W' limits from $e\gamma \to \nu q + X$

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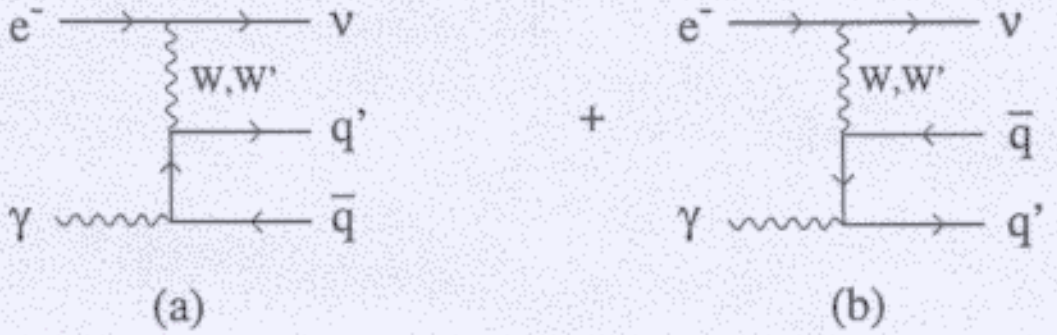
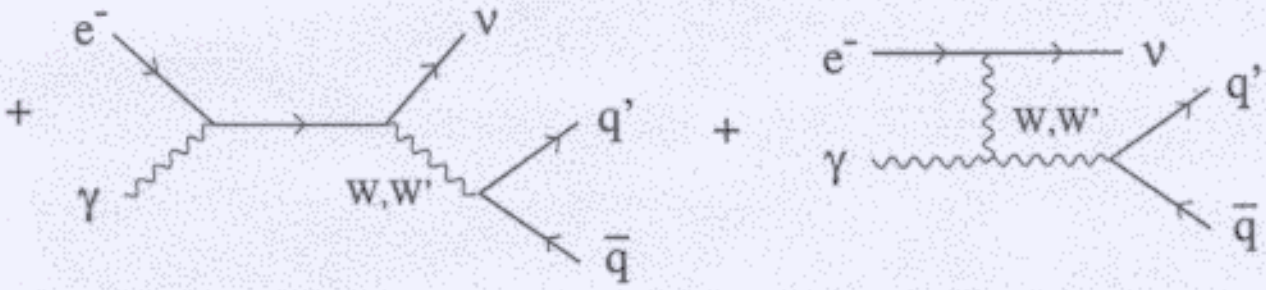
Based on: M.A. Doncheski, S. Godfrey, P. Kalyniak, B. Kamal, A. L., hep-ph/0008157, subm. to PRD.

1. The study
2. Comparison with $e^+e^- \to \nu\bar{\nu}\gamma$ and LHC
3. Conclusions

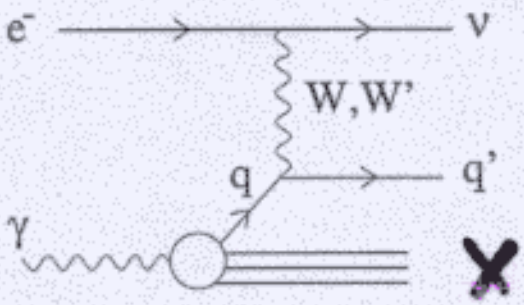
1. The study



(a) (b)



