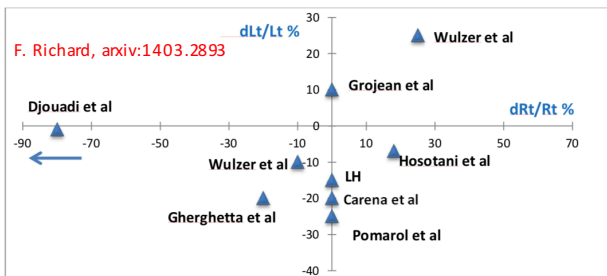
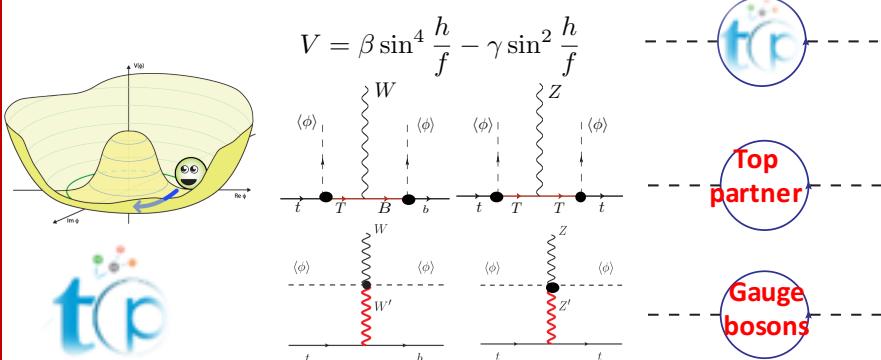


**Abstract:** We propose to utilize the polarization information of the Z bosons in ZZ production, via the gluon-gluon fusion process, to probe the Ztt gauge coupling. The contribution of longitudinally polarized Z bosons is sensitive to the axial-vector component of the Ztt coupling. We demonstrate that the angular distribution of the charged lepton from Z boson decays serves well for measuring the polarization of Z bosons and the determination of  $a_t$ . We show that ZZ production via the gluon fusion process complement to Ztt and tZj productions in measuring the Ztt coupling at hadron colliders.

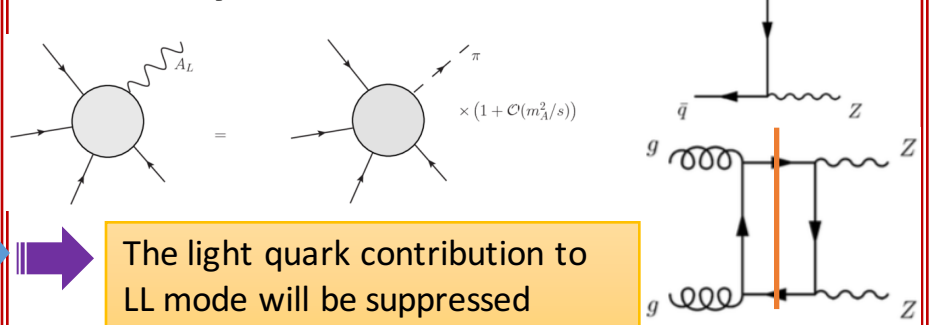
Qing-Hong Cao, Bin Yan, C.-P. Yuan and Ya Zhang, arxiv:2004.02031

### Motivation: top quark and EWSB

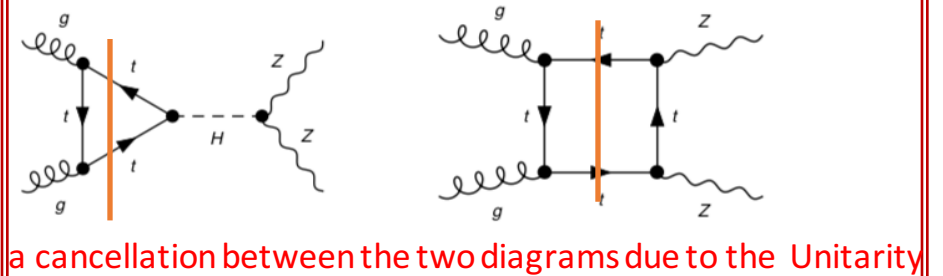


Distinguishing the vector and axial vector components of Ztt coupling => different NP models

