MOLLER: An ultra-precise measurement of weak mixing angle

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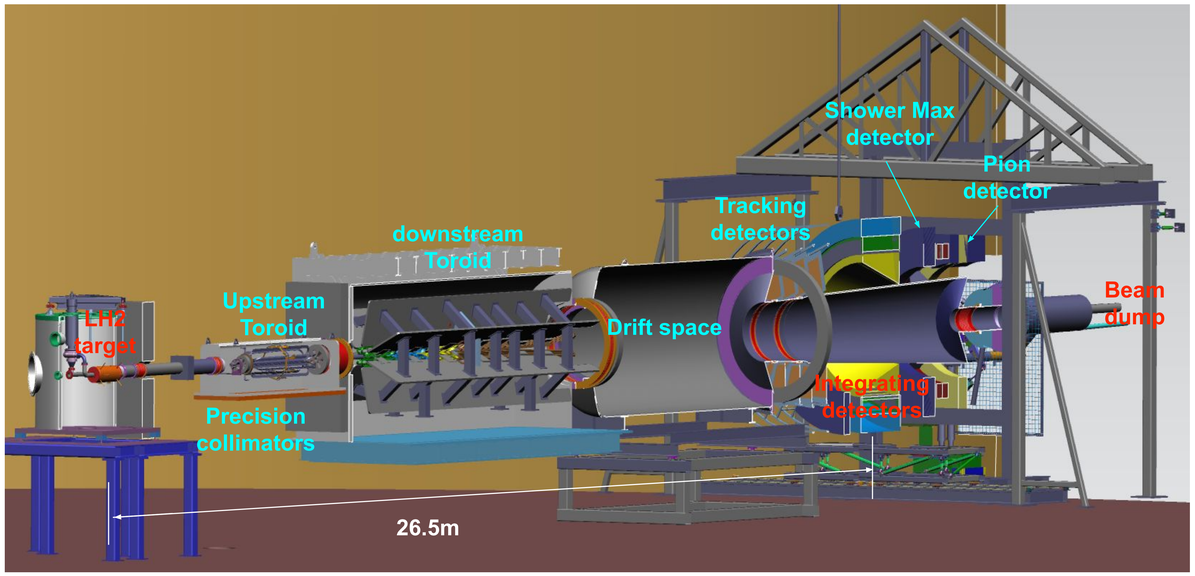
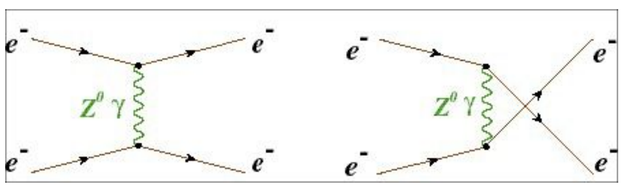
What is MOLLER?

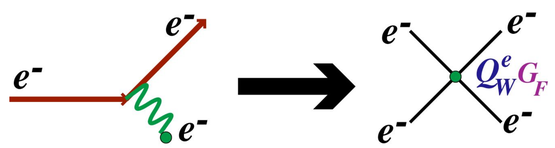
Measuring the parity violation of the e-e scattering



Motivation of MOLLER

Search for new flavor diagonal neutral currents





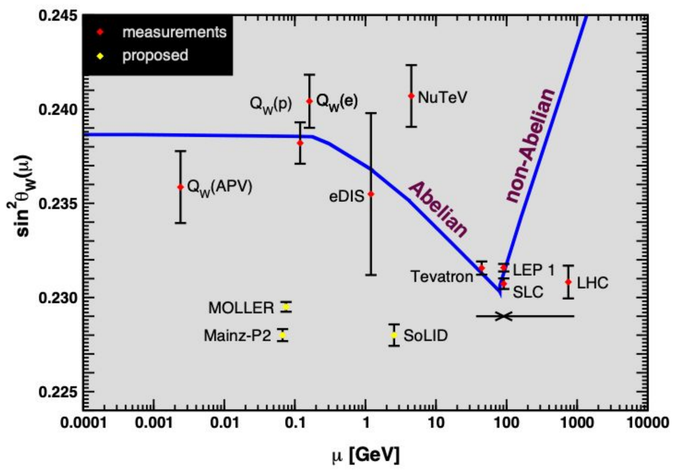
$$Z = W^0 \cos\theta_W - B^0 \sin\theta_W$$
$$A = B^0 \cos\theta_W + W^0 \sin\theta_W$$

$$\mathcal{L}_{e_1 e_2} = \sum_{i,j=L,R} \frac{g_{ij}^2}{2\Lambda^2} \bar{e}_i \gamma_\mu e_i \bar{e}_j \gamma^\mu e_j$$

$$A_{PV} = \frac{\sigma_R - \sigma_L}{\sigma_R + \sigma_L} = -mE \frac{G_F}{\sqrt{2}\pi\alpha} \frac{16 \sin^2\Theta}{(3+\cos^2\Theta)^2} Q_W^e$$

$$Q_W^e = 1 - 4\sin^2\theta_W \sim 0.075$$

Proposed measurement



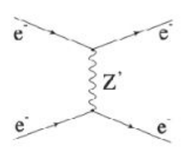
MOLLER Projection:

$\delta(\sin^2\theta_W) = \pm 0.00023\ (stat.) \pm 0.00012\ (syst.)$

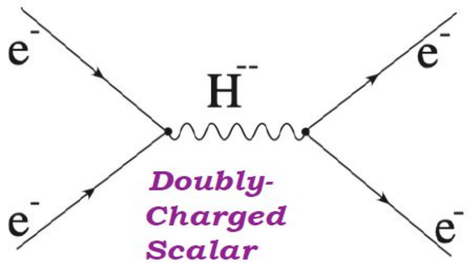
~0.1% measurement

MOLLER is accessing discovery space that cannot be reached until the advent of a new lepton collider or neutrino factory

Possibility of New physics?

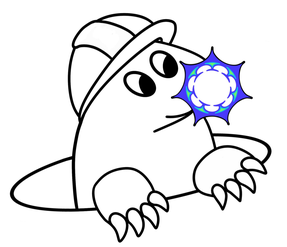


Heavy Photons (A' mixed with Z_0): The Dark Z



Lepton number violation

e^+e^- Collisions	LEP200 Reach	$\Lambda_{LL}^{ee} \sim 8.3$ TeV
Fixed Target	E158 Reach	$\Lambda_{LL}^{ee} \sim 12$ TeV
MOLLER Reach		$\Lambda_{LL}^{ee} \sim 27$ TeV



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