V. Telnov

22. 9. 2000

Higgs section.

Higgs at photon Colliders (what to TDR)

INTERNATIONAL WORKSHOP ON HIGH ENERGY PHOTON COLLIDERS

SCIENTIFIC PROGRAM

WEDNESDAY, June 14

PLENARY SESSION (meet.room 4, building 1b)

9:30	Welcome	director, chairmen
9:45	Photon Colliders: Introduction	Tohru Takahashi
10:15	Standard Model, Higgs, SUSY at Phot.Coll.	Kaoru Hagiwara
10:55	COFFEE	
11:15	Top quarks at Photon Colliders	Edward Boos
11:40	QCD at Photon Colliders	Jan Kwiecinski
12:10	Other theories beyond the SM	Thomas Rizzo
12:45	LUNCH	
14:00	Photon collider at TESLA	Valery Telnov
14:40	Photon collider at NLC	Jeffrey Gronberg
15:20	Photon collider at JLC:accel. and IR issues	Tohru Takahashi
15:45	Multi-TeV CLIC photon collider option	Helmut Burkhardt
16:10	COFFEE	
16:30	TESLA-HERA based gamma-proton and gamma-nucleus colliders	Salech Sultansoy
16:55	Laser system for the TESLA photon collider	Ingo Will
17:30	Femtosecond Laser Technologies for LC designs	Katsuyuki Kobayashi
18:05	Free Electron Laser for Gamma-Gamma Collider at TESLA	Mikhail Yurkov
19:00	Welcome party (DESY Bistro)	

THURSDAY, June 15

9:00–	PHYSICS SESSION (meet.room 4a)	see prog. of session
9:00–	TECHNICAL SESSION (meet.room 4b) (14:00 - discussions on lasers and IR) (~ 16:20 - excursion to TTF)	see prog. of session

FRIDAY, June 16

9:00–	PHYSICS SESSION (meet.room 4a) 16:30 - "round table" on physics program	see prog. of session
9:00–	TECHNICAL SESSION (meet.room 4b) 14:00-16:00 discussion on accel. and IR) 16:30 - "round table" on physics program	see prog. of session
19:00	Conference dinner (DESY Bistro)	

SATURDAY, June 17

SUMMARY PLENARY SESSION (meet. room 4)

9:00	New parameters of photon collider at TESLA	Valery Telnov
9:10	SM, Higgs, SUSY	Isamu Watanabe
9:45	top	Edward Boos
10:00	QCD	Jan Kwicienski
10:20	Beyond SM	Tom Rizzo
10:45	Gold-plated processes for photon colliders	George Jikia + 10
11:10	COFFEE	
11:30	Lasers/IR	Sigi Schreiber
11:55	Accelerators	Nick Walker
12:20	Concluding remarks, the end	chairmen
12:45	LUNCH	
14:15	Meeting (all invited): Intern. collab. on photon colliders, plans of works towards TDR's	

INTERNATIONAL WORKSHOP ON HIGH ENERGY PHOTON COLLIDERS

PROGRAM, PHYSICS SESSION

THURSDAY, June 15,
meeting room 4a, building 1b

H plen.

Standard model, Higgs, SUSY

9:00	Why Photon Colliders are necessary	Ilya Ginzburg
9:35	Precision Higgs Physics at a gamma-gamma Collider	Michael Melles
10:00	Higgs production at the Compton Collider	Stefan Soldner-Rembold
10:25	The production of MSSM Higgs bosons in gamma-gamma collisions	Margarete Muehlleitner
10:50	Possibilities to distinguish between MSSM and NMSSM in electron-gamma scattering processes gamma-gamma collisions	Claus Bloechinger
11:15	COFFEE	
11:35	On the distinguishing Higgs boson at Photon Collider	Maria Krawczyk
12:00	Heavy quark pair production background to the Higgs signal in linearly polarized photon-photon collisions	George Jikia
12:20	Sfermion production in gamma-gamma collisions	Michael Klasen

W SUSY plen.