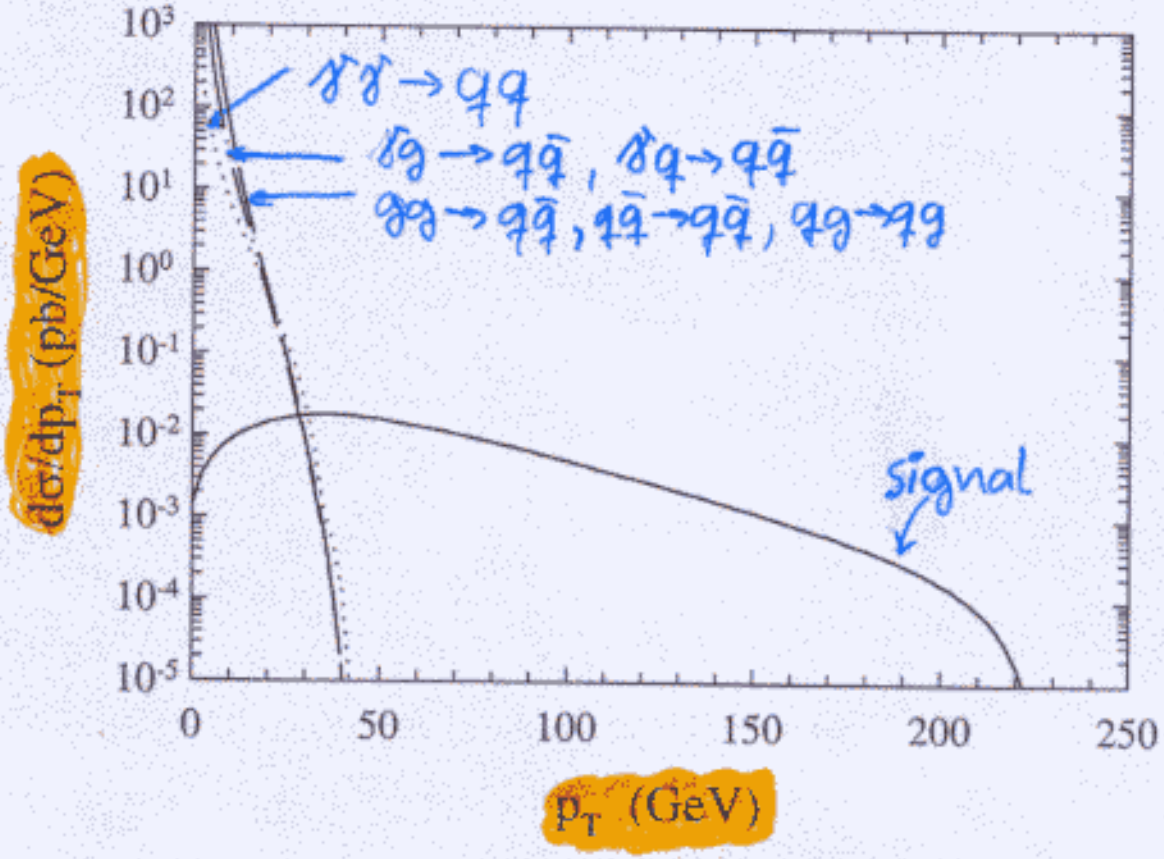
(c) (d)



$$\sigma = \int dx \int dy f_{\gamma/e}(x, \sqrt{s}/2) f_{q/\gamma}(y, Q^2) \hat{\sigma}(eq \to \nu q'), \tag{1}$$

$$\hat{\sigma}(e^- q \to \nu q') = \frac{\pi\alpha^2}{4\sin^4\theta_w} \int d\hat{t} \frac{1}{(\hat{t} - M_W^2)^2} \left\{ 1 + 2C_L^q C_L^l \left(\frac{\hat{t} - M_W^2}{\hat{t} - M_{W'}^2} \right) + \frac{1}{2} \left(\frac{\hat{t} - M_W^2}{\hat{t} - M_{W'}^2} \right)^2 \left[(C_L^{q\,2} + C_R^{q\,2})(C_L^{l\,2} + C_R^{l\,2})(1 + \hat{u}^2/\hat{s}^2) + (C_L^{q\,2} - C_R^{q\,2})(C_L^{l\,2} - C_R^{l\,2})(1 - \hat{u}^2/\hat{s}^2) \right] \right\} \tag{2}$$

- Analysis for
  - Weizsäcker Williams (WW) photons
  - backscattered laser photons
- Cuts:
  - $10° \leq \Theta_q \leq 170°$ (detector acceptance)
  - $p_{T_q} > \begin{cases} 40\,\text{GeV} & \text{for } \sqrt{s} = 0.5\,\text{TeV} \\ 75\,\text{GeV} & \text{for } \sqrt{s} = 1.0\,\text{TeV} \end{cases}$
    (SM background)



