

# Parity violation in top pair production via SUSY

SI 2013 @ Korea

Kunio Kaneta

(Kavli IPMU)

Collaborators: N. Haba (Shimane U.), S. Tsuno (KEK), Y. Takayasu (Hokkaido U.)

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# Outline

1, Motivation

2, Parity violation in top pair production @ LHC

3, Result (preliminary)

# I, Motivation

We have expected that SUSY can be observed soon @ LHC

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Really nothing?

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Really nothing?

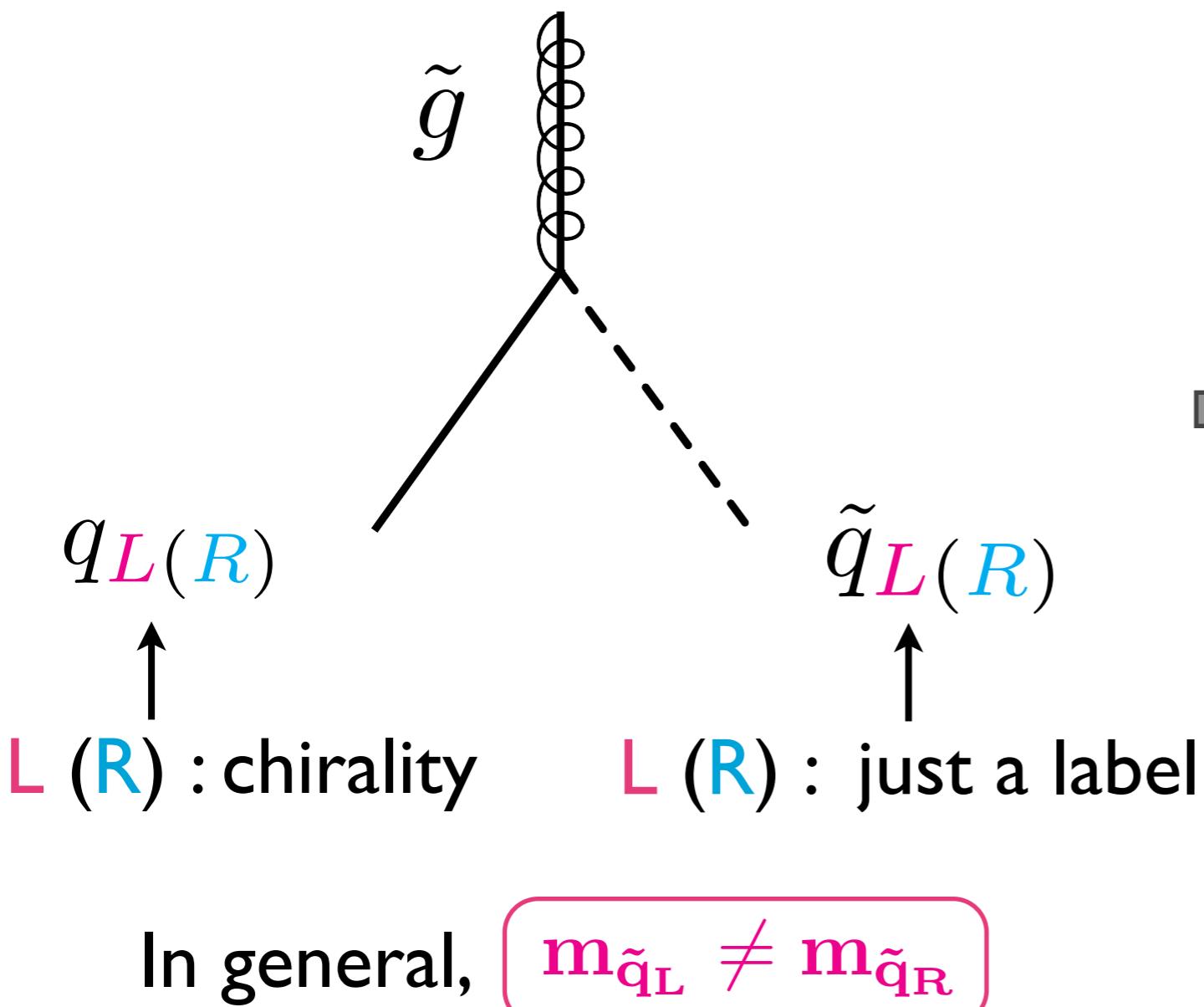
**Motivation:** “*Indirect search*” may tell us some indications.