12:40	LUNCH	
14:00	Chargino production in photon-photon collisions	Tobias Mayer
14:25	Stoponium search on linear collider in e^+e^- and gamma-gamma modes	Slava Ilyin
14:50	Production of neutral boson pairs in a gamma-gamma collider	Georgios Gounaris
15:15	Gamma-gamma to WW	Rezo Shanidze
15:40	Double logarithms in Electroweak Model	Victor Fadin
16:00	COFFEE	
16:20	Progress towards a gamma-gamma to 4 leptons Monte Carlo	Wilfrid da Silva
16:40	Thoughts on tau Physics at the Linear Collider	Sekazi Mtingwa

Top plenary

Top physics

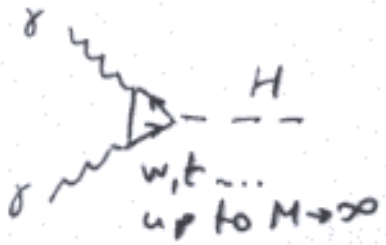
17:00	Probing Top Quark Dipole Couplings at Photon Colliders using CP-violating Asymmetries	Poulose Poulose
17:25	Top quark threshold production in $\gamma\gamma$ collision: current issues	Alexander Penin

V. Telnov

Higgs at Photon colliders

1. $\gamma\gamma \to h \to b\bar{b}$, WW, ZZ, cc, $\gamma\gamma$ — $\Gamma_{\gamma\gamma}(H)$! → distinguish models, heavy part. of branchings ($N_H \gg N_H$ even $Br(H\to\gamma\gamma) \to \Gamma_H$) — e^+e^-
2. $\gamma\gamma \to H, A \to t\bar{t}$, $b\bar{b}$ — $\Gamma_{\gamma\gamma}$, larger than e^+e^- accessible masses. CP, linear polar. coves regions of par. not covered by LHC, e^+e^-
3. $\gamma e \to eH$ — $\Gamma_{\gamma Z}(H)$
4. $\gamma\gamma \to H^+H^-$ — all H properties. $\sigma_{\gamma\gamma\to H^+H^-} \sim 10\,\sigma_{e^+e^-\to H^+H^-}$ sharp threshold.

SM Higgs production in $\gamma\gamma$ and e^+e^- coll.



$\Gamma_{H\to\gamma\gamma}$ is very sensitive to each new W', L', ℓ'

