$$\frac{d\sigma}{dx\,dy\,d\psi} = \frac{2\alpha^2}{xyQ^2}\,\frac{y^2}{2\,(1-\varepsilon)}\,\Big\{F_T + \varepsilon F_L + S_\parallel \lambda_e\,\sqrt{1-\varepsilon^2}\,2x\,(g_1 - \gamma^2 g_2) - |\boldsymbol{S}_\perp|\lambda_e\,\sqrt{2\,\varepsilon(1-\varepsilon)}\,\cos\phi_S\,2x\gamma\,(g_1+g_2)\Big\}, \tag{2.17}$$

where

$$\sum_h \int dz\, z\, F_{UU,T}(x,z,Q^2) = 2xF_1(x,Q^2) = F_T(x,Q^2), \tag{2.18}$$

$$\sum_h \int dz\, z\, F_{UU,L}(x,z,Q^2) = (1+\gamma^2)F_2(x,Q^2) - 2xF_1(x,Q^2) = F_L(x,Q^2), \tag{2.19}$$

$$\sum_h \int dz\, z\, F_{LL}(x,z,Q^2) = 2x\,\big(g_1(x,Q^2) - \gamma^2 g_2(x,Q^2)\big), \tag{2.20}$$

$$\sum_h \int dz\, z\, F_{LT}^{\cos\phi_S}(x,z,Q^2) = -2x\gamma\,\big(g_1(x,Q^2) + g_2(x,Q^2)\big) \tag{2.21}$$

n terms of the conventional deep inelastic structure functions. For the relation with the nore common expression for target polarization along or transverse to the lepton beam lirection see Refs. [31, 32, 27]. Finally, time-reversal invariance requires (see, e.g., Ref. [27])

$$\sum \int dz\, z\, F_{UT}^{\sin\phi_S}(x,z,Q^2) = 0. \tag{2.22}$$

$$F_{LT}^{\cos\phi_S}(x,Q^2) = -2x\gamma\,(g_1+g_2) \Rightarrow g_1 + g_2 = -\frac{1}{2x\gamma}\,F_{LT}^{\cos\phi} \qquad (A)$$

$$F_{LL}\,(x,Q^2) = 2x\,(g_1 - \gamma^2 g_2) \Rightarrow g_1 - \gamma^2 g_2 = \frac{1}{2x}\,F_{LL} \qquad (B)$$

(B) $+\gamma^2$(A)

$$g_1 - \cancel{\gamma^2 g_2} + \gamma^2 g_1 + \cancel{\gamma^2 g_2} = \frac{1}{2x}\left(F_{LL} - \gamma\,F_{LT}^{\cos\phi}\right)$$

$$\Rightarrow \quad g_1 = \frac{1}{2x\,(1+\gamma^2)}\left(F_{LL} - \gamma\,F_{LT}^{\cos\phi}\right)$$

$$\approx \frac{1}{2x}\left(F_{LL} - \gamma\,F_{LT}^{\cos\phi}\right)$$

(A) $-$ (B) $\quad \cancel{g_1} + g_2 - \cancel{g_1} + \gamma^2 g_2 = -\frac{1}{2x\gamma}\,F_{LT}^{\cos\phi} - \frac{1}{2x}\,F_{LL}$

$$g_2 = \frac{-1}{2x(1+\gamma^2)}\left(F_{LL} + \frac{1}{\gamma}F_{LT}^{\cos\phi}\right) = \frac{-1}{2x\gamma(1+\gamma^2)}\left(F_{LT}^{\cos\phi} + \gamma F_{LL}\right)$$

SUMMARIZING

$$2x(1+\gamma^2)\, g_1 = F_{LL} - \gamma F_{LT}^{\cos\phi}$$

$$2x(1+\gamma^2)\gamma g_2 = -F_{LT}^{\cos\phi} - \gamma F_{LL}$$

NEGLECTING CORRECTIONS OF ORDER γ^2

$$F_{LL}(x, Q^2) \approx 2x\, g_1$$

$$F_{LT}^{\cos\phi}(x, Q^2) = -2x\gamma\,(g_1 + g_2)$$

$$\Longrightarrow \qquad g_2 = \frac{-1}{2x\gamma} F_{LT}^{\cos\phi} - g_1 = -\frac{1}{2x\gamma} F_{LT}^{\cos\phi} - \frac{F_{LL}}{2x}$$

$$= -\frac{1}{2x\frac{2xM}{Q}} F_{LT}^{\cos\phi} - g_1$$

$$= -\frac{1}{4x^2}\frac{Q}{M} F_{LT}^{\cos\phi} - g_1$$

$$\boxed{g_2 = -\frac{1}{4x^2}\,\frac{Q}{M}\,F_{LT}^{\cos\phi} - \frac{1}{2x}\,F_{LL}}$$

IN OUR CASE

$$g_2 = -\frac{1}{2\,\cancel{4}\cancel{x^2}}\,\frac{\cancel{Q}}{M}\left[-\cancel{x}\sum_q e_q^2\,\frac{\cancel{2}\Lambda}{\cancel{Q}}\left(\cancel{x}\,g_T^q + \frac{M_q - m_q}{\Lambda}\,h_1^q\right)\right]$$

$$-\frac{1}{2\cancel{x}}\,\cancel{x}\sum_q e_q^2\;g_1^q$$

$$\boxed{g_2 = \frac{1}{2}\sum_q e_q^2\left\{\frac{\Lambda}{M}\left(g_T^q + \frac{M_q - m_q}{\Lambda}\,h_1^q\right) - g_1^q\right\}}$$

IF YOU CHOOSE $\Lambda = M$ (WHICH IS THE STANDARD CHOICE WE ADOPTED IN N.T. AND IN WW-BREAKING)

$$g_2 = \frac{1}{2}\sum_q e_q^2\left\{g_T^q + \frac{M_q - m_q}{M}\,h_1^q - g_1^q\right\}$$

SINCE IN THIS ARTICLE WE DECIDED TO KEEP TWO SEPARATE SCALES Λ & M, THE RESULTS IN N.T. & WW-BREAKING HAVE TO BE MODIFIED REPLACING

$$g_T\Big|_{\substack{\text{OLD}\\ \text{ARTICLES}}} \longrightarrow \frac{\Lambda}{M}\, g_T\Big|_{\text{HERE}}$$

BUT THIS IS JUST A REDEFINITION OF g_T. THE NUMERICAL RESULTS OF, E.G., WW BREAKING DON'T CHANGE