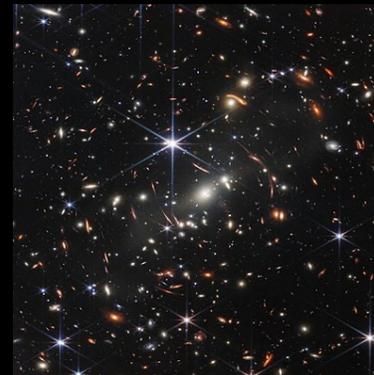
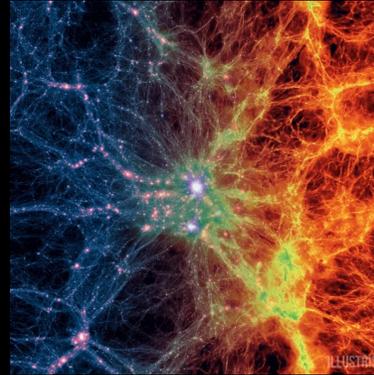
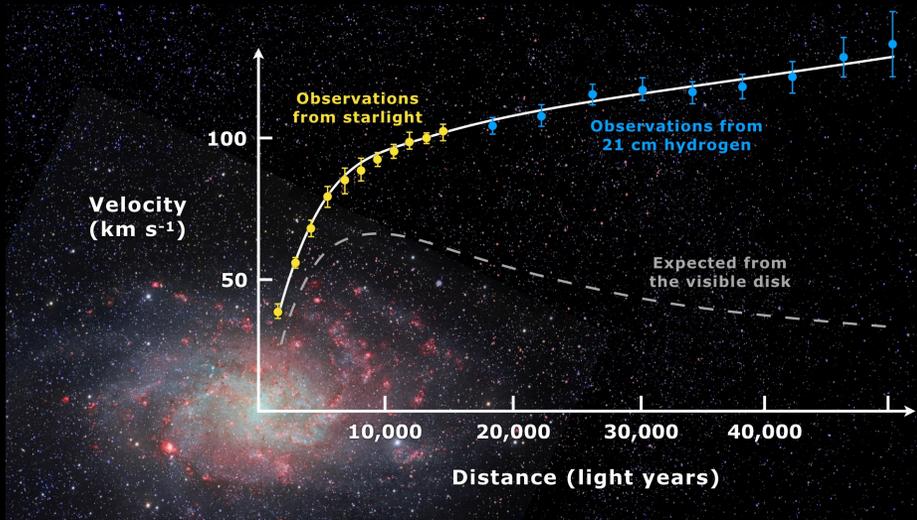


The background features a black field with several flowing, ribbon-like shapes. On the left side, there are green ribbons that curve upwards and then downwards. On the right side, there are orange and yellow ribbons that curve downwards and then upwards. The ribbons have a slight gradient and a soft, glowing appearance.

BDX @ JLAB

DARK MATTER

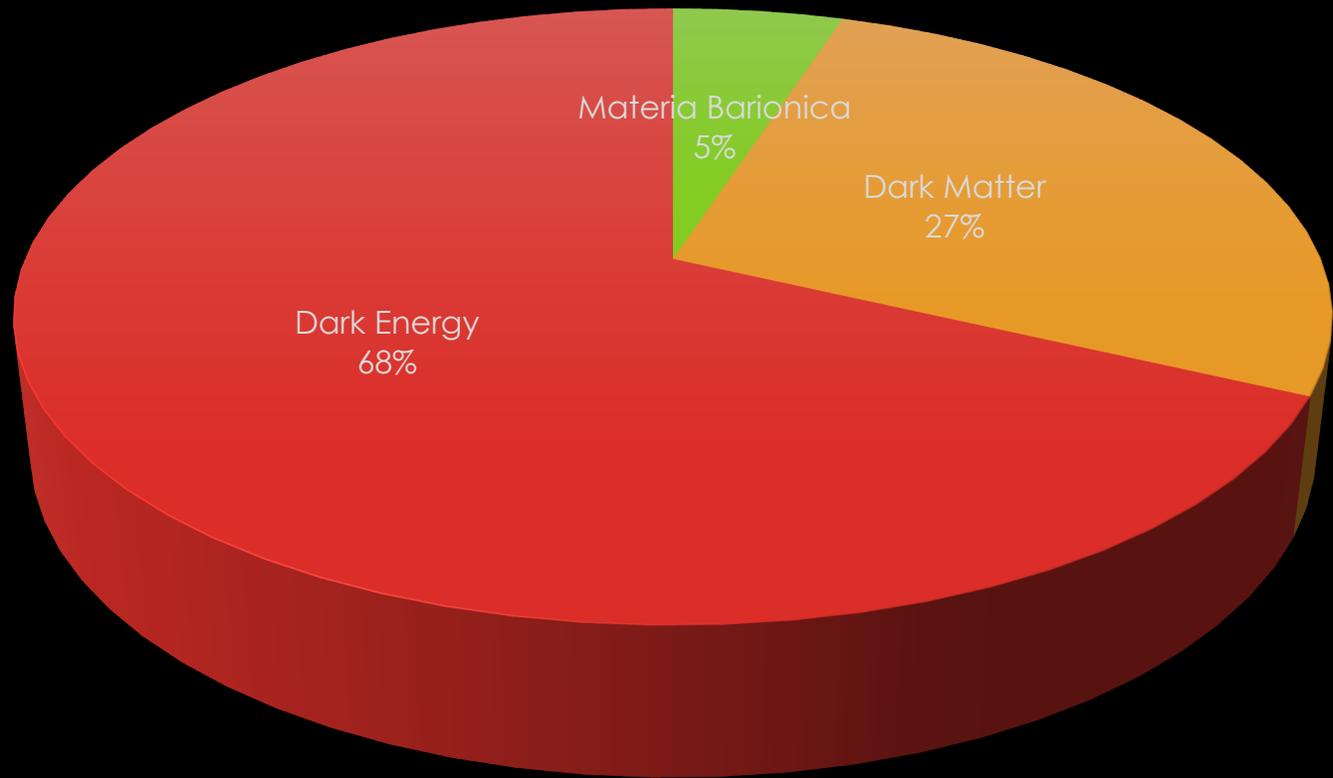


Velocità di rotazione delle galassie

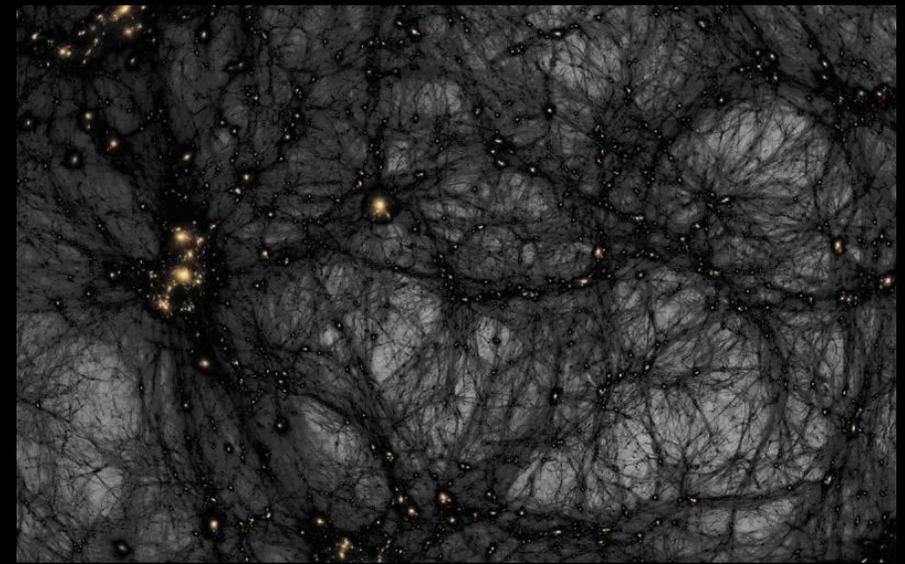
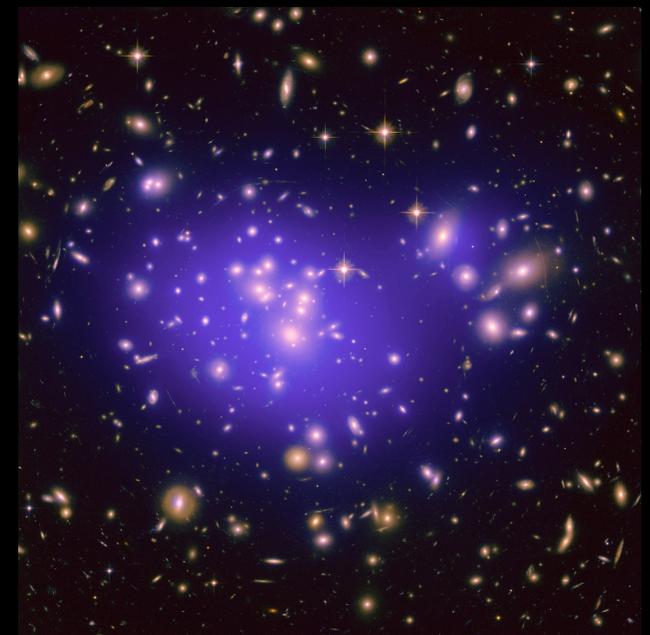
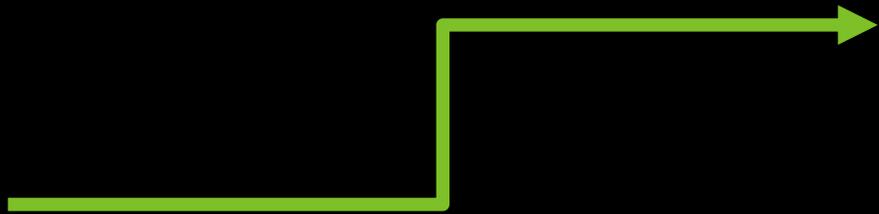
Bullet cluster