V. Telnov
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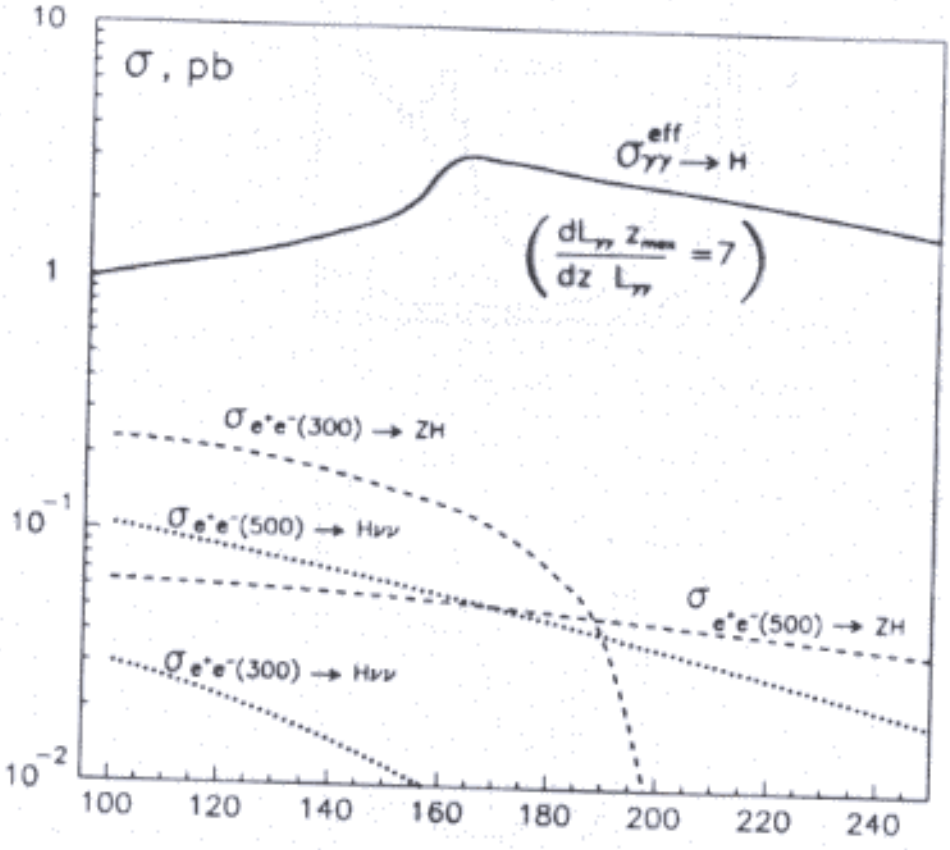
13 (1998) 2399

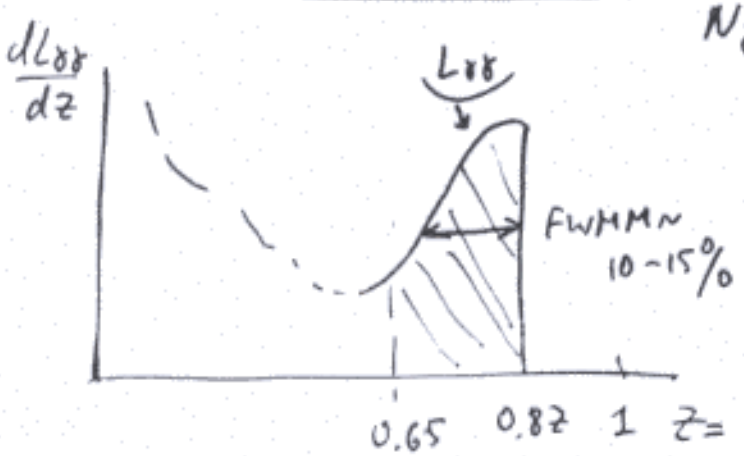


$$\frac{\sigma^{eff}_{\gamma\gamma\to H}}{\sigma_{e^+e^-\to HZ}} \approx \approx 6-40 \text{ !!!}$$

for M_H = 120 – 250

Definition of $\sigma^{eff}_{\gamma\gamma\to H}$ (for $\Gamma_H \ll \Delta W_{\gamma\gamma}$)

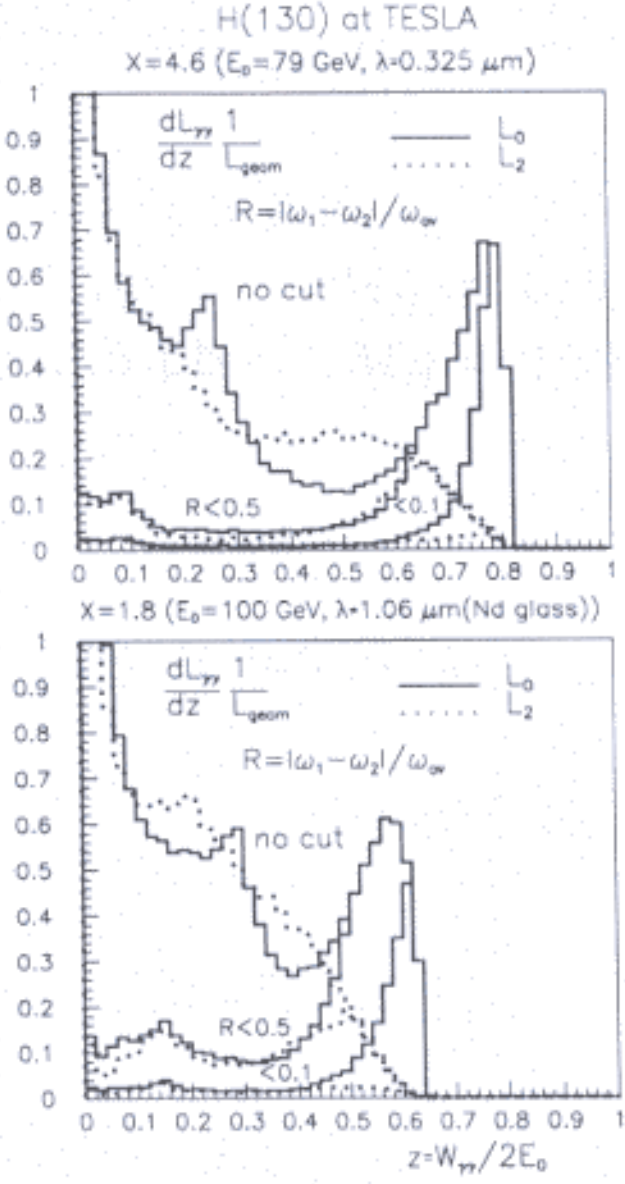
$$N_{\gamma\gamma\to H} = \frac{dL}{dW}\frac{4\pi^2\Gamma_{\gamma\gamma}}{M_H^2} = \sigma^{eff}\cdot L$$