a hint

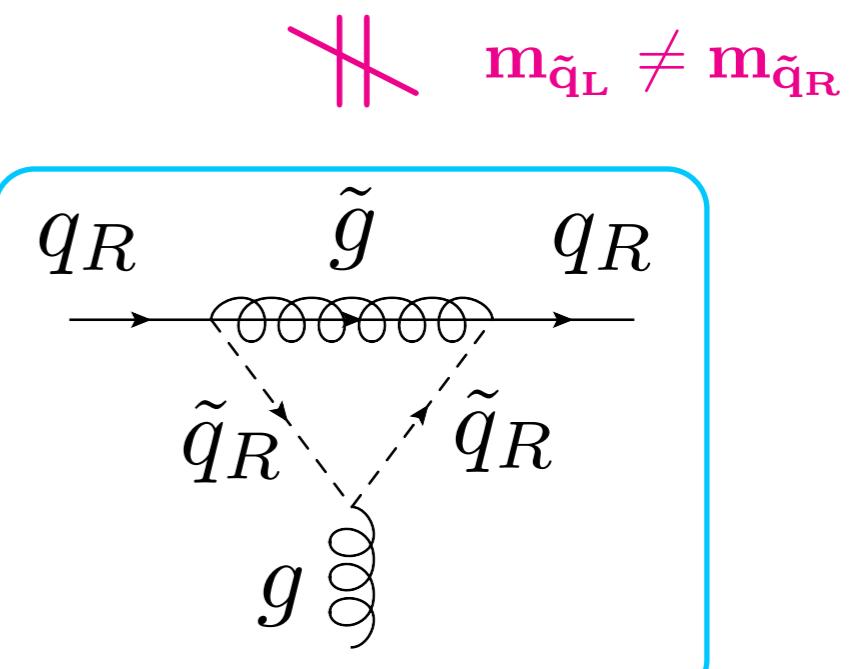
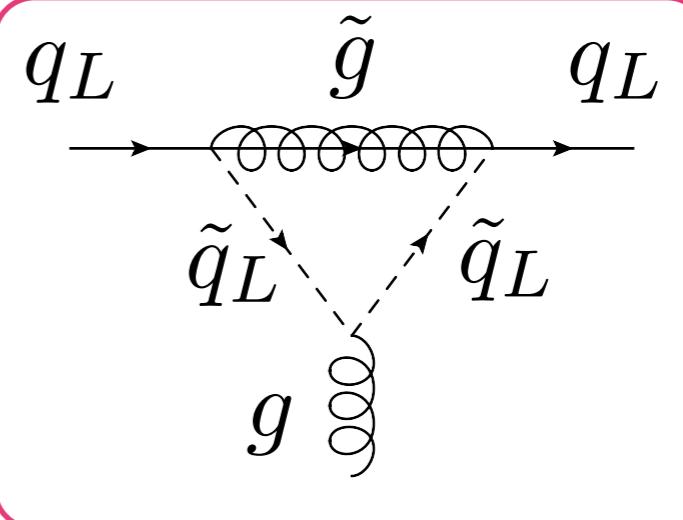
If SUSY exists,

parity can be violated even in QCD process

parity can be violated in QCD process via SUSY



ex)



How can we see the parity violation (PV)?

