

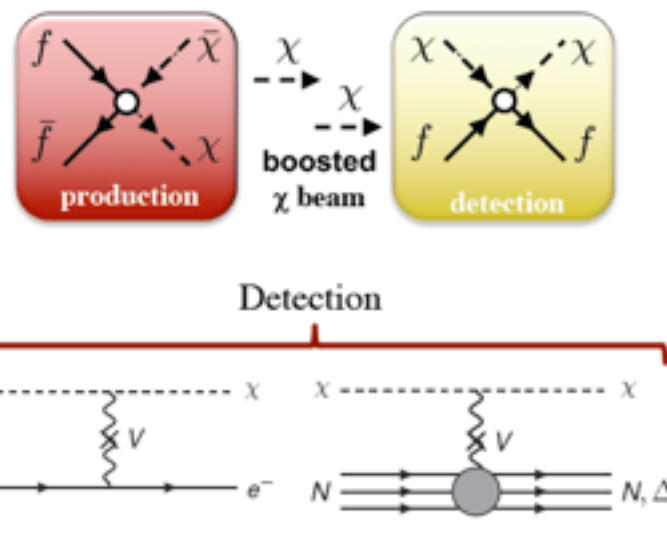
DM Scattering @ Beam Dumps

Beam Dump DM Scattering

Demonstration: MiniBooNE DM (R.L. Cooper)

Dark Matter Beams and Detection

- High-energy production and scattering detection



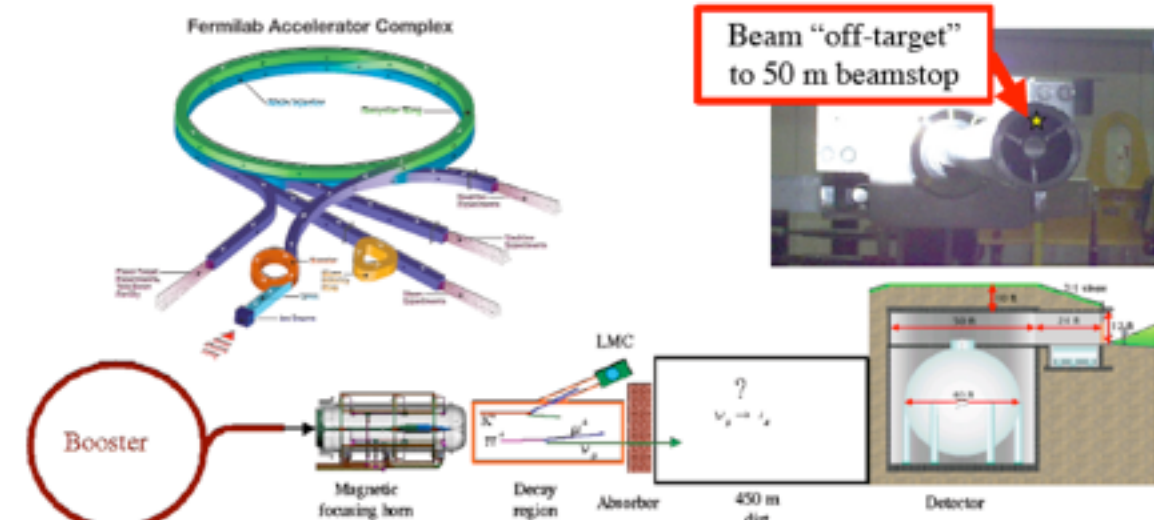
B. Batell et al., *Phys. Rev. Lett.* **113** (2014) 171802. arXiv:1406.2698 [hep-ph].
P. deNiverville et al., *Phys. Rev.* **D84** (2011) 075020. arXiv:1107.4580 [hep-ph].

- 2014 Ran beam off target, collected 1.86E20 POT.
- 2017 First results on DM search with NCE sample.