2. Comparison with $e^+e^- \to \nu\bar{\nu}\gamma$ and LHC

	$\sqrt{s} = 0.5\,TeV$, $L_{int} = 1000\,fb^{-1}$				$\sqrt{s} = 1\,TeV$, $L_{int} = 1000\,fb^{-1}$			
	$e^+e^- \to \nu\bar{\nu}\gamma$		$e\gamma \to \nu q + X$		$e^+e^- \to \nu\bar{\nu}\gamma$		$e\gamma \to \nu q + X$	
Model	no syst.	syst.	no syst	syst.	no syst.	syst.	no syst.	syst.
SSM W'	5.1	1.7	4.8	2.7	6.3	2.2	6.9	4.6
LRM	1.3	0.9	0.8	0.6	1.8	1.2	1.3	1.1
KK	5.5	1.8	6.8	3.8	6.9	2.3	9.8	6.5

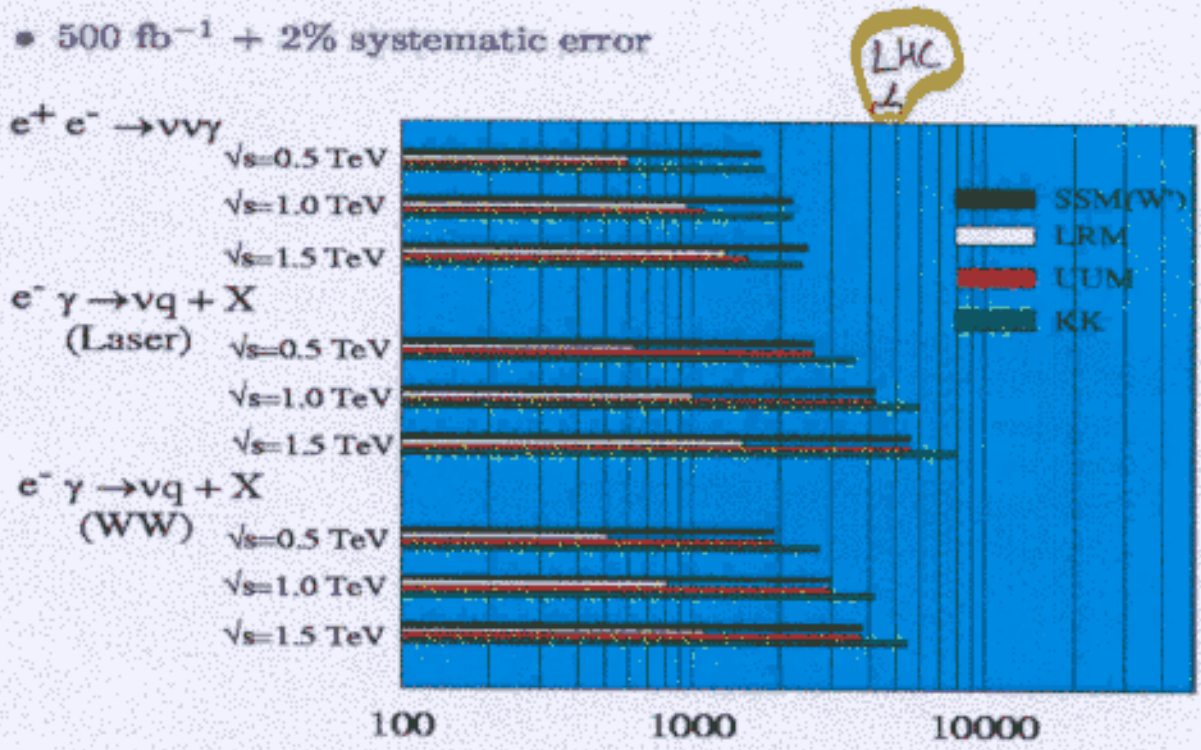
W' discovery Limits 95% CL in TeV

- syst: 2% systematic error included
- polarized beams do not improve W' Limits from $e\gamma \to \nu q + X$
- only backscattered laser photons make LC W' Limits comparable to LHC

S. Godfrey, talk at the Ohio State Univ. Aug. 2000

Discovery Limits

- Divide p_{T_e} into 10 bins
- 500 fb^{-1} + 2% systematic error



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- W' coupling measurement in $e^+e^- \to \nu\bar{\nu}\gamma$