2, PV in top pair production @ LHC

N. Haba, KK, S. Matsumoto, T. Nabeshima, S. Tsuno,  
PhysRevD.85.014007

## Parity Violation @ **LHC**

$$\sigma(pp \rightarrow t_L \bar{t}_L) \neq \sigma(pp \rightarrow t_R \bar{t}_R)$$

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☆ Why top quark ?

top quark: heaviest particle in SM particles

life time

$$\tau \sim 10^{-24} \text{ s}$$

hadronizatin time

$$\tau \sim \Lambda_{\text{QCD}}^{-1} \sim 10^{-23} \text{ s}$$

top quark decays before forming a hadron

||

We can measure helicity only for top quark

## Parity Violation @ **LHC**

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How can we measure?



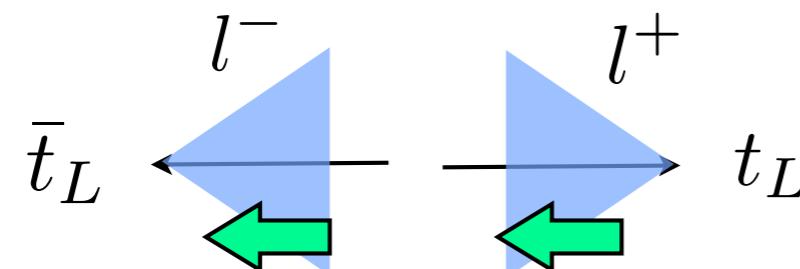
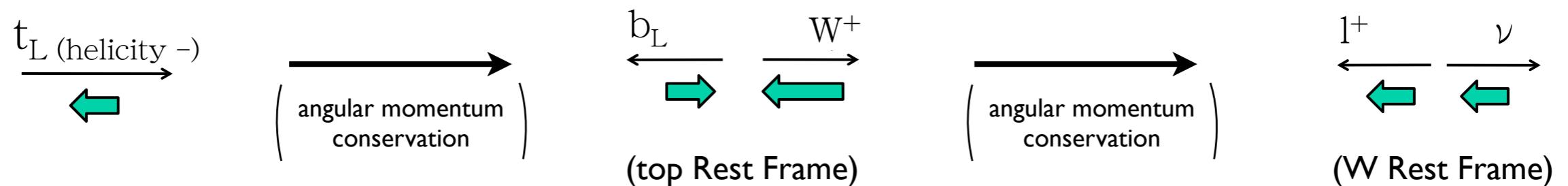
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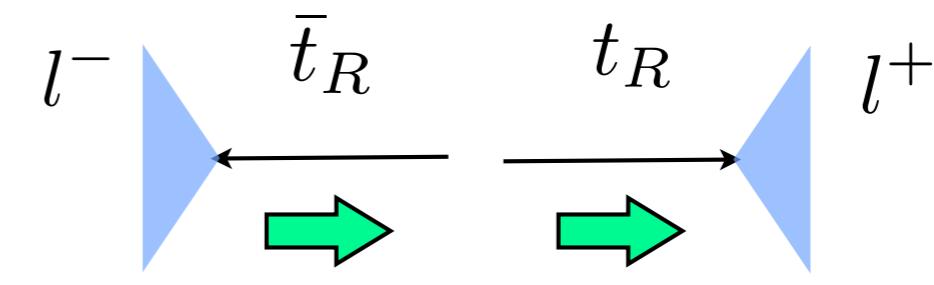
How can we measure?

*top quark helicity; measured by  $W^\pm$  polarization*

ex)



(c.m.s)