Additional analyses ongoing
– use timing to search for heavier DM
– additional scattering channels

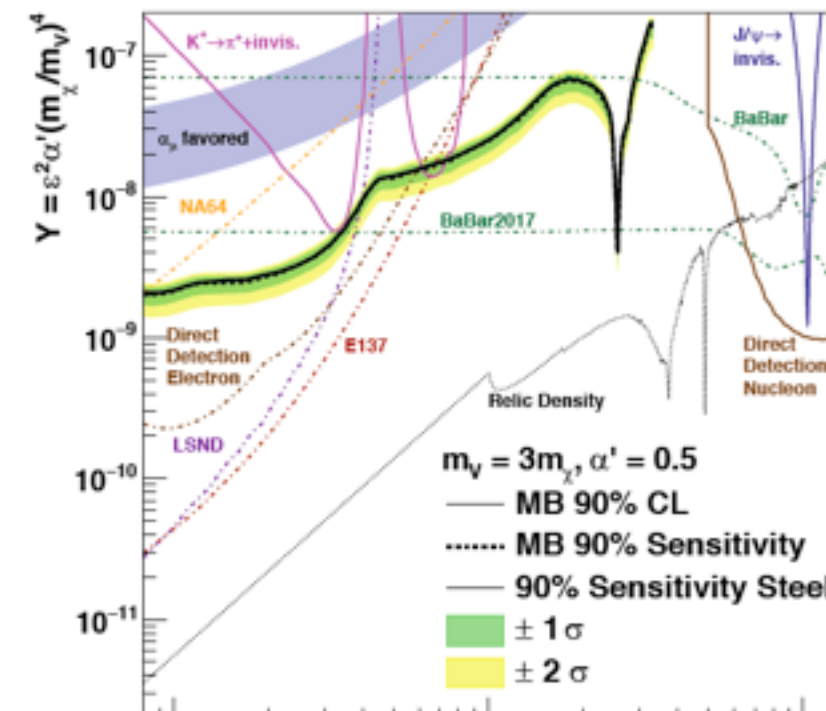
Beam Off-Target Mode

- Steer beam around target to 50 m beam dump
- Residual neutrino backgrounds from “scraping” and air



Confidence Limit Results

- Many ways to “slice” parameter space
- This parameter choice is rejected as solution for $g-2$ anomaly (Vector Portal)



Beam Dump DM Scattering

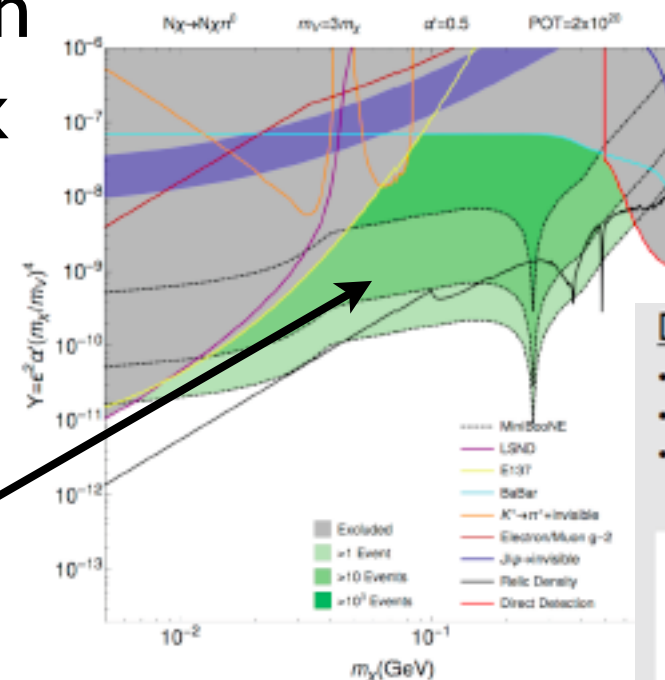
Future Prospects: Proton Beams

Fermilab: leveraging neutrino exp.

R. Van de Water

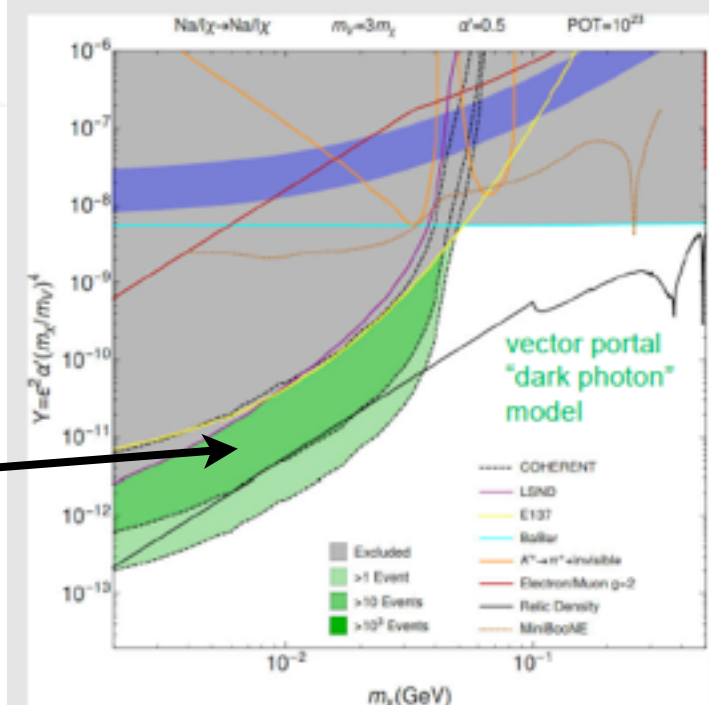
1. Reducing bkg at MiniBooNE with new absorber in beam pipe (20x lower nu bkg than last DM run)
2. Proposed sub-GeV DM search with SBND – several options, \$1-\$5M, 2018-21 start
3. MiniBooNE-like detector downstream of 120 GeV main injector dump (<\$10M??)