S. Godfrey, P. Kalyniak, B. Kamal, A. Leike, PRD61 (2000) 113009

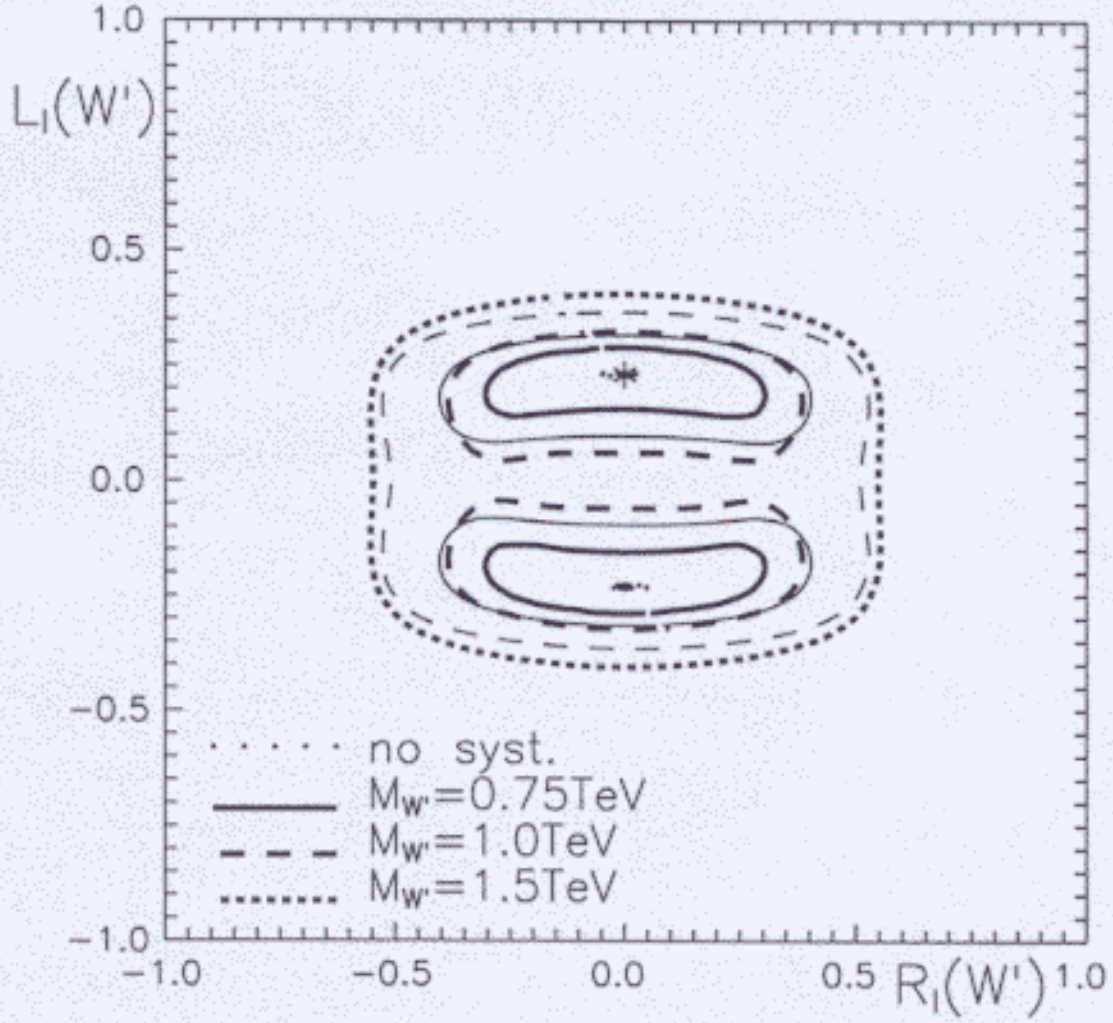

Figure 1: 95% C.L. constraints on W' couplings for $\sqrt{s} = 0.5\,TeV$ (thin lines) and $\sqrt{s} = 1.0$ TeV (thick lines) and $L_{int} = 1000\,fb^{-1}$ with a systematic error for different W' masses. No systematic error is included for the dots. The couplings of the SSM W' are indicated by a star.

