Global Fitting of HVV CP-Violating Operators

2026.10.30

• Status: Combined collider and EDM constraints

- Using collider data, electron EDM data, and neutron EDM data to constrain $C_{H\tilde{W}}$, $C_{H\tilde{B}}$, and $C_{HW\tilde{B}}$

- Framework: a combined test statistic

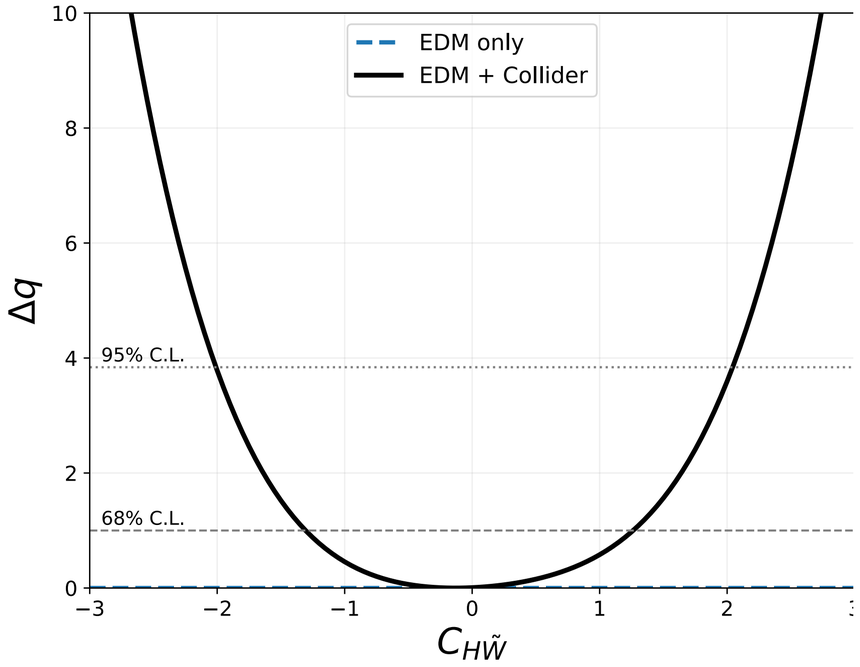
$$q(\mathbf{C}, \theta) = \chi^2_{\text{EDM}}(\mathbf{C}, \theta) - 2 \ln L_{\text{collider}}(\mathbf{C}, \theta)$$

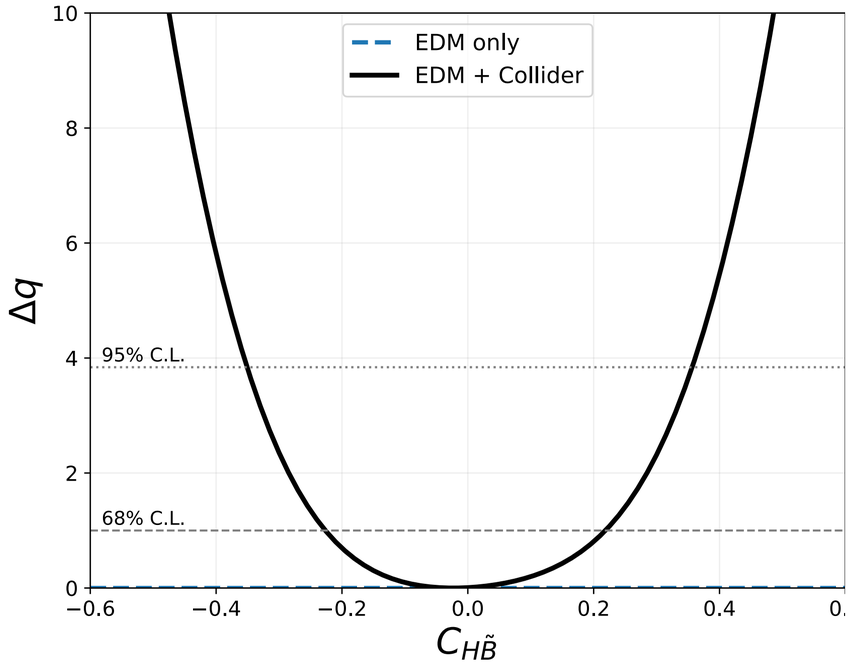
- Next step: Incorporate the updated collider constraints to complete the combined analysis