DARK MATTER



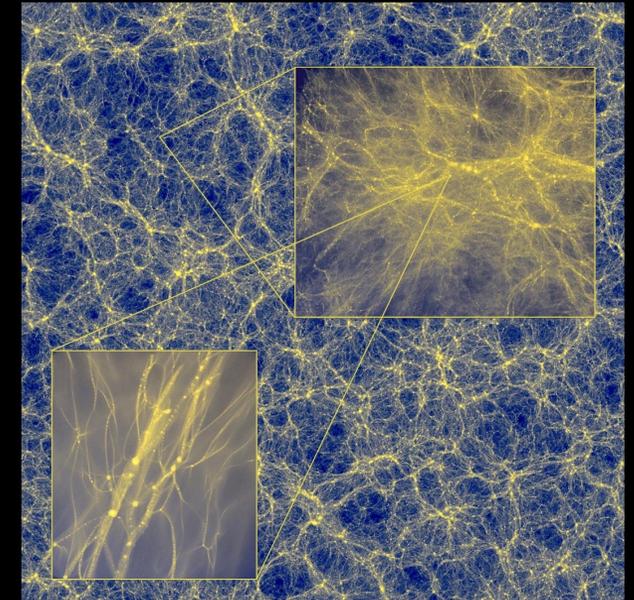
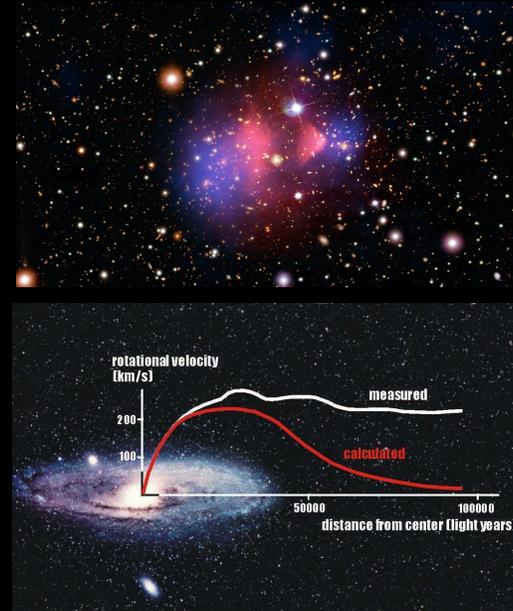
■ Materia Barionica ■ Dark Matter ■ Dark Energy



DARK MATTER

Cosa sappiamo sulla DM:

- Interagisce gravitazionalmente
- Stabile
- Neutra sotto interazioni SM



DARK MATTER

zeV aeV feV peV neV ueV meV eV

keV

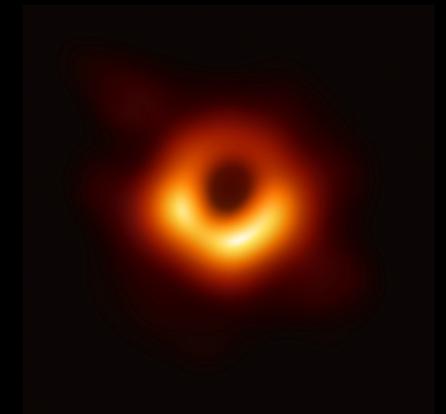
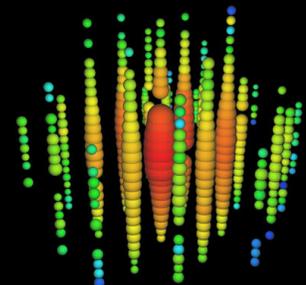
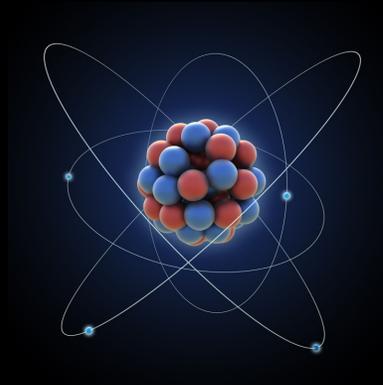
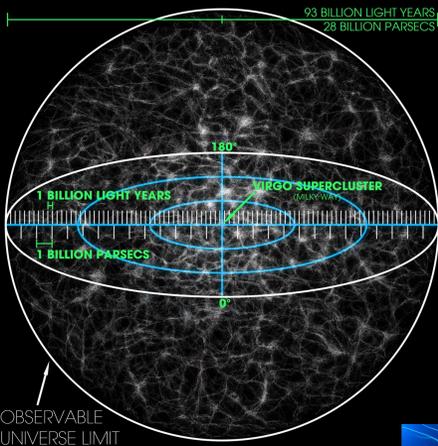
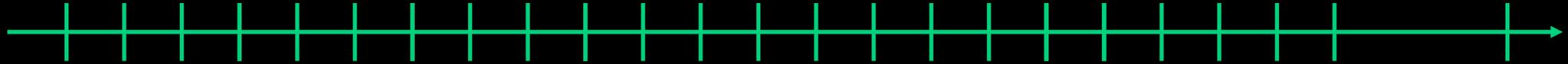
MeV

GeV

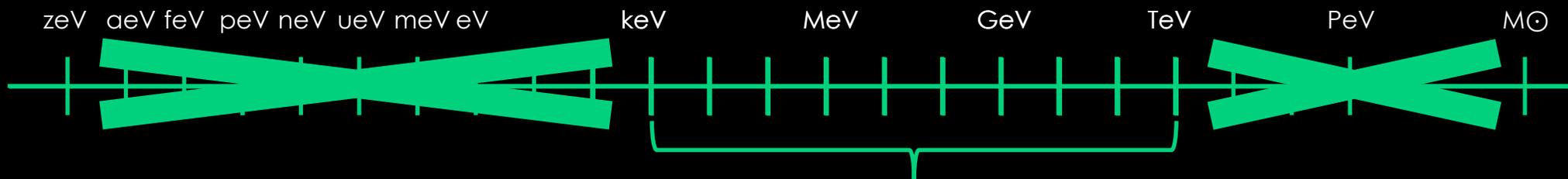
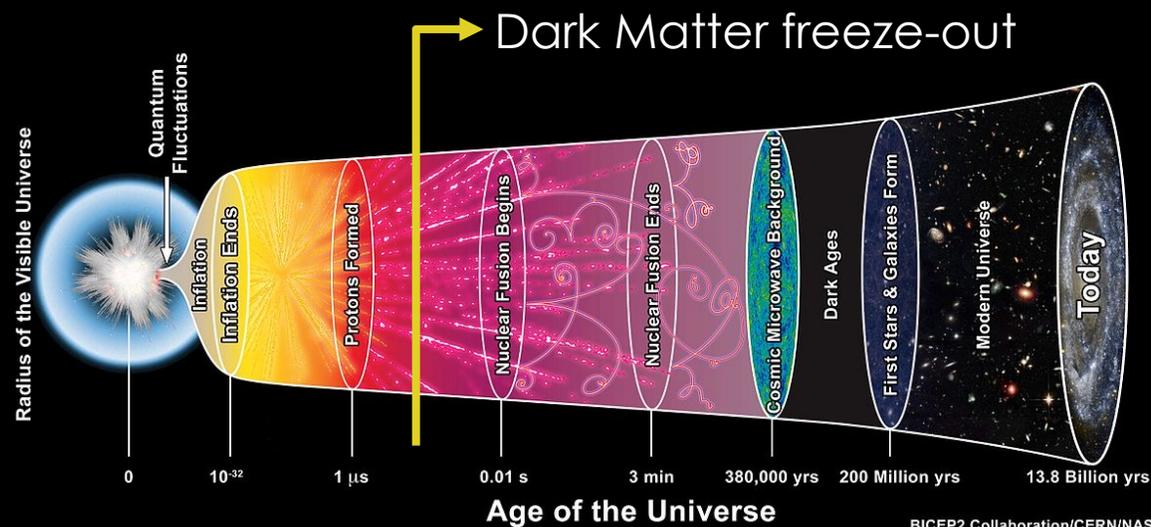
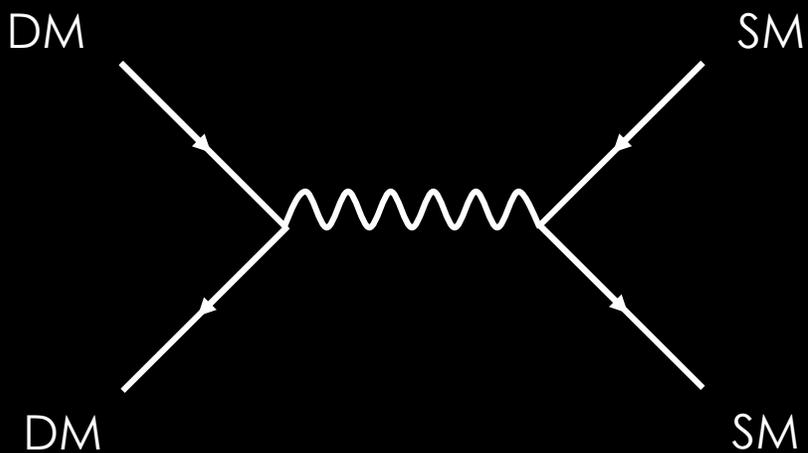
TeV