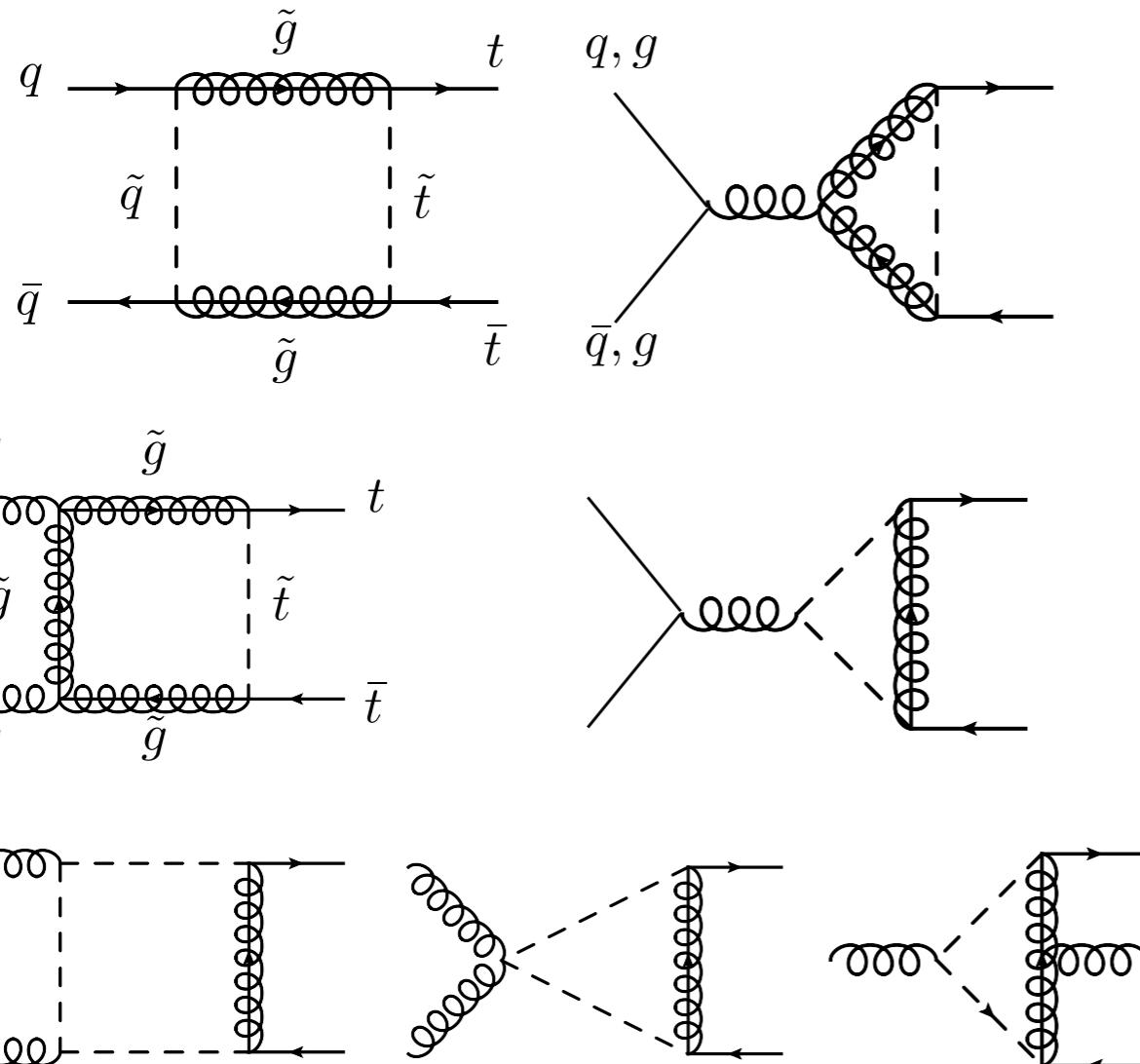


(c.m.s)

