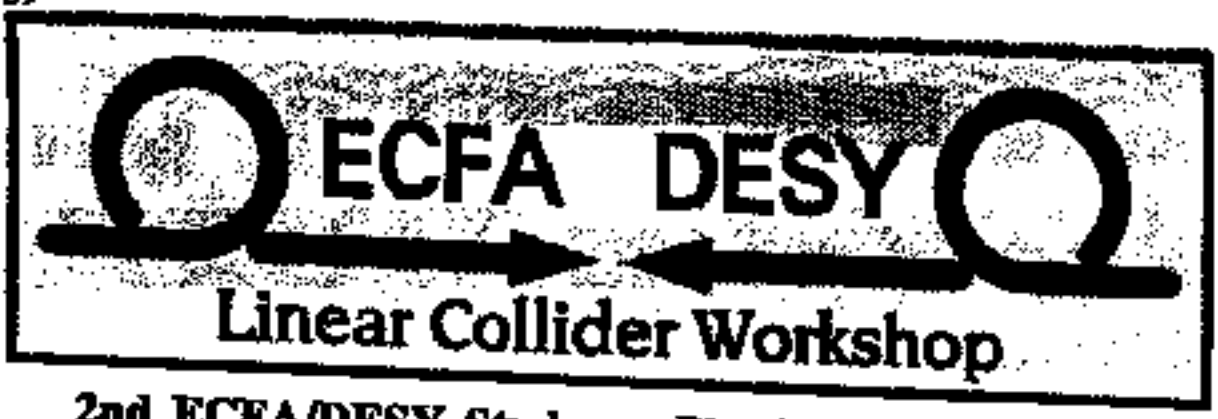
S9



2nd ECFA/DESY Study on Physics and Detectors for a Linear Electron-Positron Collider

LAL - Orsay - France, April 5-7, 1998

Date : April 6, 1998 - 09:00

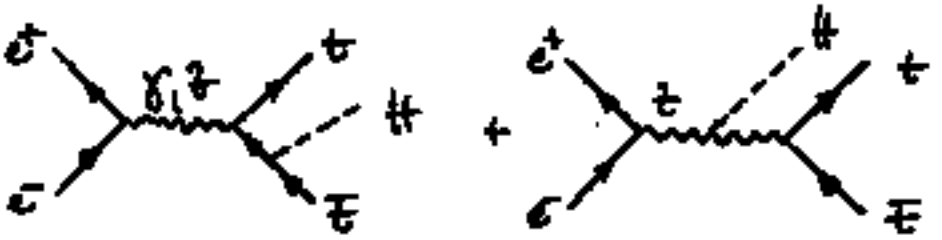
Parallel groups to plan tasks :

Higgs

$e^+e^- \to t\bar{t}H$

Liao, Mühlleitner, Dittmaier, Krämer, Spira, Zerwas

- benchmark cross section $[M_H \lesssim 120\,\mathrm{GeV}]$
- LO:



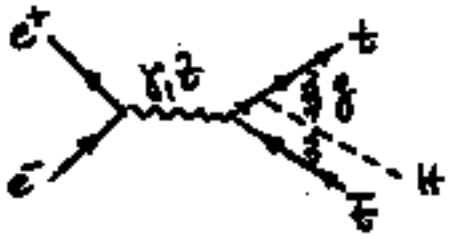
$+ \dots$

Djouadi, Kalinowski, Zerwas

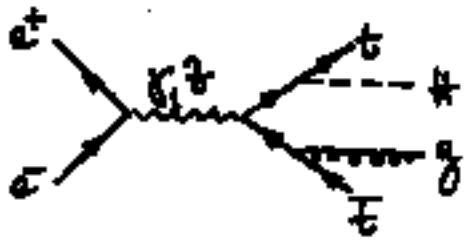
$\sigma \sim (1-10)\,\mathrm{fb}$ $\longrightarrow$ top Yukawa coupling

Dawson, Reina

- NLO:



$+ \dots$



$+ \dots$

$\Longrightarrow$ theoretical improvement

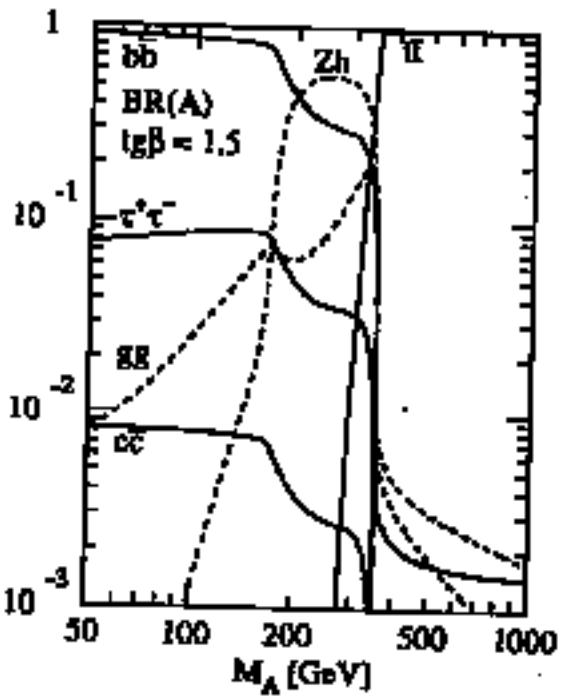
$\longrightarrow$ check of EHA

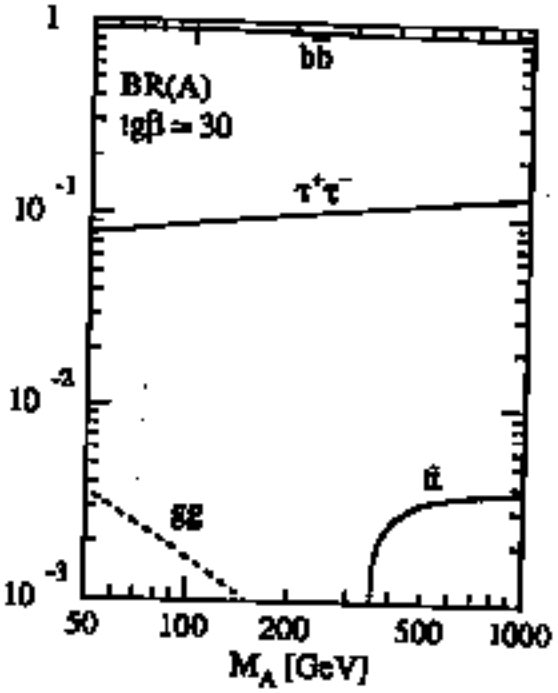
Dawson, Reina

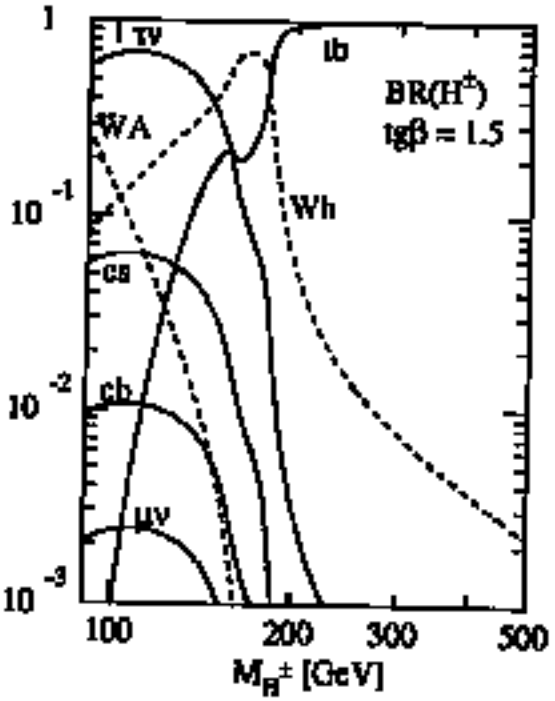
$$\sigma(e^+e^- \to t\bar{t}H) = \sigma(e^+e^- \to t\bar{t}) \otimes \left[f_{H/t} + f_{H/\bar{t}} \right]$$