PeV

M_{\odot}

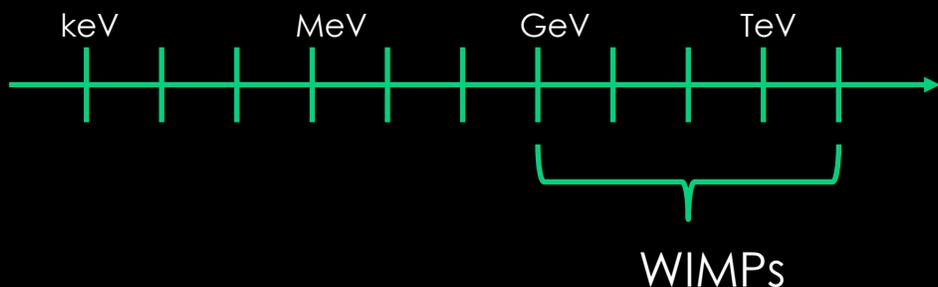


DARK MATTER TERMICA



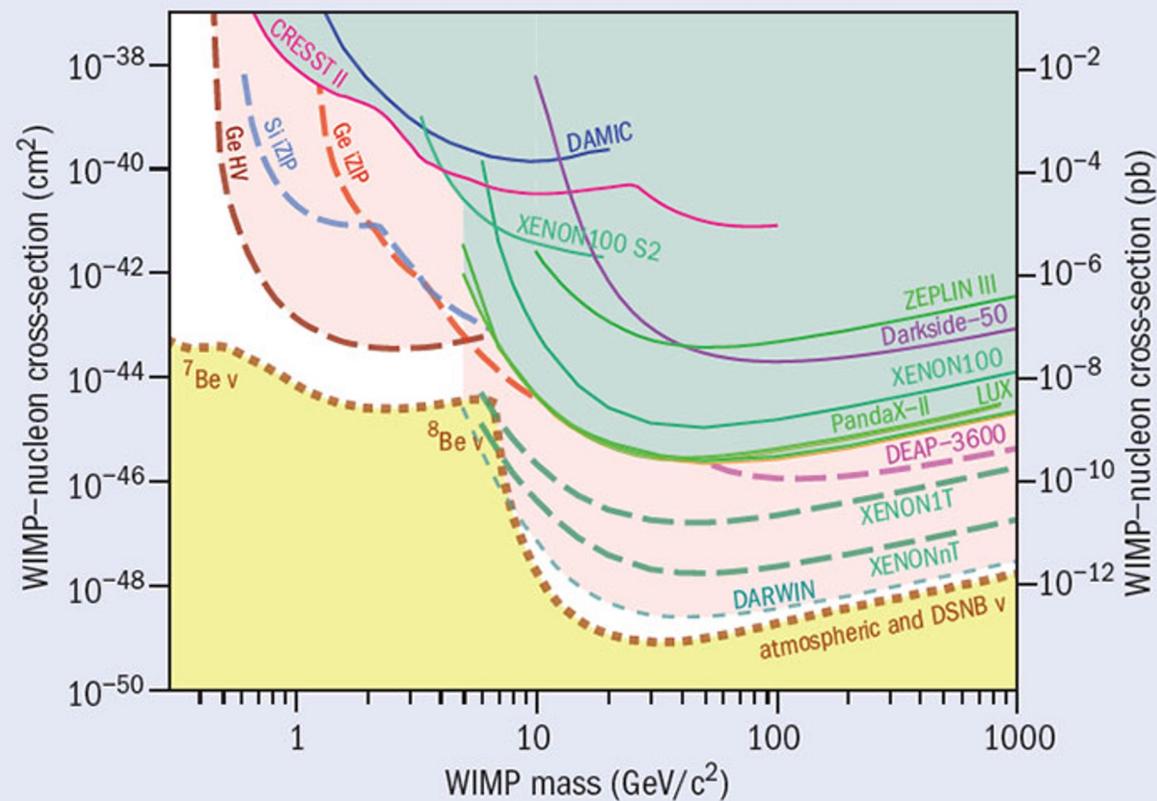
Dark Matter Termica

WIMP

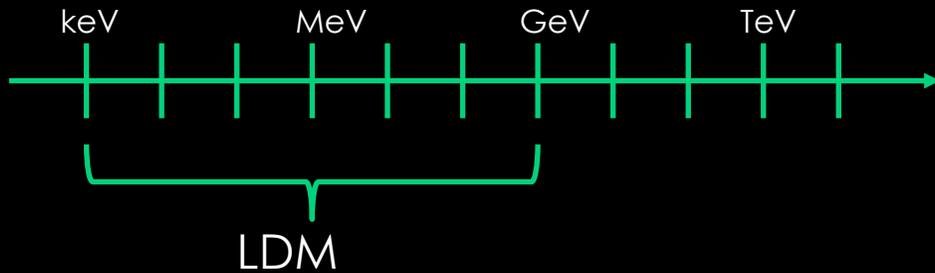


Dark Matter termica

- Massa: GeV-TeV
- Interazione: debole
- Ricerca: diretta
- Problema: non è stata trovata

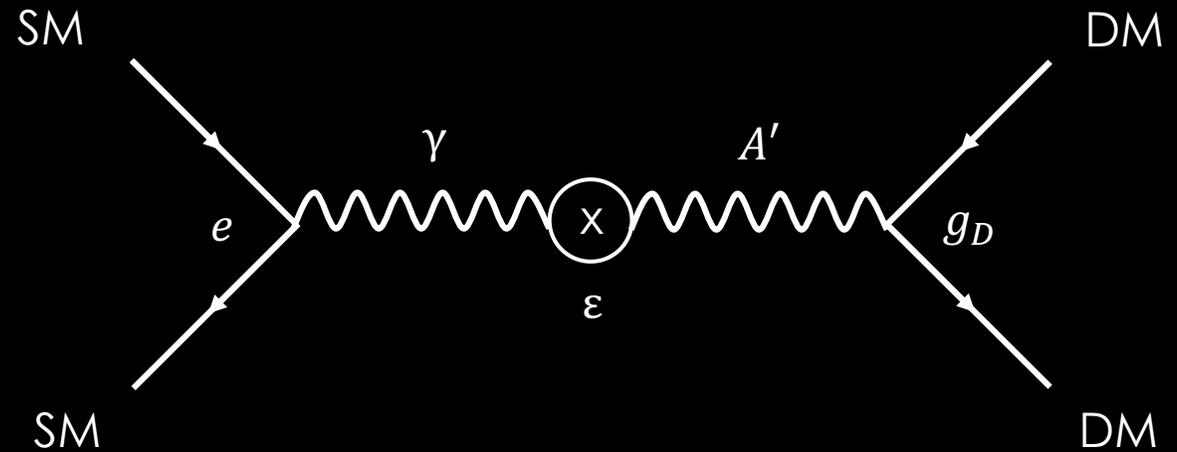


LIGHT DARK MATTER



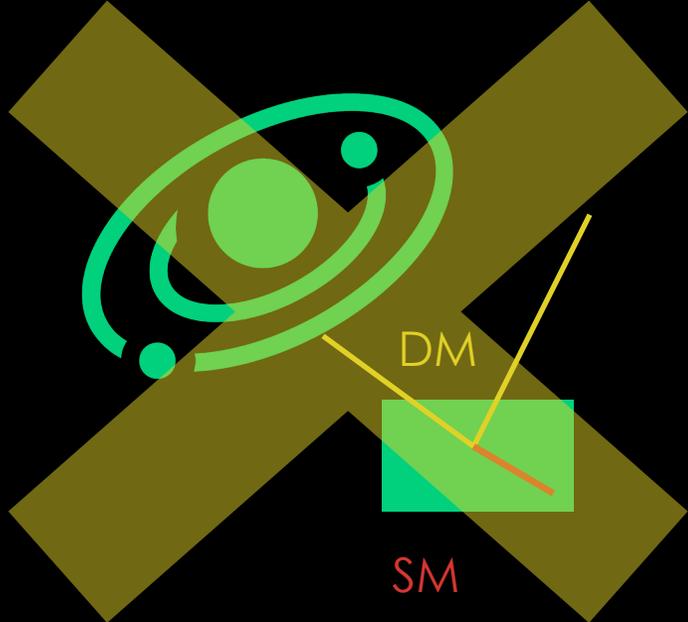
Dark Matter termica

- Massa: MeV-GeV
- Interazione: nuova

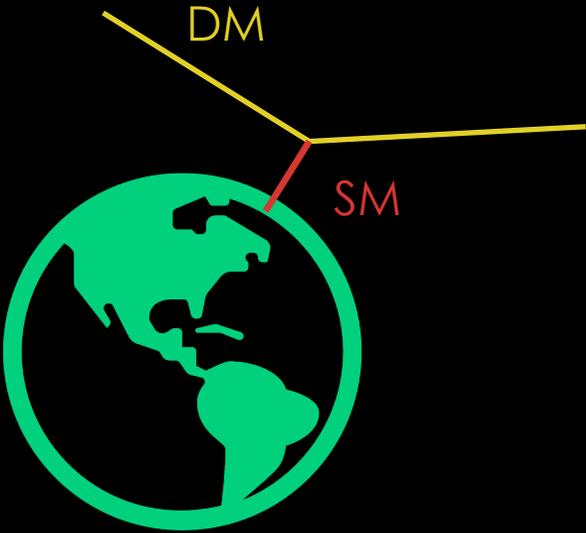


$$y = \frac{g_D^2 \epsilon^2 e^2}{4\pi} \left(\frac{m_{DM}}{m_{A'}} \right)^4 \sim \langle \sigma v \rangle_{relic} m_{DM}^2$$