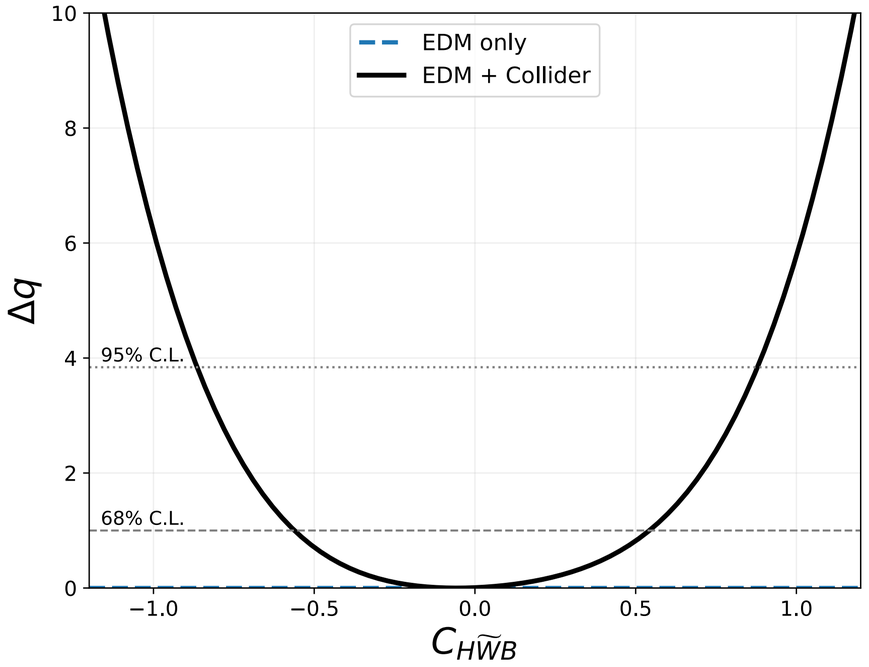
- Combined test statistic

$$q(\mathbf{C},\theta) = \chi^2_{\mathrm{EDM}}(\mathbf{C},\theta) - 2\ln L_{\mathrm{collider}}(\mathbf{C},\theta) \qquad \mathbf{C} = (C_{H\tilde{B}}, C_{H\tilde{W}}, C_{HW\tilde{B}})$$

$$\chi^2_{\mathrm{EDM}} = \left(\frac{d_e}{0.0011}\right)^2 + \left(\frac{d_n}{1.8}\right)^2 + \left(\frac{g_u - 0.204}{0.011}\right)^2 + \left(\frac{g_d - 0.784}{0.028}\right)^2 + \left(\frac{g_s - 0.0027}{0.0016}\right)^2$$