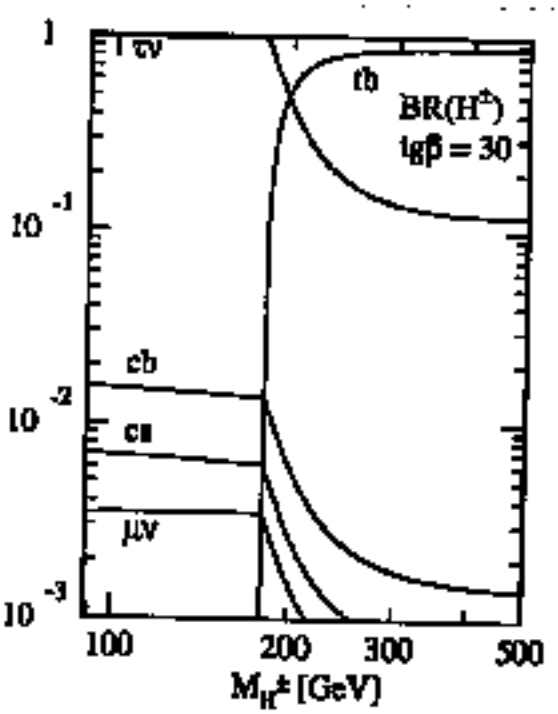
$[\text{for } M_H \ll m_t]$

HDECAY


bb
BR(A)
tgβ = 1.5
Zh
tt
τ⁺τ⁻
gg
cc
M_A [GeV]


bb
BR(A)
tgβ = 30
τ⁺τ⁻
tt
gg
M_A [GeV]


τν
tb
BR(H⁺)
tgβ = 1.5
WA
Wh
cs
cb
μν
M_H± [GeV]


τν
tb
BR(H⁺)
tgβ = 30
cb
cs
μν
M_H± [GeV]

HDECAY - a program for Higgs boson Γ_i and BR's in SM and MSSM

A. Djouadi, M. Spira, J. Kalinowski
Comp. Phys. Com. '98

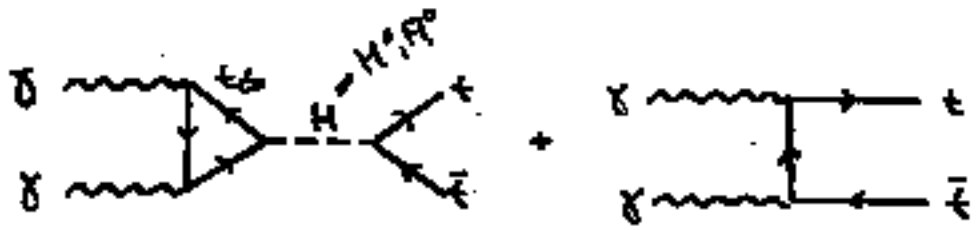
- state of the art (May 97)
- decay channels with BR $> 10^{-4}$ (2- and 3-body decays)
- all H.O. corrections included
- input: SM and low-energy MSSM

improvements / modifications:

- simplify the code (for 2-body decays)
- include new decay modes ($H \to hZ$, graviton
- include new H.O. corrections (SUSY-QCD)
- interface for SUGRA GUT input
- interface for gauge-mediated SUSY
- 2HDM option (no SUSY)
  (Higgs boson can still be relatively light!)
- NMSM option

$\gamma\gamma \to t\bar{t}$

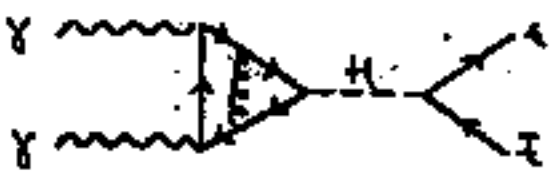
M. Krämer, M. Spira, P.M. Zerwas

- LO: 

➡ interference ?