Parity Violation @ **LHC**

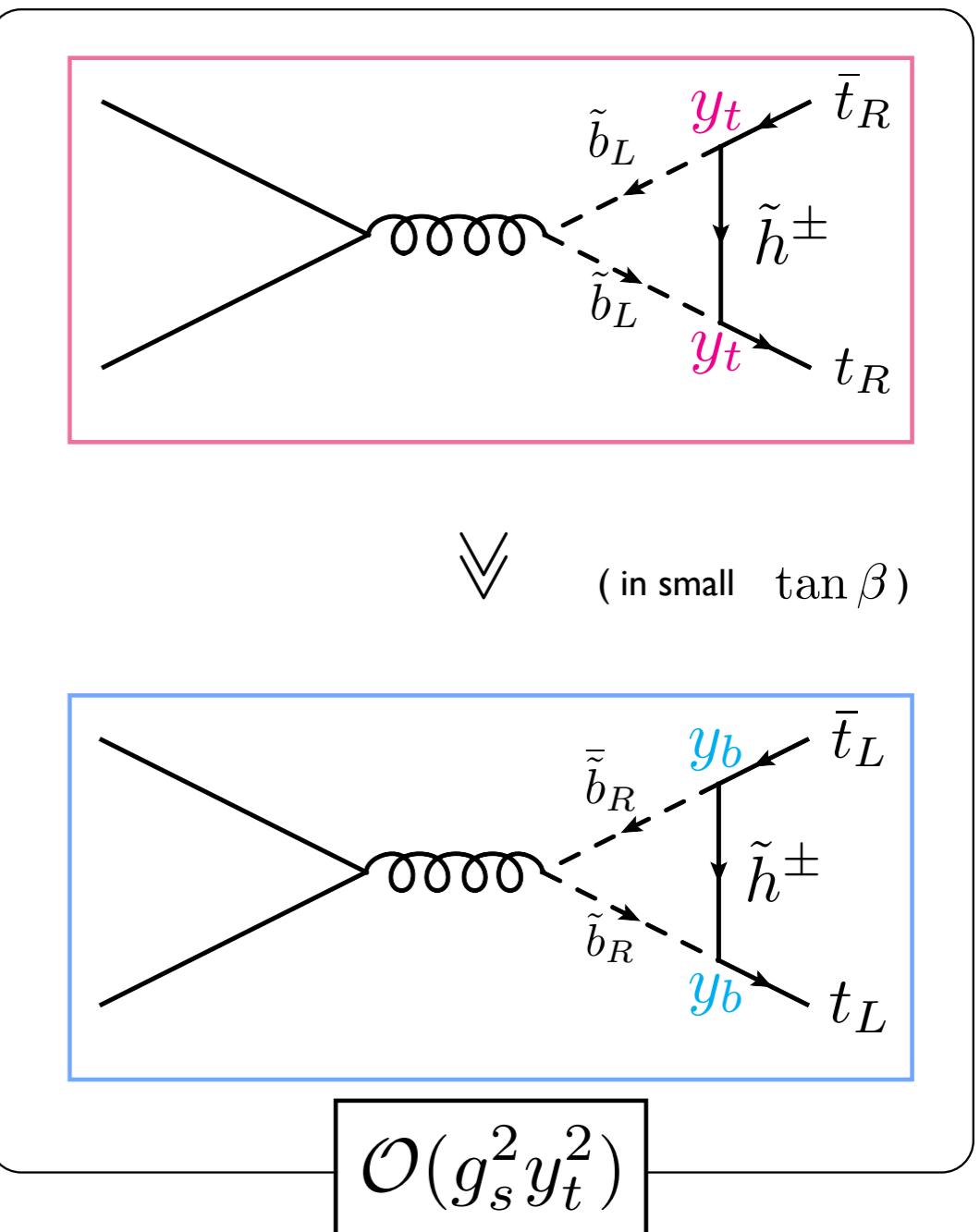
$$\sigma(pp \rightarrow t_L \bar{t}_L) \neq \sigma(pp \rightarrow t_R \bar{t}_R)$$