### Goldstone equivalence theorem and Unitarity:

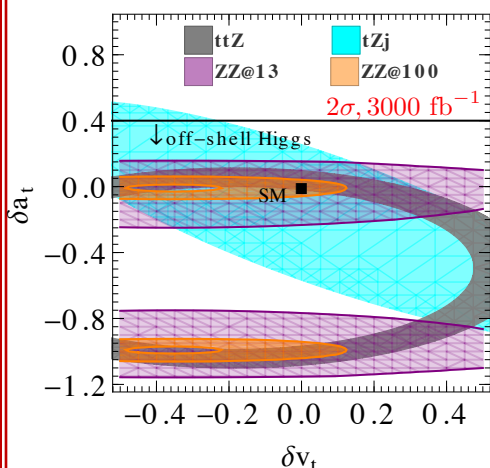
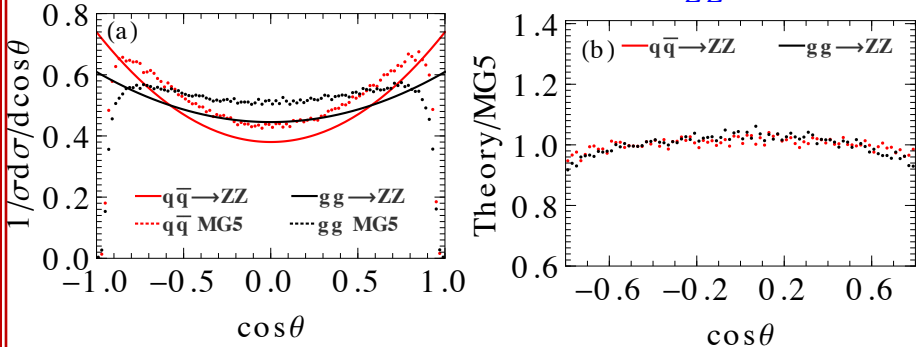


The light quark contribution to LL mode will be suppressed



### Collider Simulation and Results

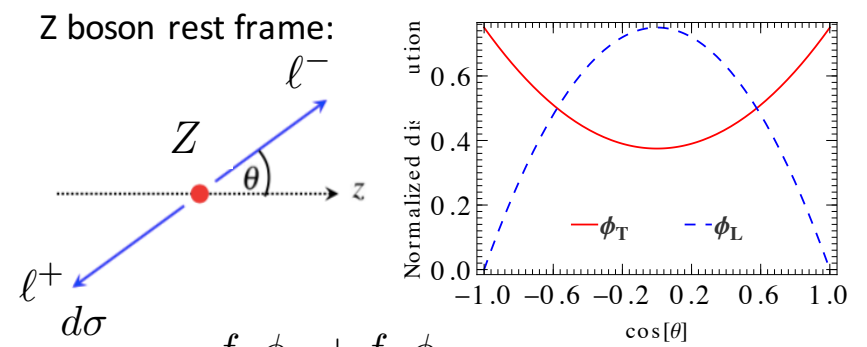
$|\eta| < 2.5, P_{T\ell} > 15 \text{ GeV}$  Effectively  $|\eta_Z| < 2.$   
 $80 < m_{\ell+\ell^-} < 100 \text{ GeV}$   
 $m_{4\ell} > 600 \text{ GeV}$   $m_{ZZ} > 600 \text{ GeV}$



A. ZZ polarization only sensitive to the axial-vector component of Ztt coupling;

B. ZZ production is complementary to the Ztt and Ztj productions in measurements of the Ztt coupling.

### Polarization of Z bosons in ZZ scattering



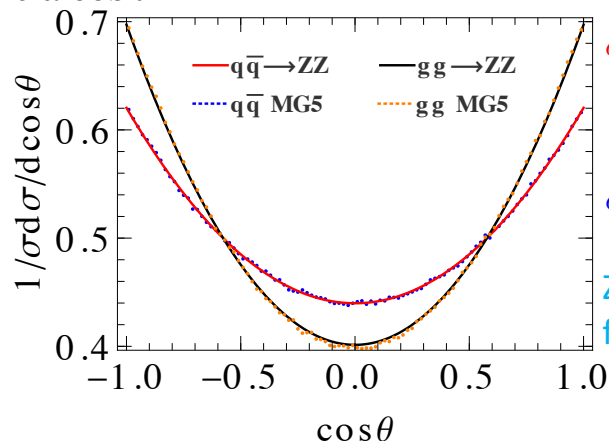
Transverse:

$$\phi_T = \frac{3}{8}(1 + \cos^2\theta)$$

Longitudinal:

$$\phi_L = \frac{3}{4}(1 - \cos^2\theta)$$

ZZ polarization fractions:  $f_{L,T}$



$$\mathcal{L} = \frac{g_W}{2c_W} \bar{q}(v_q - a_q \gamma_5) \gamma_\mu q$$