- W' coupling measurement in $e\gamma \to \nu q + X$

M. Donchesky, S. Godfrey, P. Kalyniak, B. Kamal, A. L., hep-ph/0008157

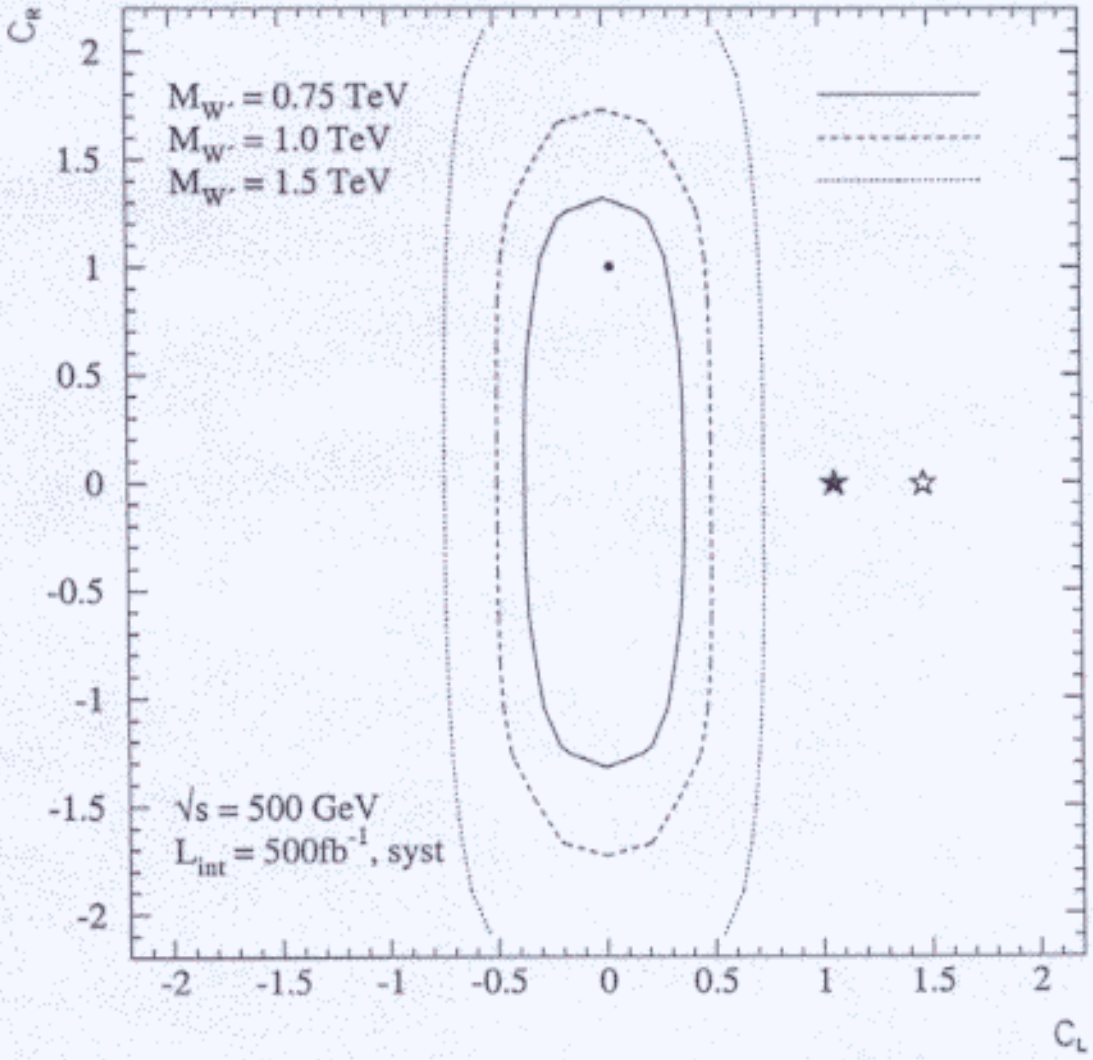

Figure 2: 95% C.L. constraints on W' couplings for $\sqrt{s} = 0.5\,TeV$ and $L_{int} = 500\,fb^{-1}$ with a 2% systematic error for different W' masses. The couplings corresponding to the SSM, LRM and the KK model are inidcated by a full star, a dot and an open star, respectively.

3 Conclusions

Backscattered Laser photons are very important for a W' search at the LC.

Systematic errors largely dominate the W' measurements

The LC can compete with the LHC in a W' search