SUSY contributions @ 1-loop



$$\mathcal{O}(g_s^4)$$

+



$$\mathcal{O}(g_s^2 y_t^2)$$

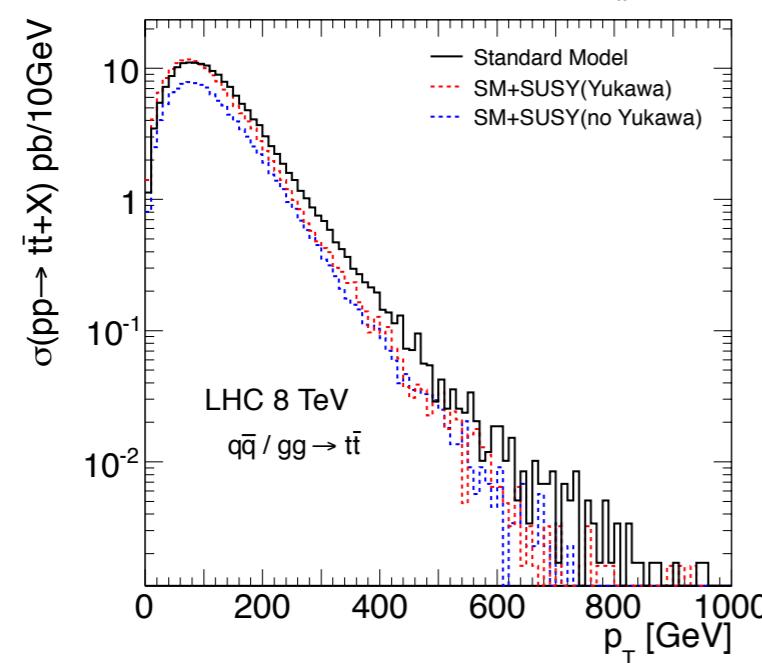
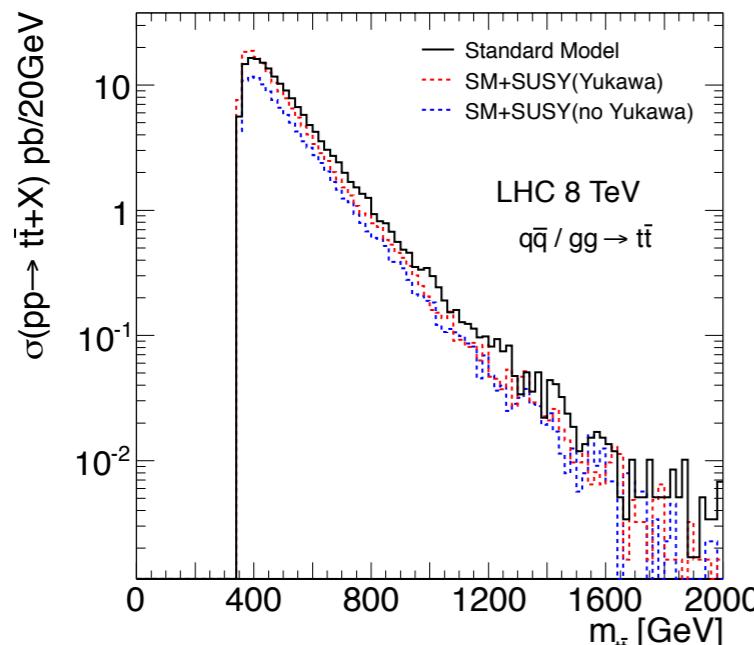
## 3, Results (preliminary)

