τ polarisation $\gamma\gamma \to \phi_1 \to \tau^+\tau^-$

S. Kraml, R.K. Singh and R.G. [arXiv:hep-ph/0409199], Talk given at International Conference on Linear Colliders (LCWS 04), Paris, France, 19-24 Apr 2004, ;

Manuscript in preparation

What have we done?

S. Kraml, R.Singh, R.G, [arXiv:hep-ph/0409199]

τ pair production as a probe of the Higgs contribution and CP structure of its coupling. Studied

$$\gamma\gamma \to \phi \to \tau^+ \tau^-$$

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QED background : P, CP and chirality conserving.

Higgs exchange diagram violates these symmetries,

$\{x_i, y_j\} \neq 0 \Rightarrow$. Chirality flipping interaction, $\Rightarrow \tau$-polarisation affected.

Polarisation of τ:

$$P_\tau^{IJ} = \frac{N_+^{IJ} - N_-^{IJ}}{N_+^{IJ} + N_-^{IJ}}$$

$I, J = +, -, U$ Polarisation of parent e^+/e^- beam.
$N_+^{IJ} = \#$ of τ_R, $N_-^{IJ} = \#$ of τ_L.

♢ $P_\tau^U = 0$: for QED contribution.

♢ $P_\tau^U = 0$: even with Higgs contribution, if $y_j = 0$; i.e. Higgs is a CP eigenstate.

□ $P_\tau^U \propto m_\tau \Rightarrow$ small **even** with CPV.

□ P_τ^U a 'poor' but 'pure' probe of CPV in the Higgs sector.

Move to polarised photons :

- P_τ^{++}, P_τ^{--} : finite for QED diagrams alone.

P invariance of QED $\Rightarrow P_\tau^{++} = -P_\tau^{--} \Rightarrow P_\tau^{++} + P_\tau^{--} = 0$

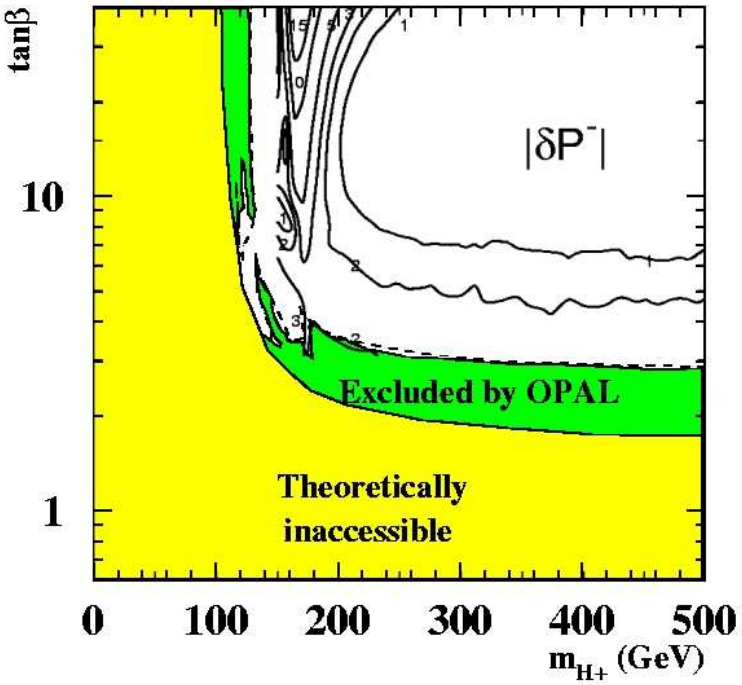
$P_\tau^{++} + P_\tau^{--} \neq 0 \Rightarrow$ signal of $\not{P}$ In case of C invariance $\Rightarrow$ signal of CP violation.

- P_τ^{++} : modified by the Higgs contribution.

- $P_\tau^{++} - (P_\tau^{++})^{QED} \neq 0$ even if ϕ is CP eigenstate, $\Rightarrow$probe of chirality flipping amplitude.

Observables	Interaction probed
P_τ^U	CP-violating interaction
$\delta P_\tau^{CP} = P_\tau^{++} + P_\tau^{--}$	CP-violating interaction
$\delta P_\tau^{+} = P_\tau^{++} - (P_\tau^{++})^{QED}$	Chirality flipping interaction
$\delta P_\tau^{-} = P_\tau^{--} - (P_\tau^{--})^{QED}$	Chirality flipping interaction

CPSUPER-H



FeynHiggs