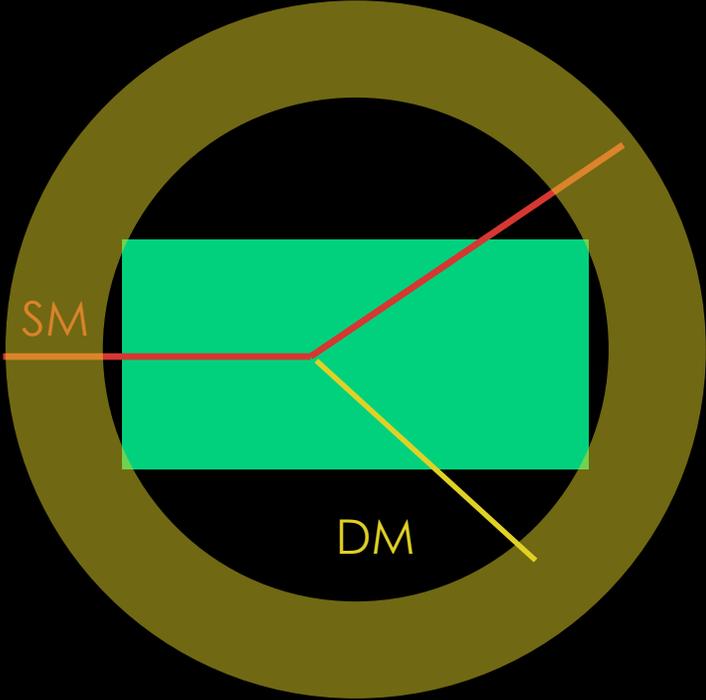
RICERCA LDM



Ricerca diretta

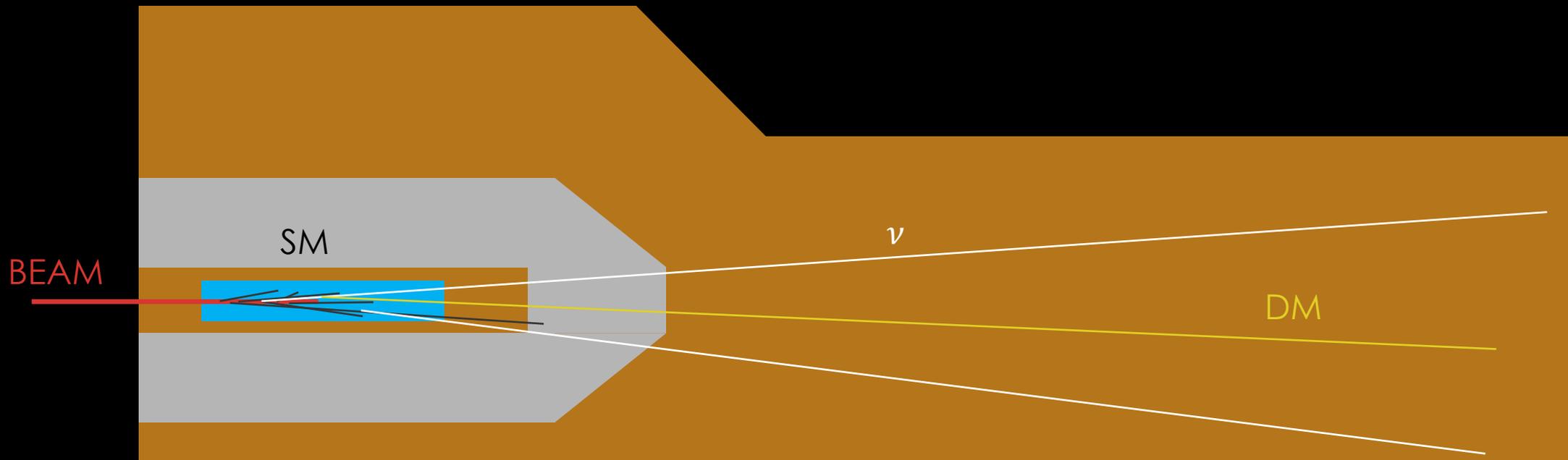


Ricerca indiretta

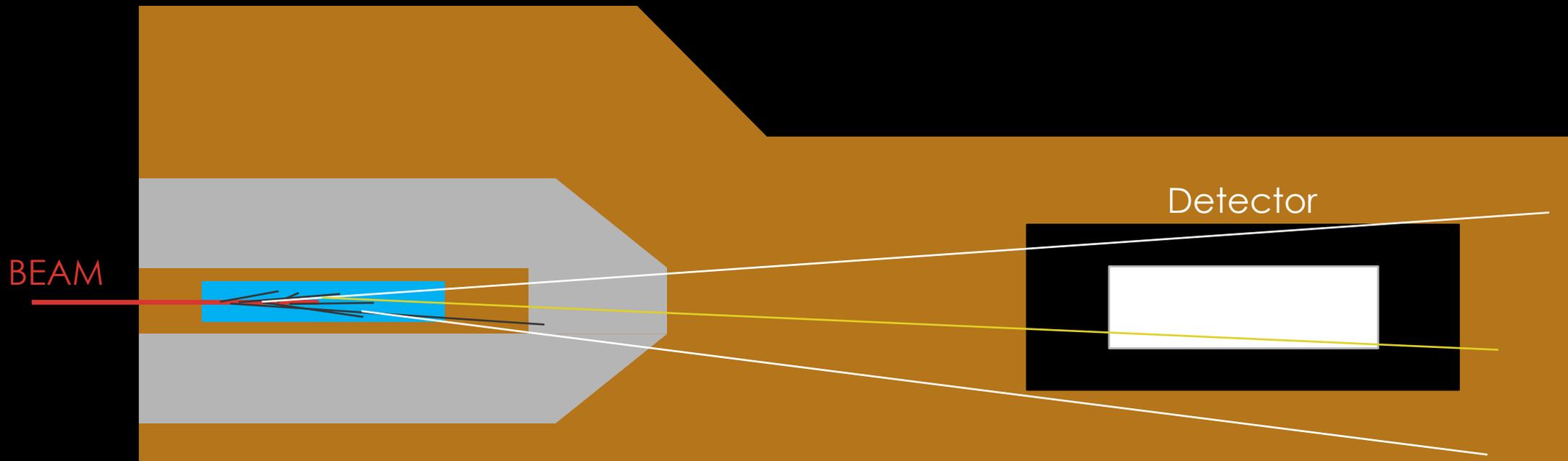


Ricerca agli acceleratori

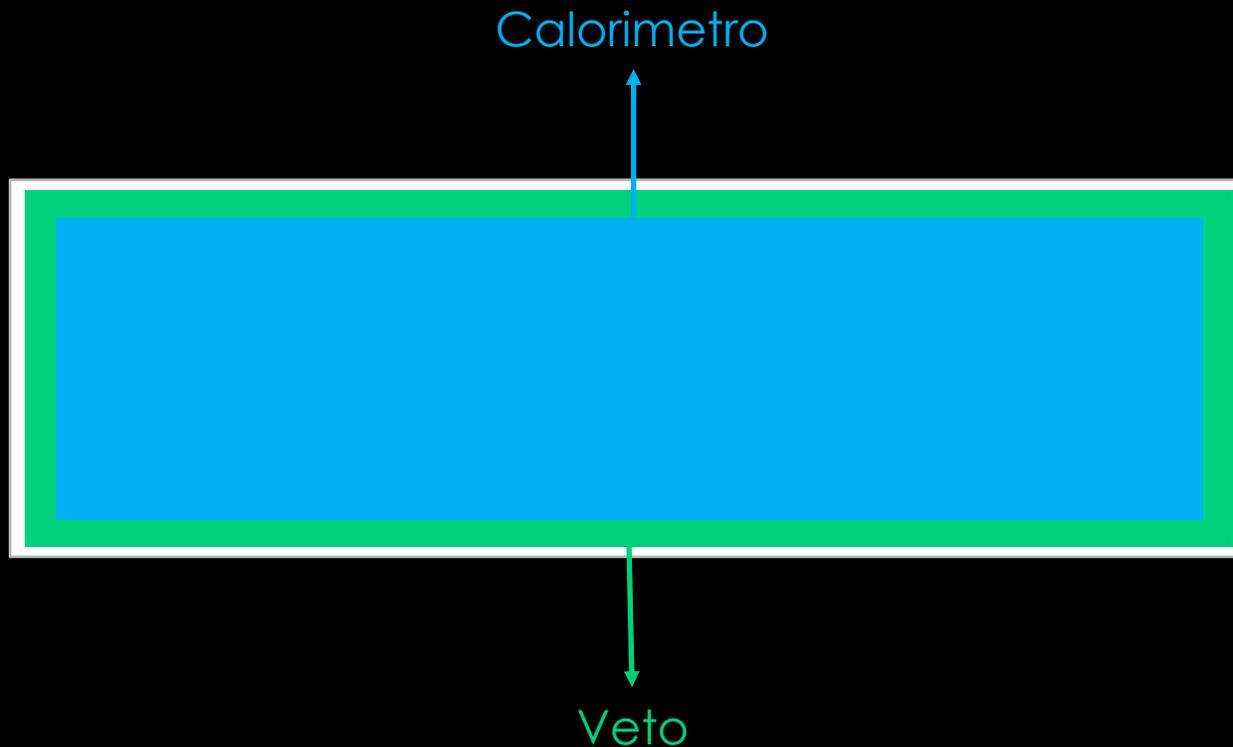
BEAM DUMP EXPERIMENT



BEAM DUMP EXPERIMENT



BEAM DUMP EXPERIMENT



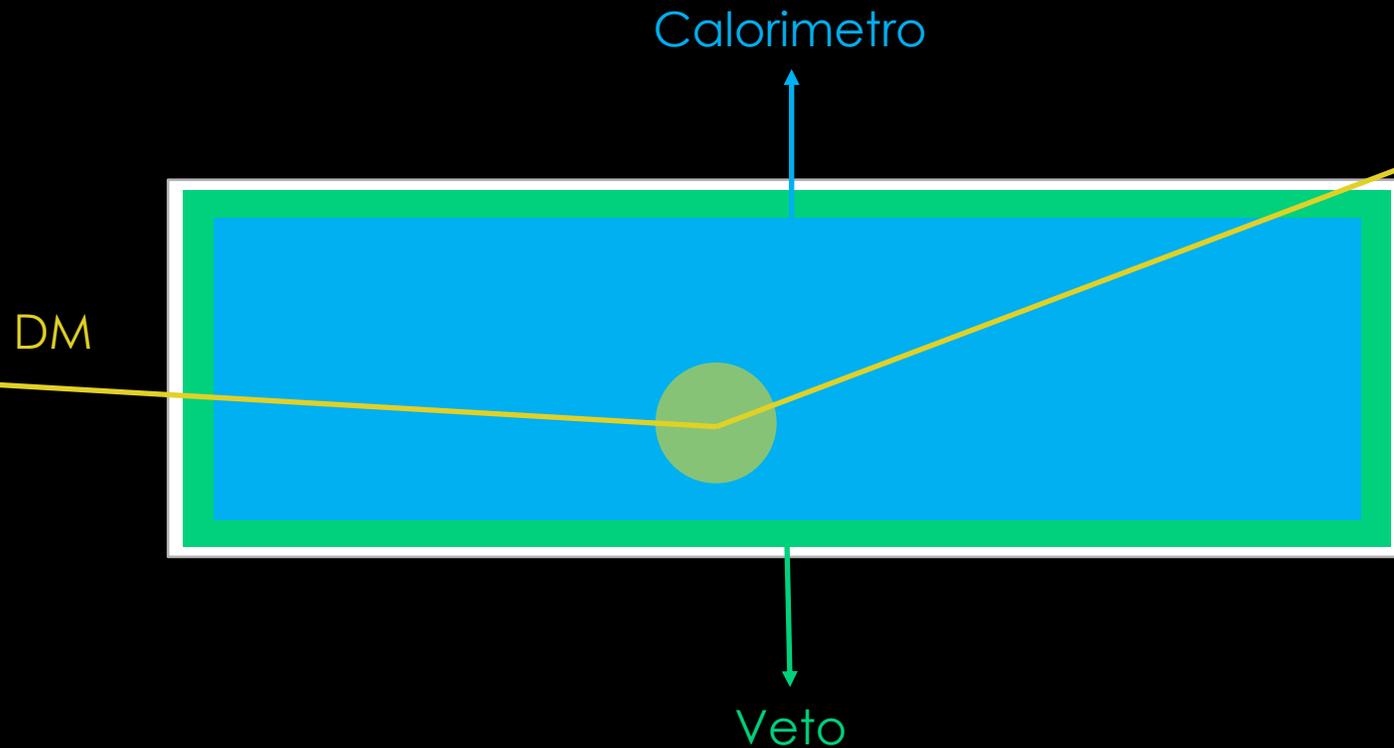
Calorimetro :