chirality:  $t_{L,R} \longleftrightarrow$  helicity:  $t_{-,+}$

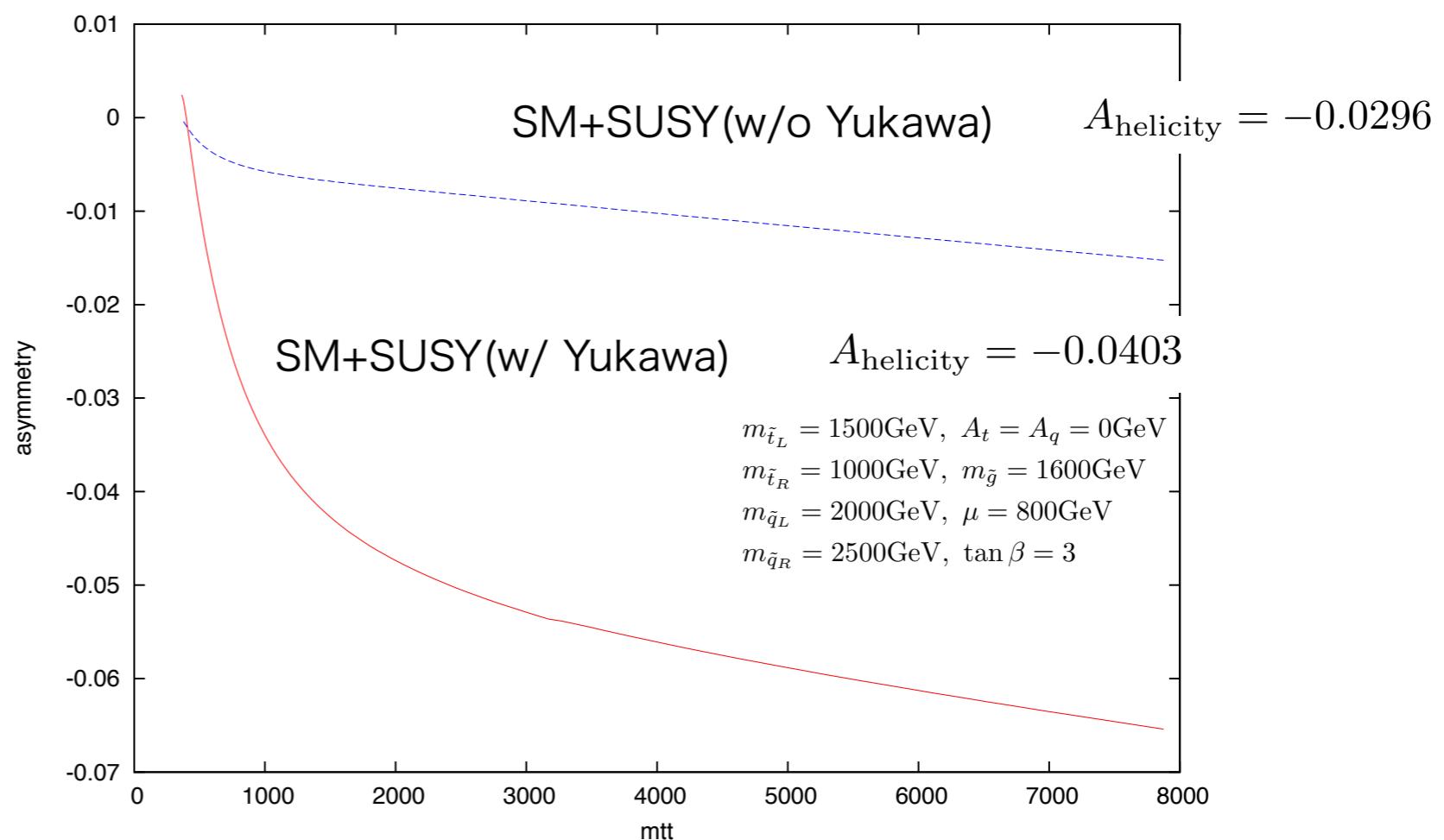
### def. of helicity asymmetry

$$A_{\text{helicity}} = \frac{(\sigma_{++} + \sigma{+-}) - (\sigma_{--} + \sigma_{-+})}{(\sigma_{++} + \sigma{+-}) + (\sigma_{--} + \sigma_{-+})}$$

$$\sigma \lambda_{\bar{t}} \lambda_t \quad \left\{ \begin{array}{l} \lambda_t : \text{top helicity} \\ \lambda_{\bar{t}} : \text{anti-top helicity} \end{array} \right.$$



(Preliminary)



*Thank you for your attention*