$$\Rightarrow \sigma^{eff}_{\gamma\gamma\to H} = \frac{dL}{dz}\frac{z_m}{L}\cdot\frac{4\pi\Gamma_{\gamma\gamma\to H}}{M_H^3}$$

$$\frac{dL}{dz}\frac{z_m}{L} \sim 7$$

γγ luminosity spectra for H(130)



X = 4.6, E_e = 79 GeV
(λ = 0.325 μm)

X = 1.8, E_e = 100 GeV
(λ = 1 μm)

Higgs factory

$\gamma\gamma$ ($L_{eff} \equiv L_{\gamma\gamma}(z > 0.8 z_m)$)

$\sigma_{\gamma\gamma \to H} \sim$ 1.3 pb $\quad M_H = 130$ GeV

$\sigma_{\gamma\gamma \to H} \sim$ 3–2.5 pb $\quad M_H = 160 - 200$ GeV

e^+e^-

$\sigma_{\gamma\gamma \to HZ} \sim$ 0.06–0.045 pb $M_H = 130 - 200$ GeV

This gives

$$\frac{\sigma_{\gamma\gamma \to H}}{\sigma_{e^+e^- \to ZH}} \sim 20\text{–}60$$

But $\quad L_{\gamma\gamma} \sim 0.15\text{–}0.5\ L_{e^+e^-}$

As result

$N(\gamma\gamma \to H) \sim (3-10) \div (9-30)\ N(e^+e^- \to HZ)$

Additional increase of $L_{\gamma\gamma}$ (as long term perspective) can be achieved using a laser cooling

(× 5)

$\gamma\gamma$,γe collider for Higgs(130) based on TESLA.

	$\lambda = 1.06\mu m$	$\lambda = 1.06/3$
	T(2x100)	T(2x79)
	x=1.8	x=4.6
$N/10^{10}$	2	2
σ_z, mm	0.3	0.3
$f_{rep} \times n_b$, kHz	14.1	14.1
$\gamma\epsilon_{x,y}/10^{-6}$,m·rad	2.5/0.03	2.5/0.03
$\beta_{x,y}$,mm at IP	? 1/0.3	? 1/0.3
$\sigma_{x,y}$,nm	110/6.8	139/7.6
b, mm	1.3	1.2
$L(geom)$, 10^{33}	58.5	46.3
$L_{\gamma\gamma}(z > 0.8z_m), 10^{33}$	4.3	4.25
$L_{\gamma e}(z > 0.8z_m), 10^{33}$	4.4	3.4

For $H(130) \to L_{\gamma\gamma}(z > 0.8z_m) \sim \underline{0.15}\, L_{e^+e^-}(500)$ without special measures