- Materiale ad alta densità
- Rivelazione segnale (sciame EM)

Veto :

- Materiale con alta resa di luce
- Identificazione particelle cariche

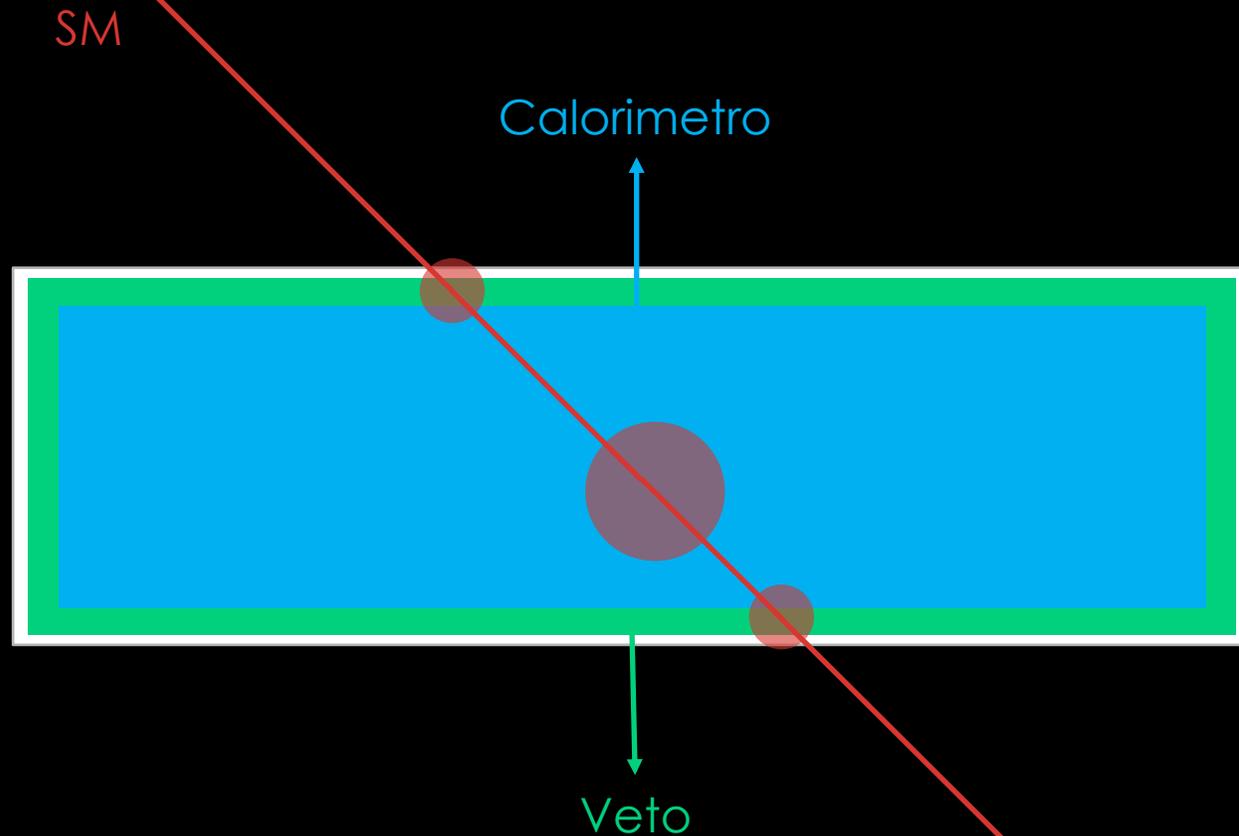
BEAM DUMP EXPERIMENT



Segnale DM:

- Deposito di energia nel calorimetro
- Nessun segnale nel veto

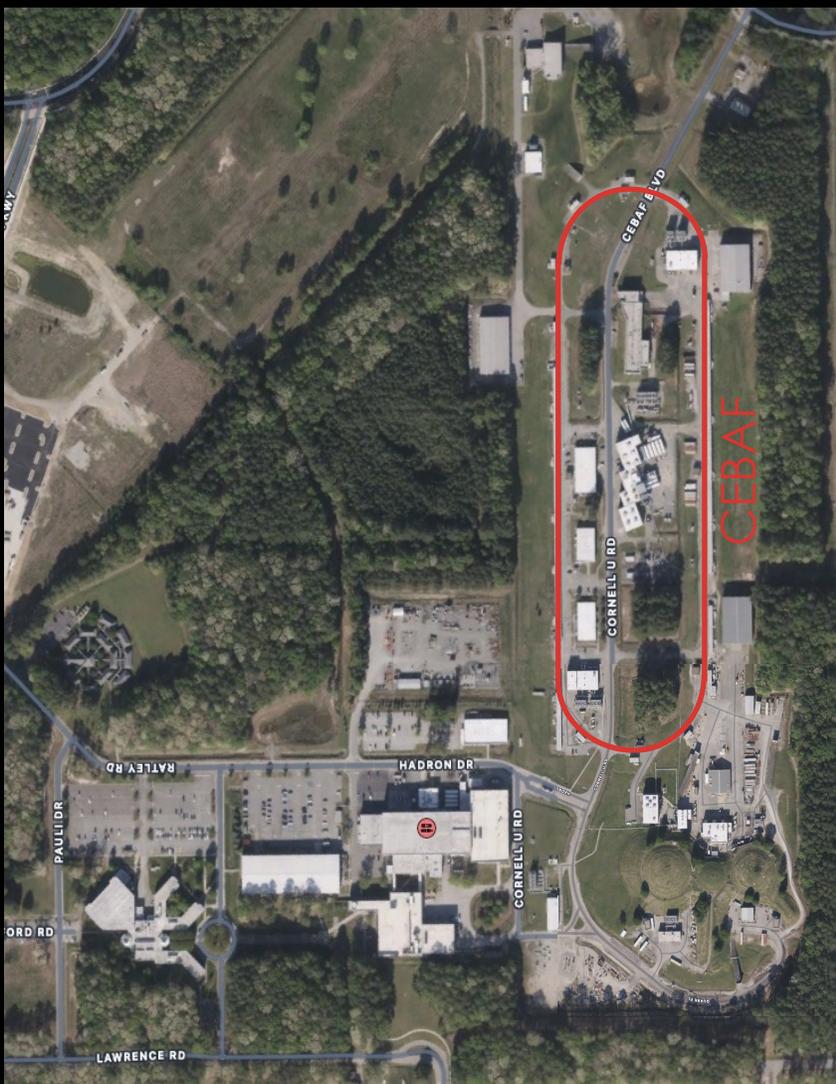
BEAM DUMP EXPERIMENT



Segnale SM:

- Deposito di energia nel calorimetro
- Segnale nel veto

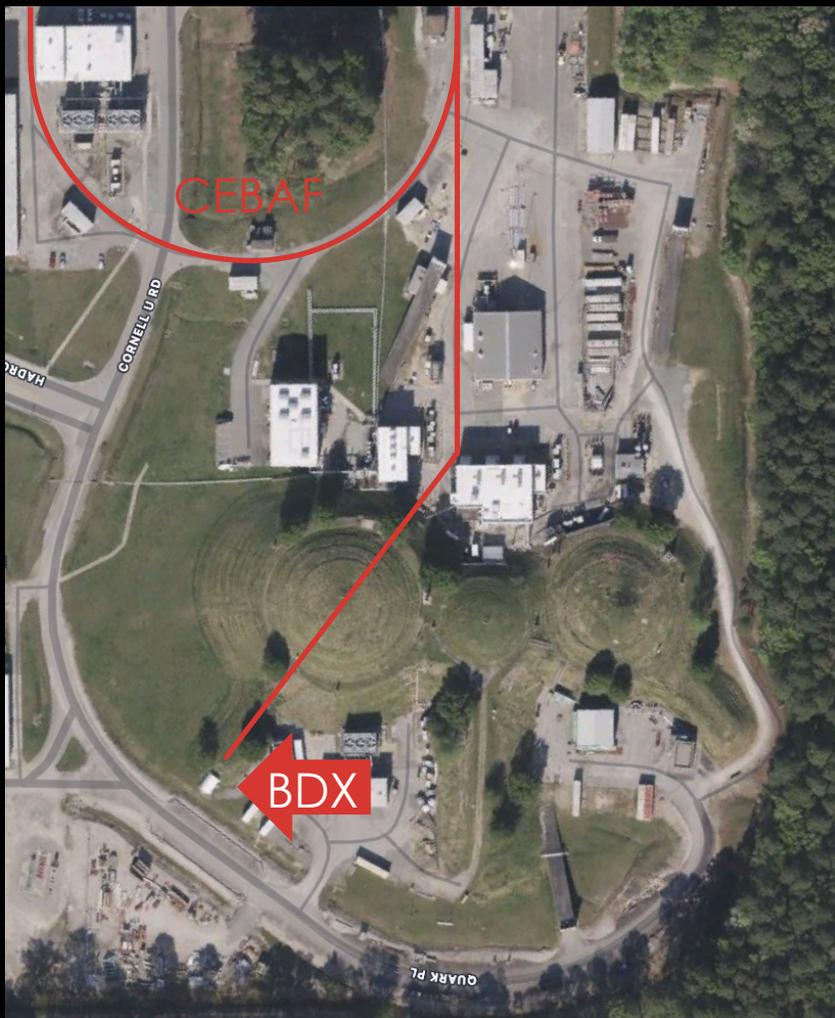
→ Facile reiezione di eventi dello SM



Beam Dump eXperiment

- Futuro Beam Dump experiment al JLab
- Fascio: elettroni fino a 11 GeV
- Altissima intensità ($65 \mu\text{A}$)
- Statistica attesa: 10^{22} EOT
- Inizio presa dati: 2026

BDX



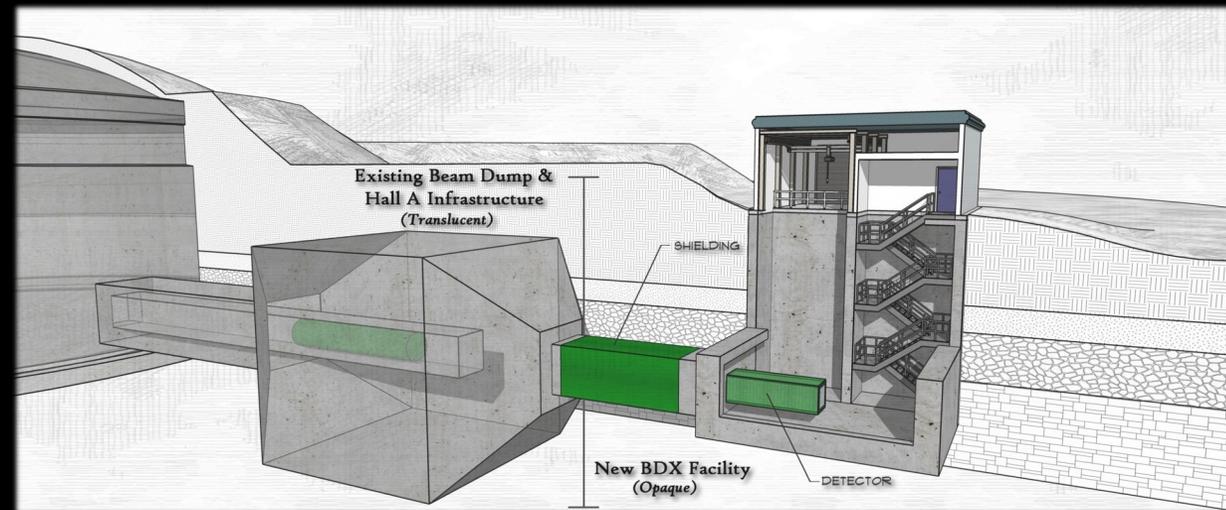
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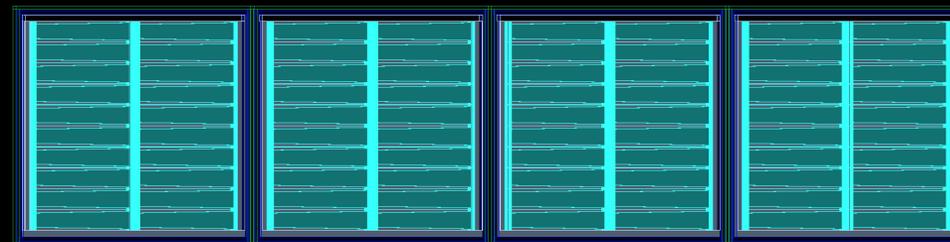
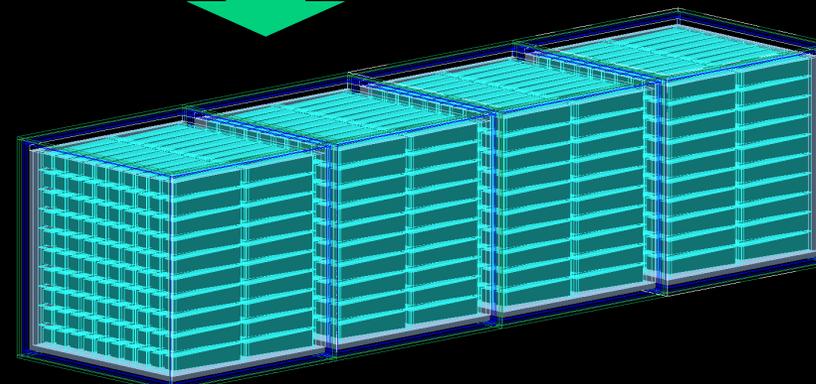
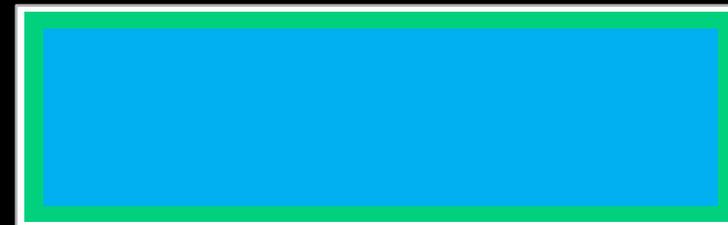
BDX

Calorimetro elettromagnetico

- 800 cristalli di CsI letti da SiPM
- Design modulare, 4 moduli da 2 matrici di 10x10 cristalli

Veto

- Strato interno passivo di Pb
- Due strati attivi di scintillatore plastico
- Ogni modulo è circondato dal veto