Significant sensitivity gains possible!



DM sensitivities with NaI in COHERENT

- 5 ton NaI, E > 20keVnr, 1E23POT
- 1-1000 event sensitivity plots
- predicted experimental sensitivities – work in



R. Tayloe, Cosmic Visions 2017

Using COHERENT at SNS R. Tayloe

Existing LAr & NaI detectors; can be upgraded to larger mass

Beam Dump DM Scattering

Future Prospects: Electron beams

BDX: Lower neutrino bkg from e^- beam

BDX foreseen activities

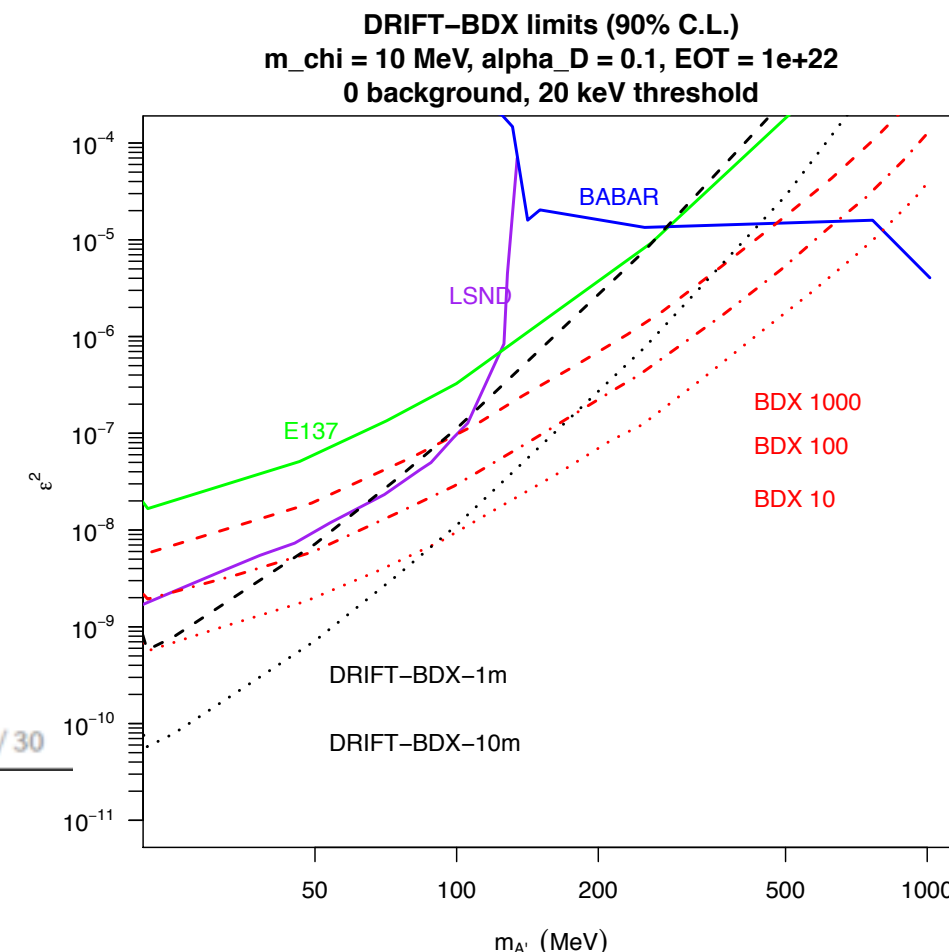
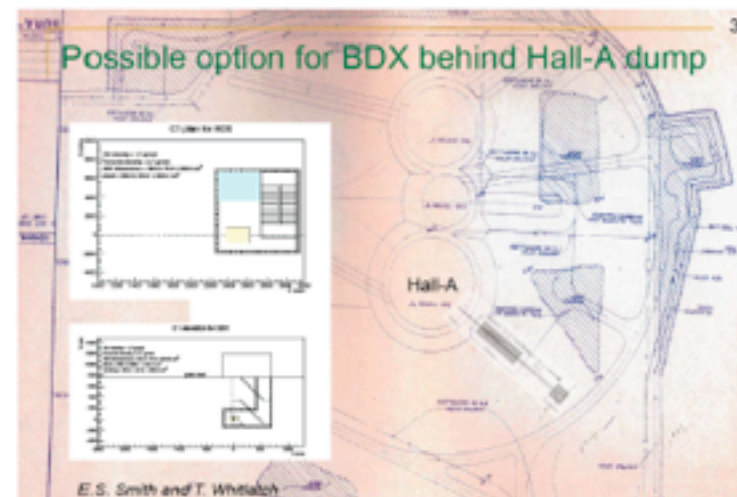
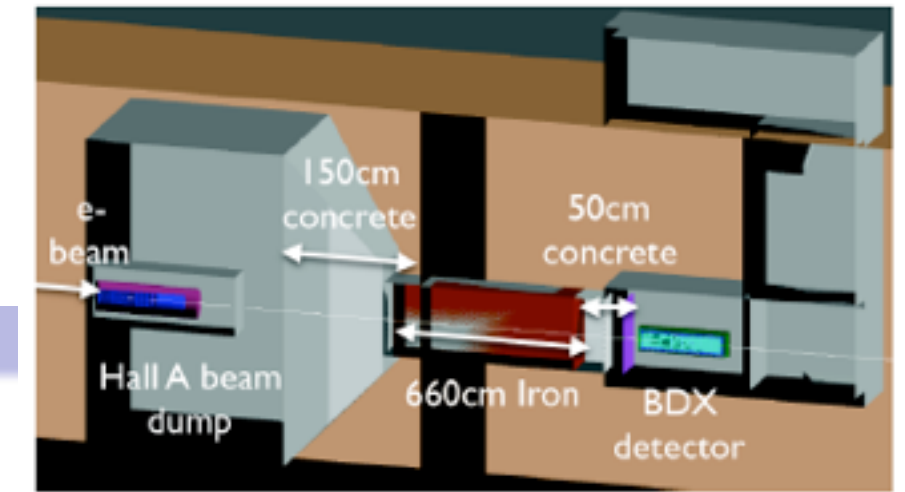
Detector