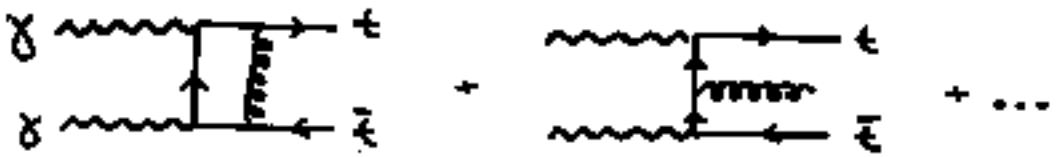
[LHC: destructive interference]

→ stable in NLO ?

- NLO 

→ ~ + (20-30)%

+ ... → ~ + 20%



→ ~ + 30%

➡ interference ?

$e\gamma \to eH$

E. Gabrielli
V.A. Ilyin
B. Mele

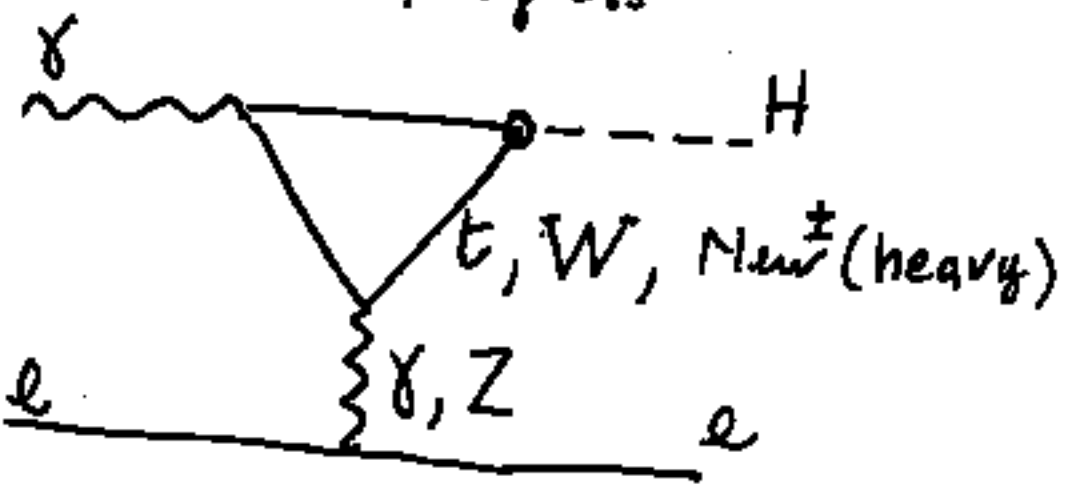
SM + Anomalous $\gamma\gamma H$, $\gamma Z H$ coupl