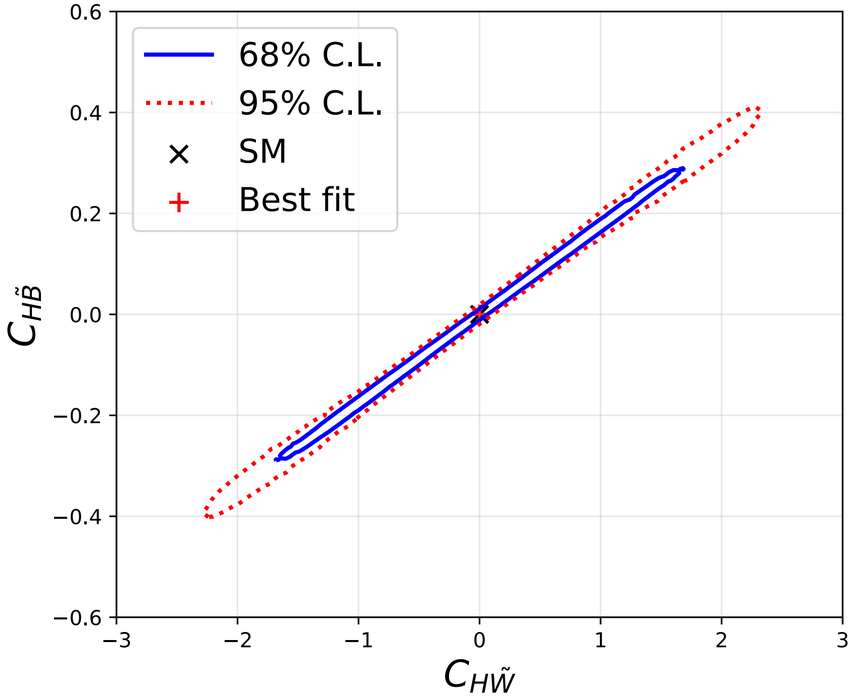


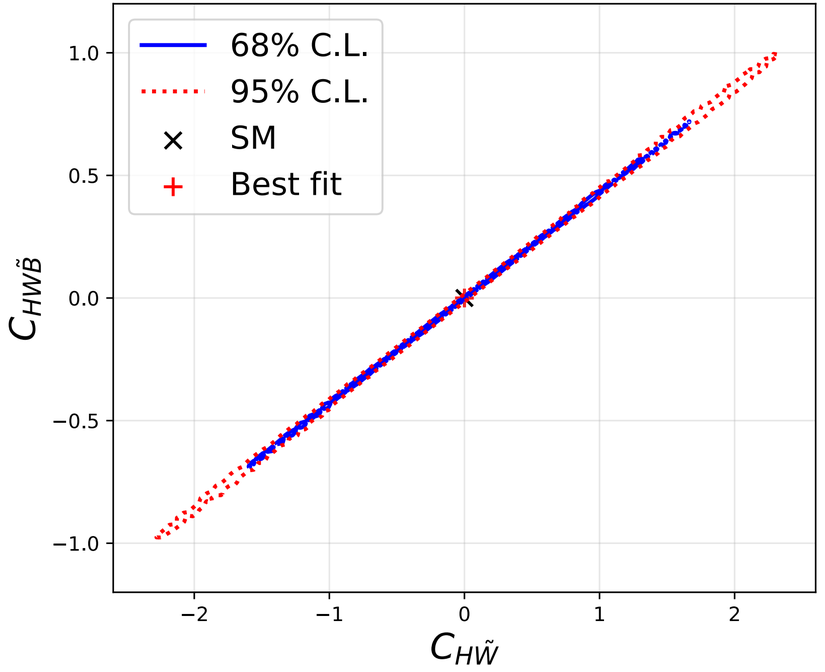


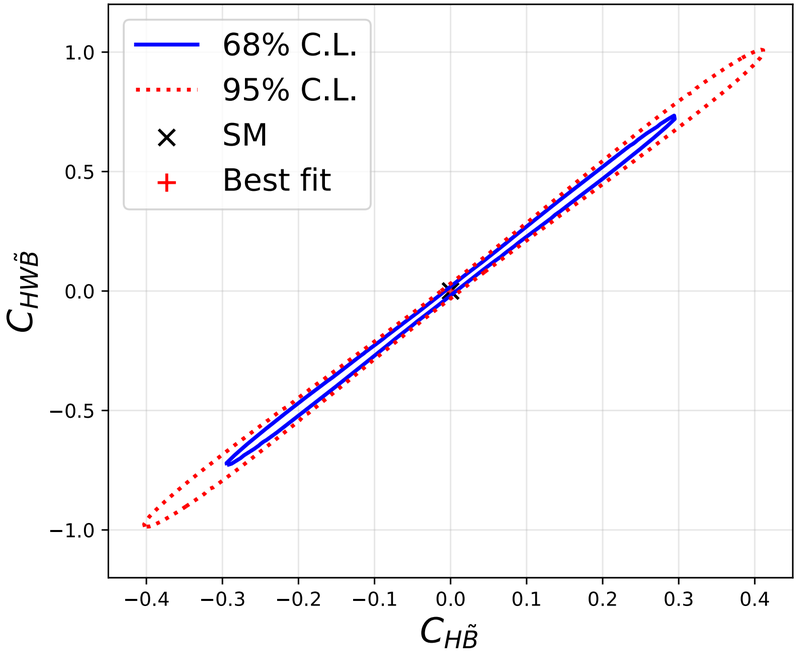


marginalize the other two Wilson coefficients,
always have the flat direction without collider data

