Complementarity of DM and Ceνns experiments in light Z' models

Leon Manuel Garcia de la Vega, IF-UNAM

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Work in progress

In collaboration with L. Flores, N. Nath, E. Peinado

Numerous extensions of the Standard Model with additional U(1)' gauge symmetries can be motivated by the problems of gauge unification, dark matter models, neutrino masses, among others.

We consider anomaly-free models of U(1)' gauge symmetries to obtain neutrino masses and mixings and to provide a portal for dark matter to the Standard Model sector.

$$\mathscr{L} \supset \frac{m_{Z'}^2}{2} Z'^{\mu} Z'_{\mu} + i g' Z'_{\mu} (Q_f \bar{f} \gamma^{\mu} f)$$

Some possible models: $B - L$, $B - 2L_{\alpha} - L_{\beta}$

Strong constraints on light Z' couplings can be obtained from colliders, neutrino cross section measurements and beam dump experiments.

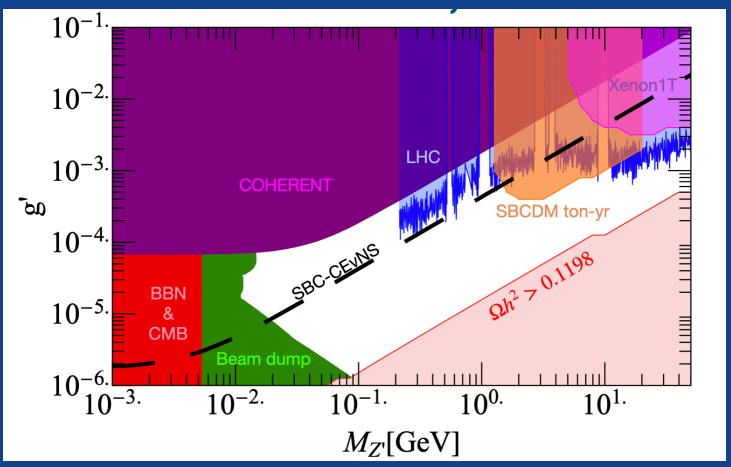
Vector-like fermions (χ) can be added to the model keeping the anomaly-free nature of the model. Fractional charges for these fermions can result in remnant Z_2 symmetry from U(1)' breaking, making them dark matter candidates.

$$\mathscr{L} \supset M_D \bar{\chi}\chi + \bar{\chi}\gamma^{\mu}(\partial_{\mu} + i g' Q_{\chi} Z'_{\mu})\chi$$

In the absence of scalar interactions, Z' portal determines DM physics completely, making it a strongly constrained paradigm. To overcome the constraints on g' we consider the resonant DM limit, $2M_{Z'} \sim M_{\chi}$.

Results

We perform an analysis of the DM sector with the *MicrOmegas* package. We integrate the Z' constraints from collider, CEvNS and beam dump experiments with the DM constraints from relic density and direct detection. We consider future limits on g' and DM spin independent cross section from the proposed Scintillating Bubble Chamber experiment at a nuclear reactor and SNOLAB respectively.



References

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