↑ done

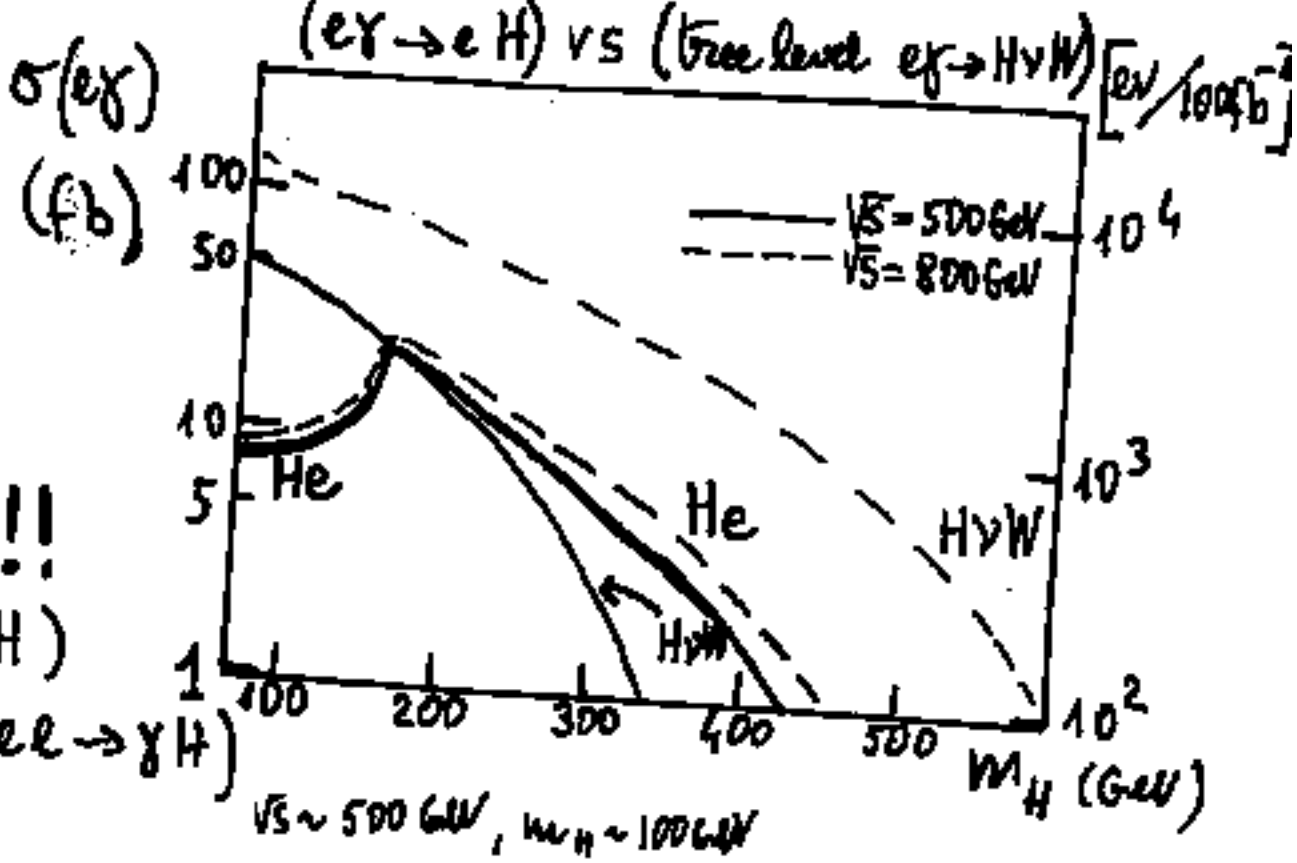
↑ in progress

SM:

one-loop process



- Competitive with $\gamma\gamma \to H$ for testing $\gamma\gamma H$!
- Can also test $\gamma Z H$!!! (tag the final e^- at large angle)



NOTE !!!

$\sigma(e\gamma \to eH) > 10^2\, \sigma(ee \to \gamma H)$

σ's, Kinematical distr's, backgrounds, detection strategies studied in the SM (intermediate m_H) (see DESY 97-123E also Phys. Rev. D?

NOW:

$e\gamma \to eH$ and anomalous $\gamma\gamma H$ and γZH coupl

---

"Model indipendent" approach:
add to $\mathcal{L}_{SM}$ dim = 6, $SU(2) \times U(1)$ invariant operator

$$\mathcal{L}^{eff} \simeq d \cdot O_{WW} + d_B \cdot O_{WB} \; (+ \text{CP-odd})$$

↳ tree-level $\gamma\gamma H$ and γZH couplings

$$\begin{cases} O_{WW} = \frac{1}{v^2}\left(|\phi|^2 - \frac{v^2}{2}\right) W^{i\mu\nu} W^i_{\mu\nu} \\ O_{WB} = \frac{1}{v^2}\left(|\phi|^2 - \frac{v^2}{2}\right) B^{\mu\nu} B_{\mu\nu} \end{cases}$$

$v \simeq 250$ GeV

$$(d, d_B) \to (d_{\gamma\gamma H}, d_{\gamma ZH})$$

example: $\sqrt{s} = 500$ GeV $\quad m_t = 120$ GeV

$$-0.0025 < d_{\gamma ZH} < 0.004 \qquad (95\%\ CL)$$

If $d_{\gamma ZH}$ given by New Particles in the loop:

$$d_{\gamma ZH} \sim \left(\frac{v}{M_{New}}\right)^2 \Rightarrow M_{New} > 6.2 \text{ TeV}$$

$(100\ fb^{-1})$