- Projected 2D constraints



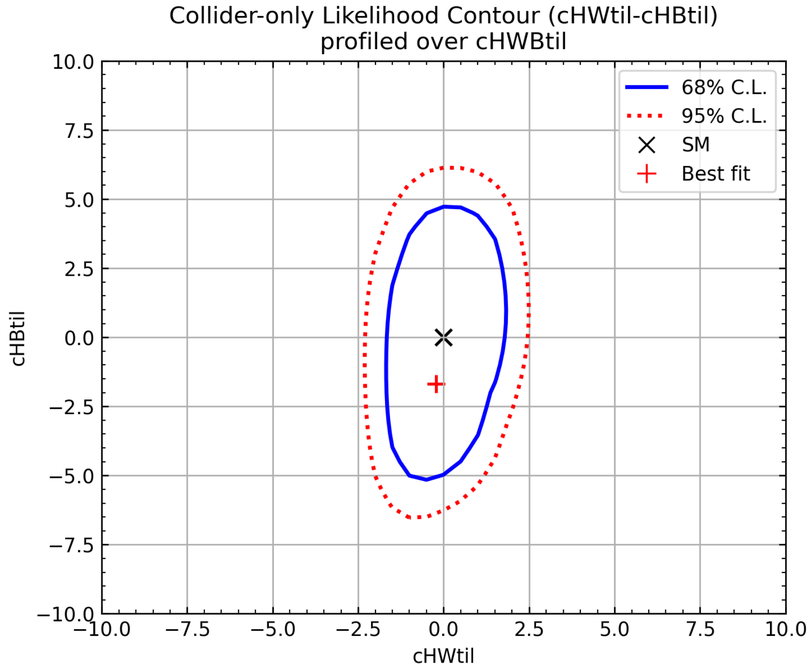


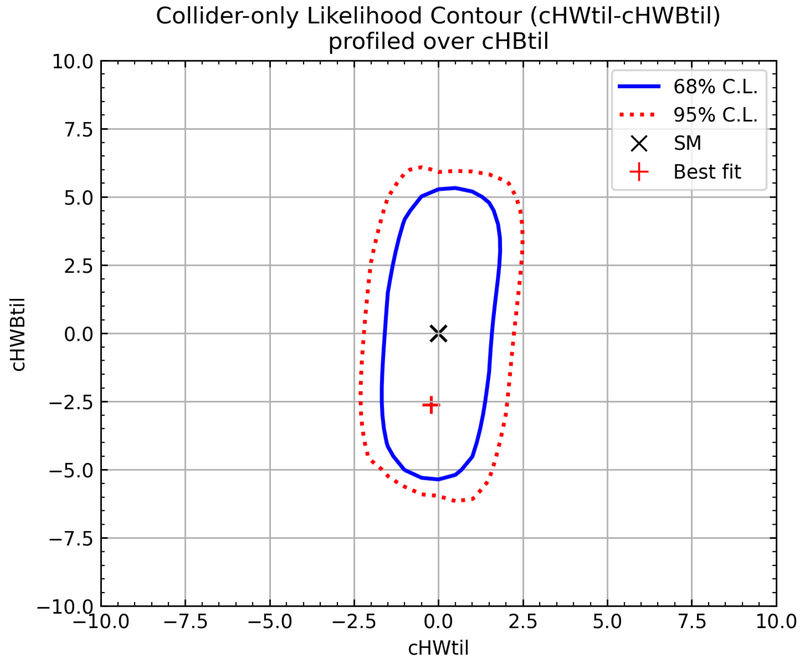


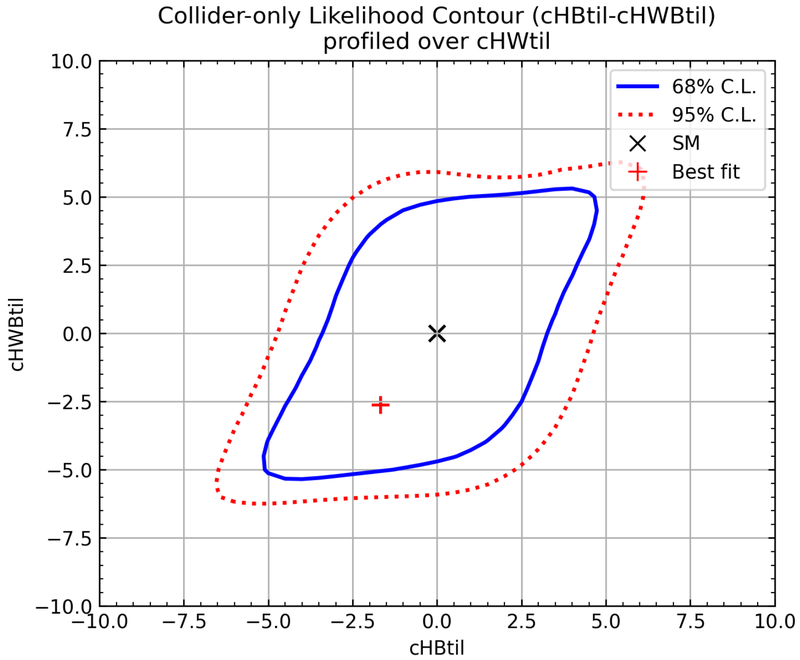
collider + EDM

marginalize the other Wilson coefficient

- Backup



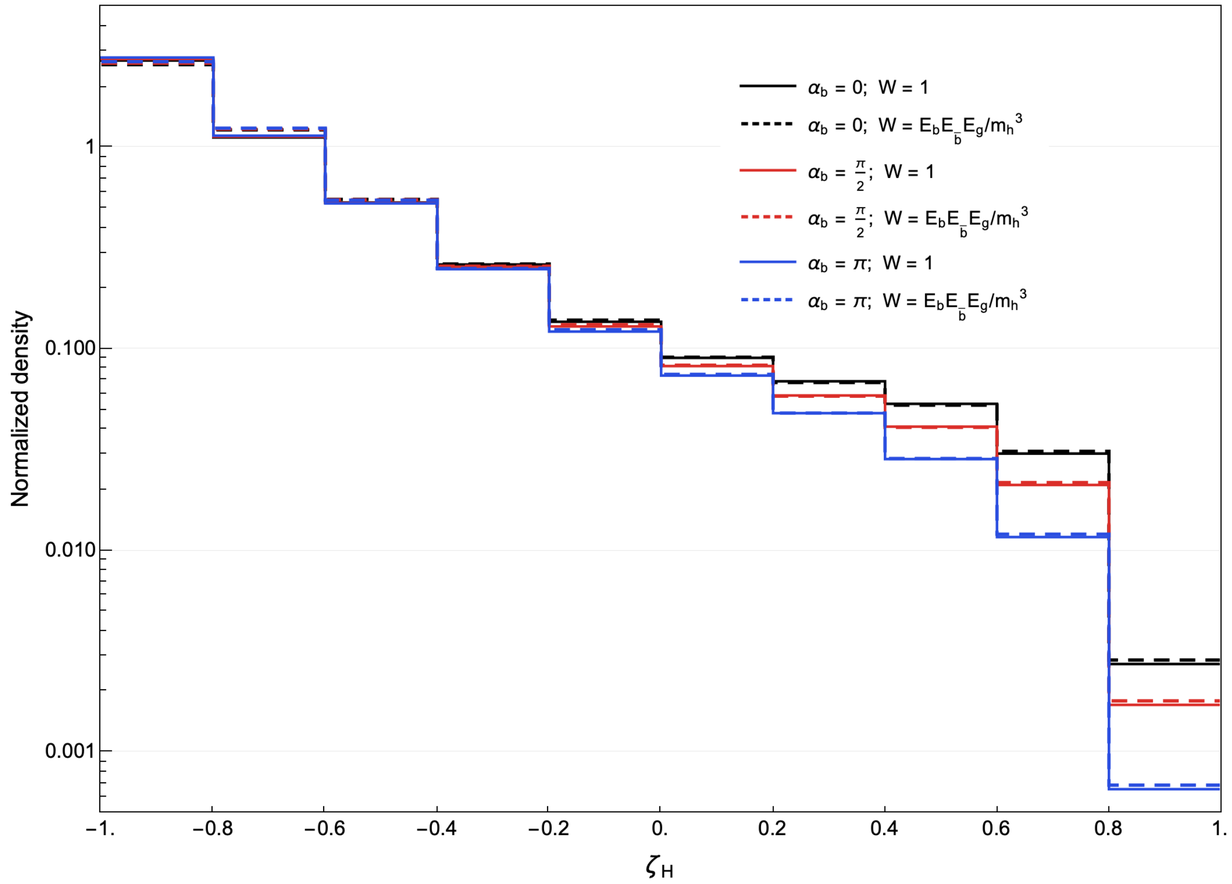




collider only

marginalize the other Wilson coefficient

- Backup: Hbb



Consider $h \to b\bar{b}g$

$$\zeta_H \equiv \frac{2E_b E_{\bar{b}}}{E_b^2 + E_{\bar{b}}^2} \cos\theta_{b\bar{b}}$$

Ref 2009.02000

$$\frac{d\Gamma}{d\zeta_H} = \int d\Gamma \delta(\zeta - \zeta_H)$$

energy weighted

$$\frac{d\Gamma}{d\zeta_H} = \int d\Gamma \frac{E_b E_{\bar{b}} E_g}{m_H^3} \delta(\zeta - \zeta_H)$$