im(d_\tau^w)$: $\mathcal{CP}$-Odd Observ's

1–3 meas $|d_\tau^w|^2 \propto |\mathcal{M}_{\mathcal{CP}}|^2$ — Not a $\mathcal{CP}$-Inv. Test

4 meas $\mathcal{M}_{\mathcal{CP}} \mathcal{M}_{\rm SM}$ — True $\mathcal{CP}$-Inv. Test

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