Reserves:

x 2 (rep.rate, in a damping ring $\tau_{e^-} \sim 0.5\tau_{e^+}$)

x ~ 1.5 ($\sigma_c(x = 1.8) = 1.7\sigma_c(x = 4.6)$)

total: ~ 3

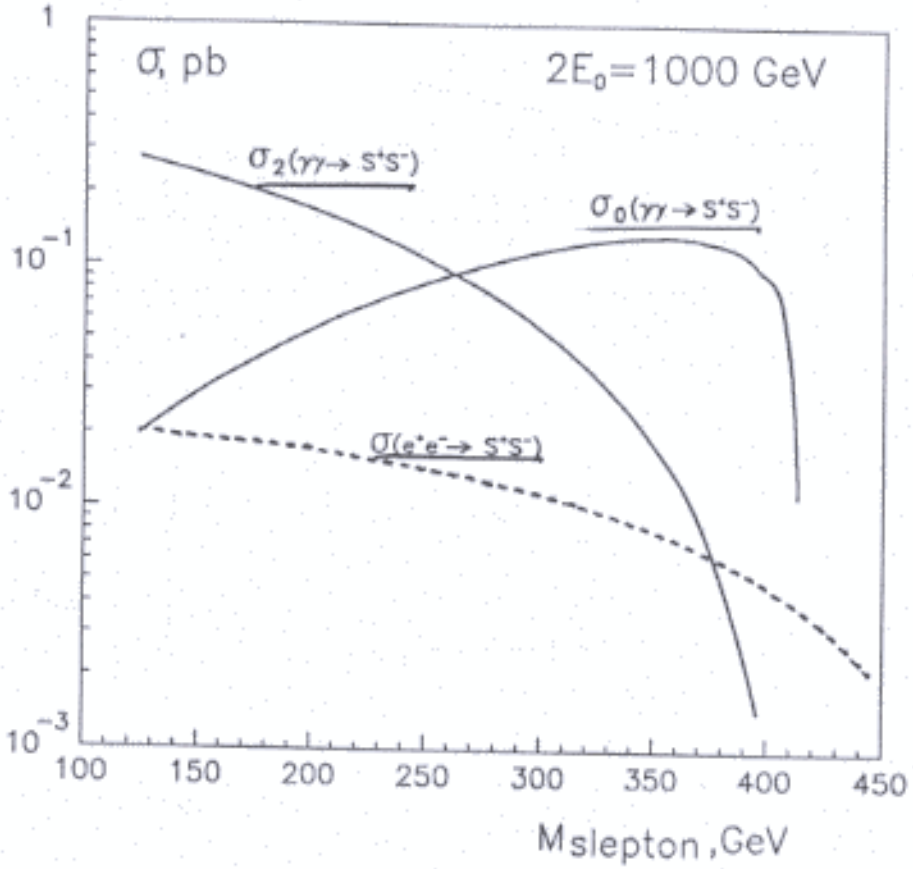
If beam loading is opimized than "total" ~ 4

So, idealy

$L_{\gamma\gamma}(z > 0.8z_m) \approx$ const $\sim 1.5 \times 10^{34} \sim 0.5 L_{e^+e^-}$

(P_{RF} = const)

Production of charged scalar pairs in e^+e^- and polarized $\gamma\gamma$ collisions



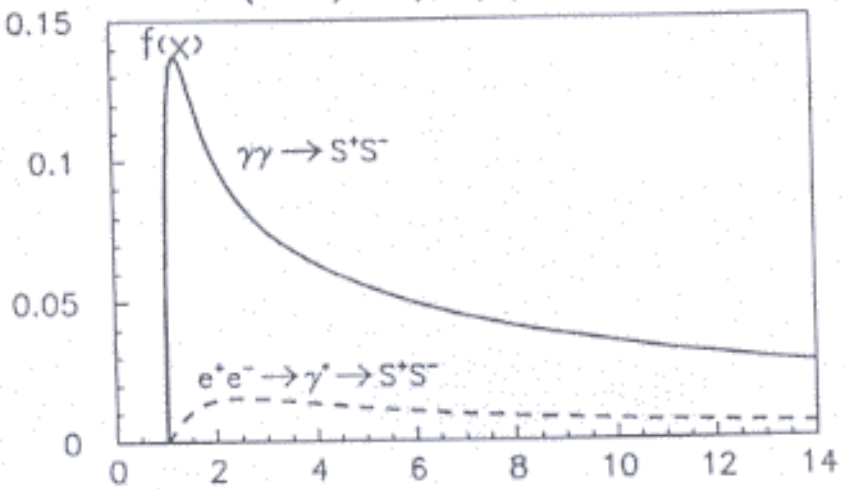
For heavy particles $\sigma_{\gamma\gamma} \sim 15\text{-}20\, \sigma_{e^+e^-}$