- Technology selected and design defined. Active volume: CsI(Tl) calorimeter with SiPM readout. Active veto: plastic scintillator + SiPM / PMT readout
- $\simeq 1$ -year time-scale to assembly detector: refurbish 800 BaBar crystals, mount calorimeter, mount active-veto
- $\simeq 1.5M\$$ total cost for full BDX detector construction

Civil construction

- Detailed costs / time-scale evaluation in collaboration with JLab facility office: $\simeq 1.5M\$$, $\simeq 2$ -years time-scale for construction

Within 2 years (detector assembly + civil work), BDX can be ready to run at JLab, to explore unknown territories in the LDM space, and to provide directions for future activities in this field



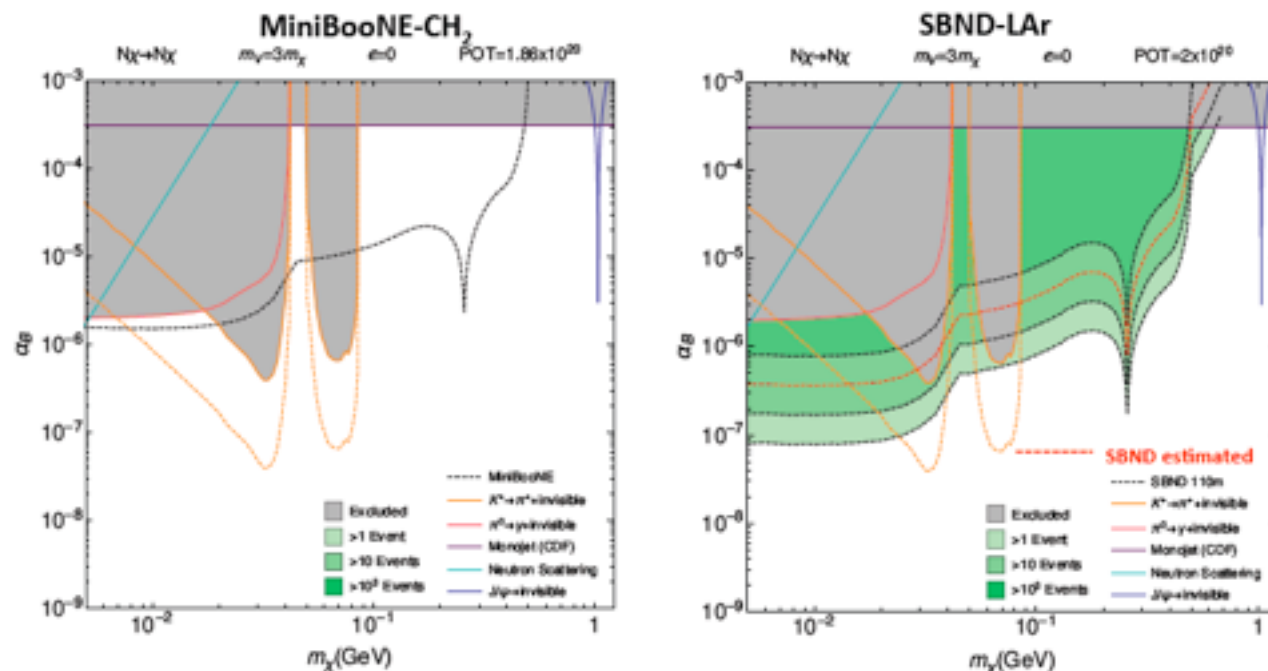
A. Celentano

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Beam Dump DM Scattering

Complementarity of proton and electron beams

SBND Leptophobic Searches with Improved Beam Dump

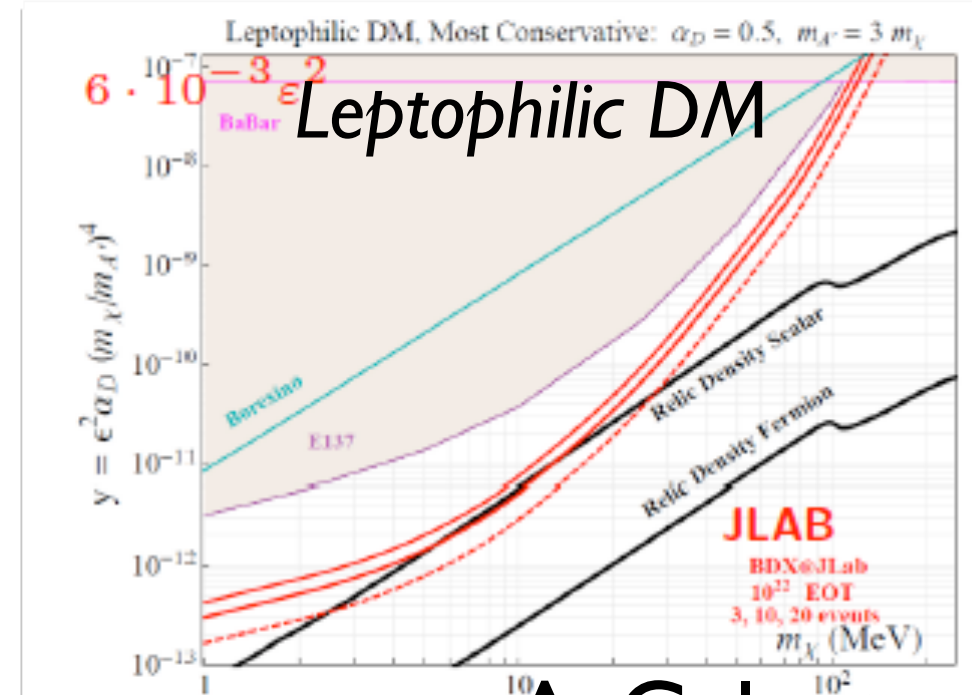


- Proton dump can significantly probe leptophobic models!

R. Van de Water

Opportunities to use MiniBooNE as low-background off-axis detector for DM from MINOS/NOVA, eventually LBNF

– C. Frugiuele



A. Celentano