(Note: $\sigma_{e^+e^-\to SS}$ is valid for all sleptons, except selectron)

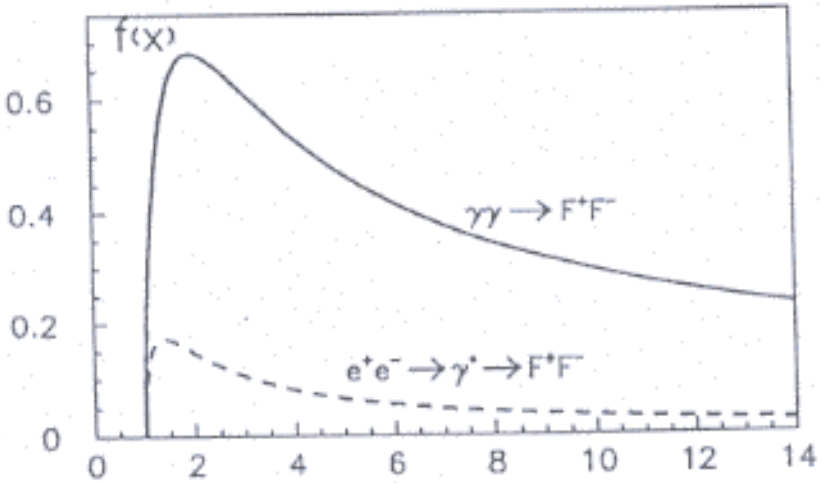
Charged particle production in $\gamma\gamma$ and e^+e^- collisions

unpolirized beams

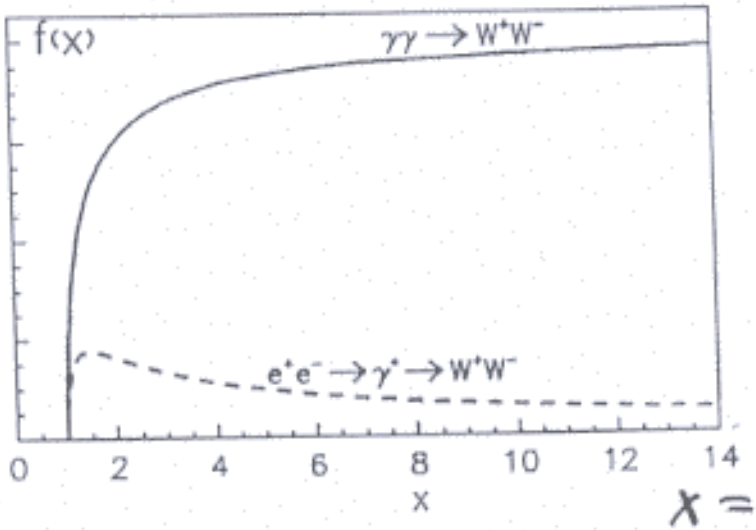
$\sigma = (\pi\alpha^2/M^2)\, f(x),\ x = W^2/4M^2$



scalars

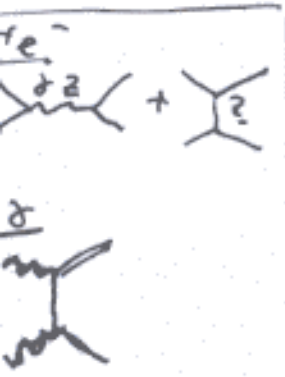


leptons



W-bosons

$x = \frac{W_{\gamma\gamma}^2}{4M^2}$



QED
direct meas. of charge.

$\sigma_{\gamma\gamma} \sim 5 \div 20\ \sigma_{e^+e^-}$