BDX-MINI



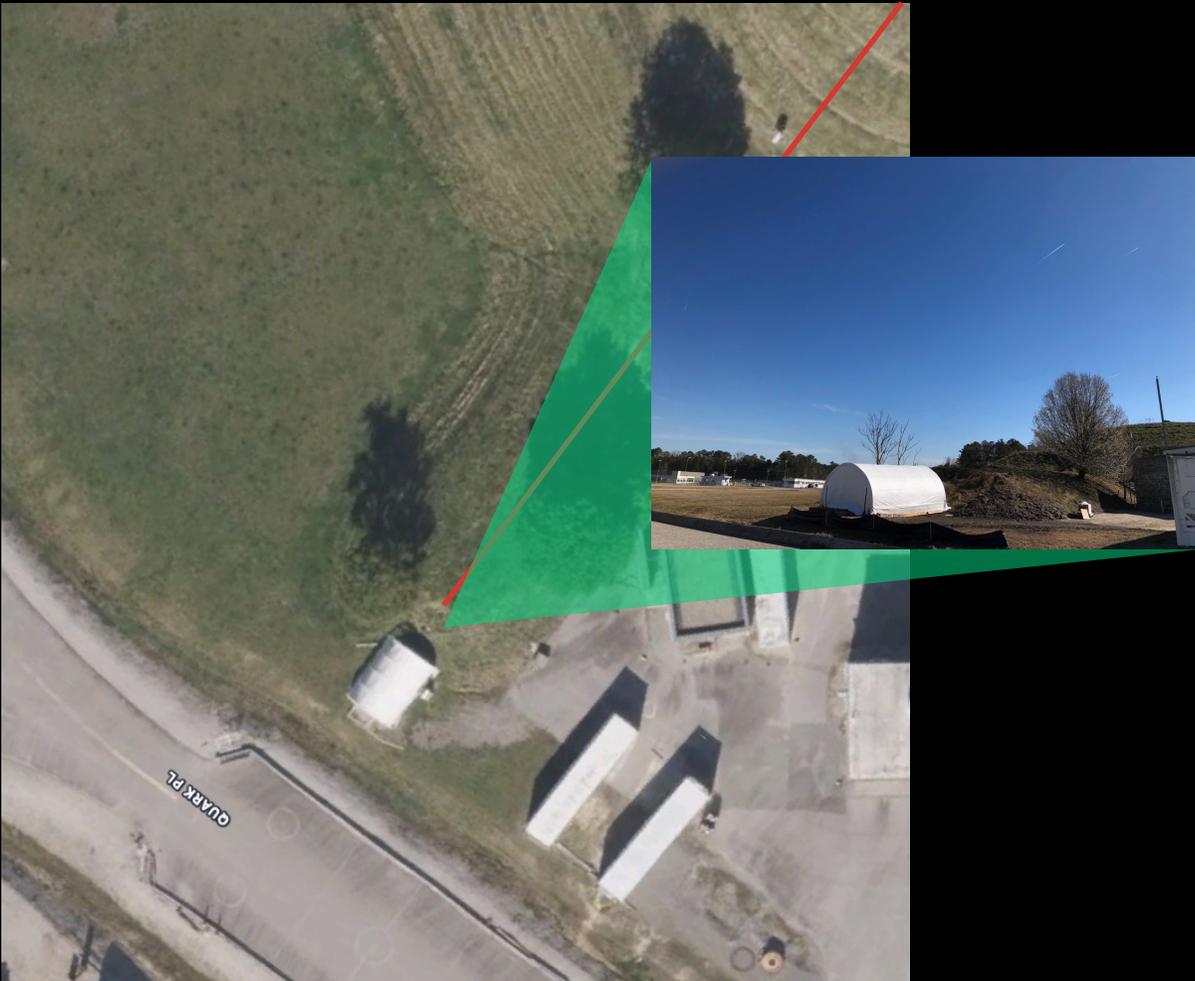
Versione pilota di BDX

- Fascio di elettroni a 2.56 GeV
- Corrente fino a 150 μA
- Misura alternando fascio acceso e spento
- Accumulati 2.54×10^{21} EOT
- Misura fondo cosmico con dati a fascio spento

BDX-MINI

Versione pilota di BDX

- Presa dati: primavera-estate 2020
- Fascio di elettroni a 2.56 GeV
- Corrente fino a 150 μA
- Accumulati 2.54×10^{21} EOT
- Misura fondo cosmico con dati a fascio spento



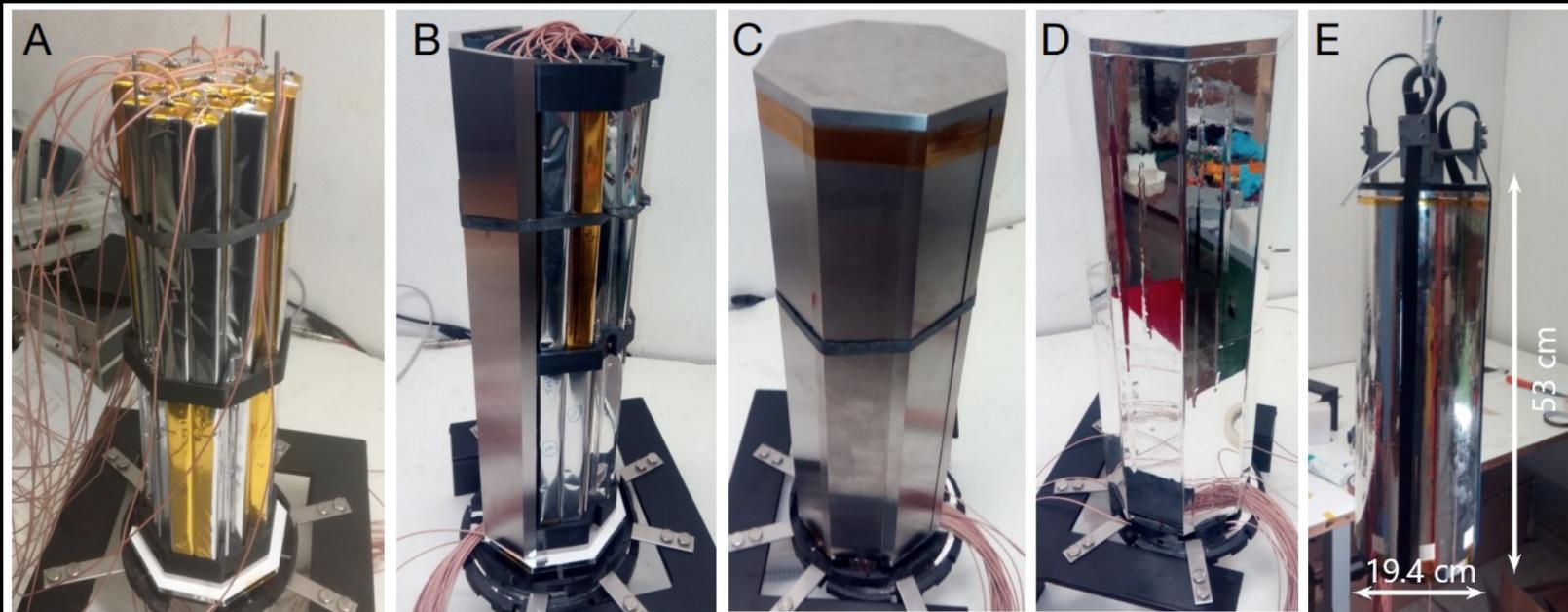
BDX-MINI

Calorimetro:

- 44 cristalli PbWO_4

Veto:

- Shielding interno di tungsteno
- Scintillatori plastici cilindrico e ottagonale



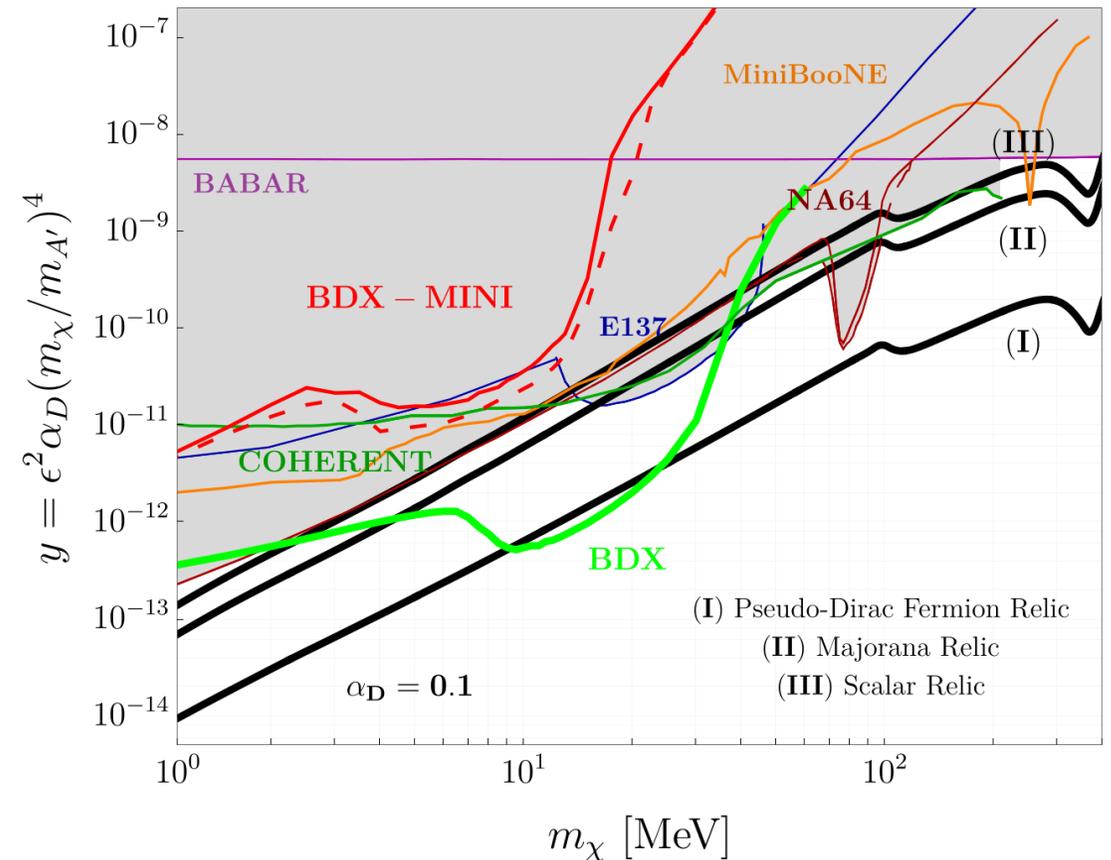
BDX-MINI

Nessun eccesso di eventi nei dati a fascio acceso:

- $N_{on} = 3623$
- $N_{off} = 3822$

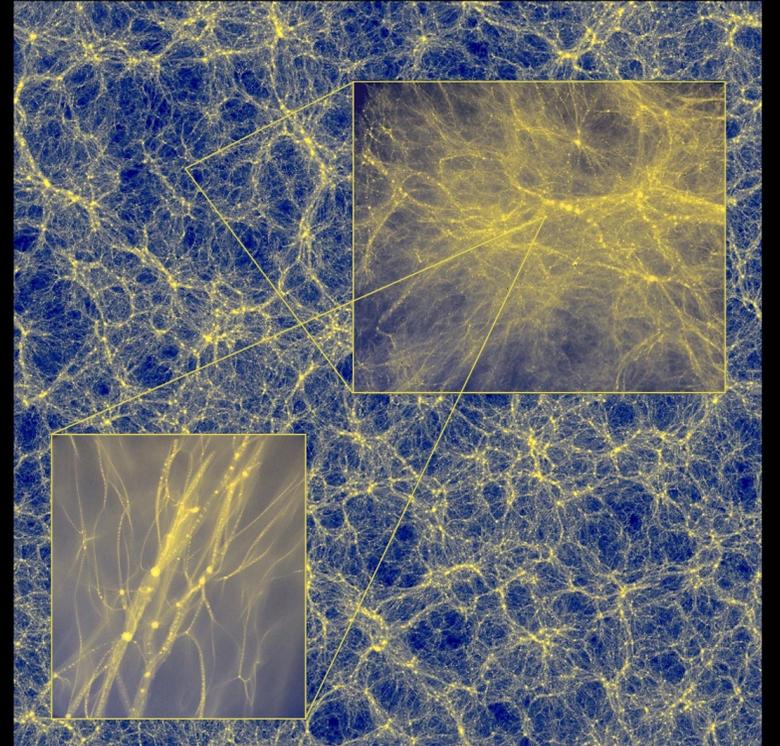
Valutazione limite esclusione DM

BDX sarà in grado di sondare nuove regioni



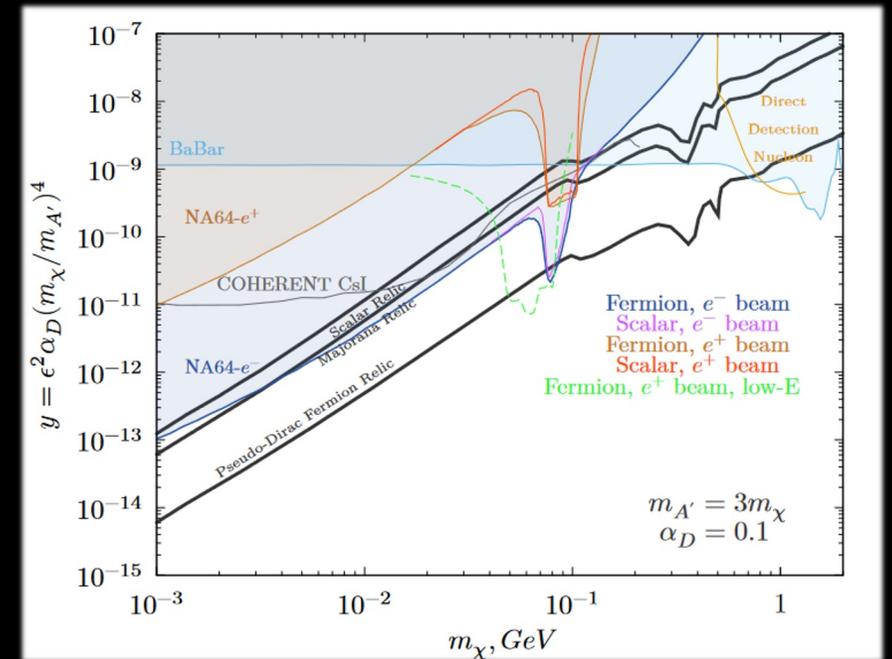
CONCLUSIONI

- Misure cosmologiche suggeriscono l'esistenza di Dark Matter



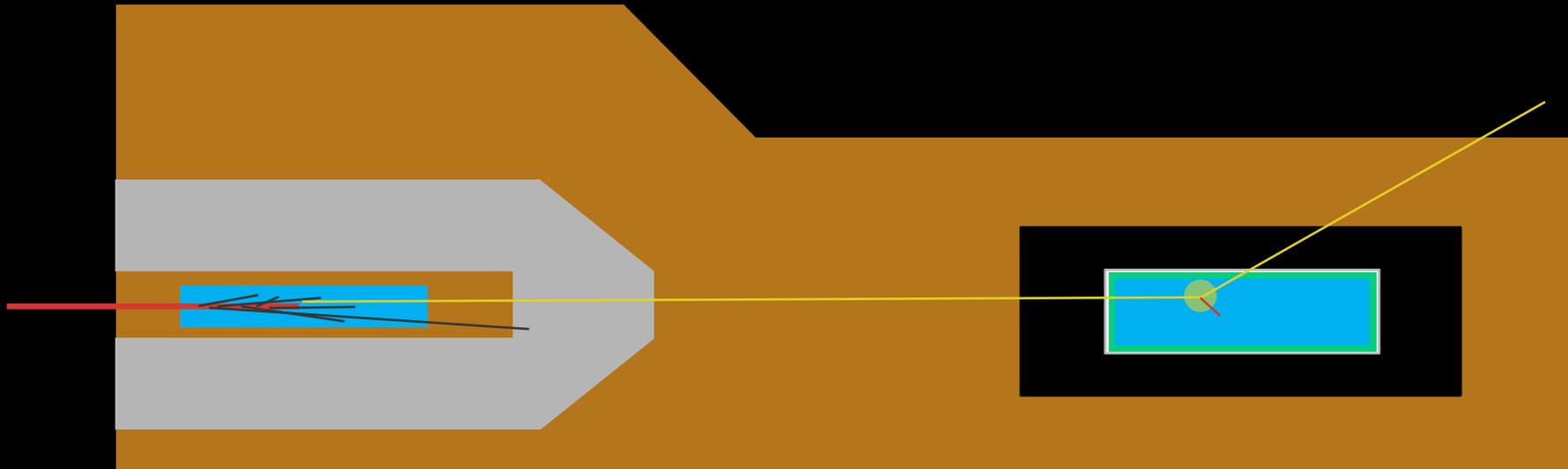
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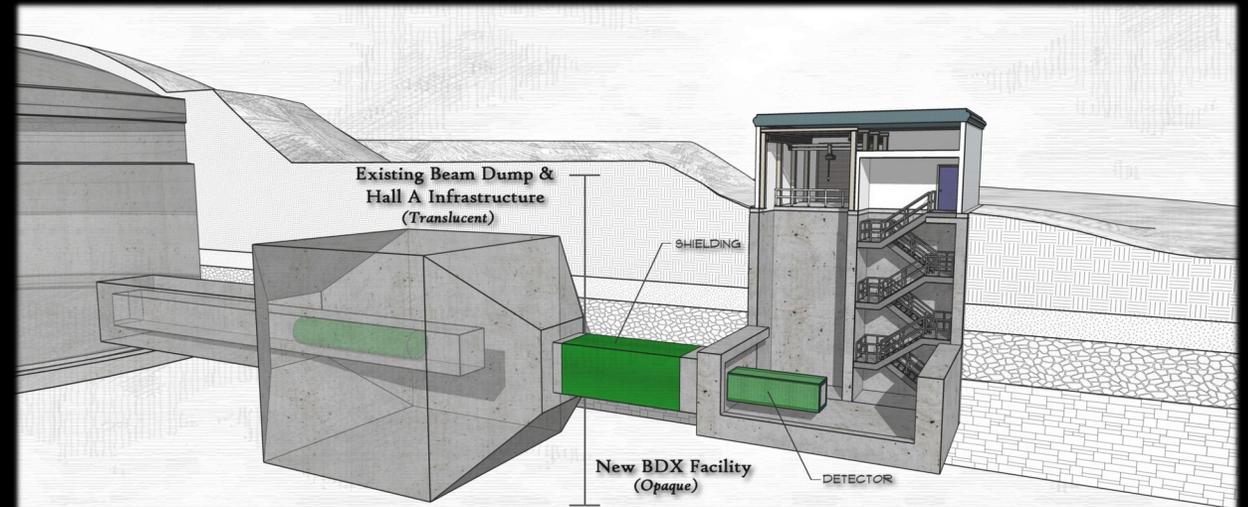
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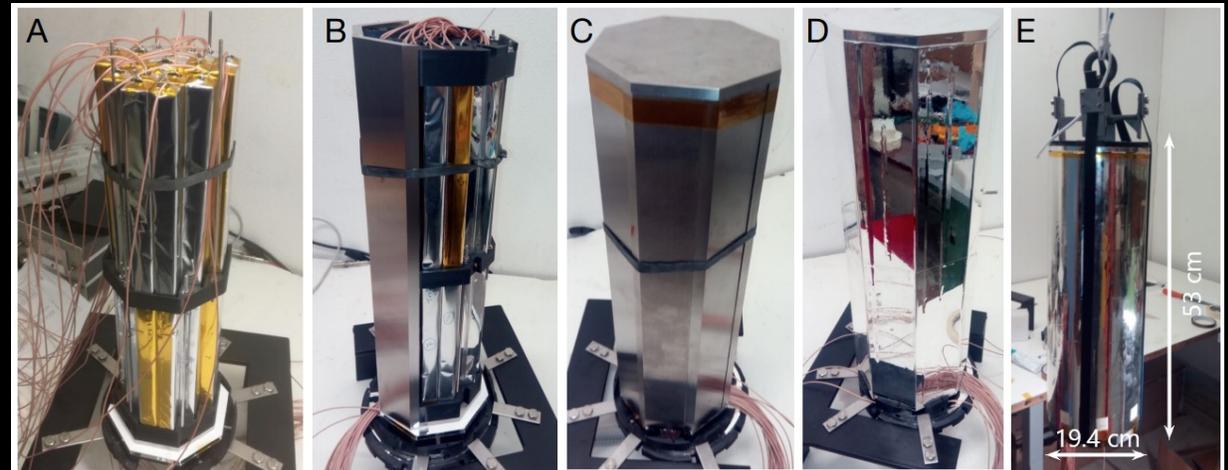
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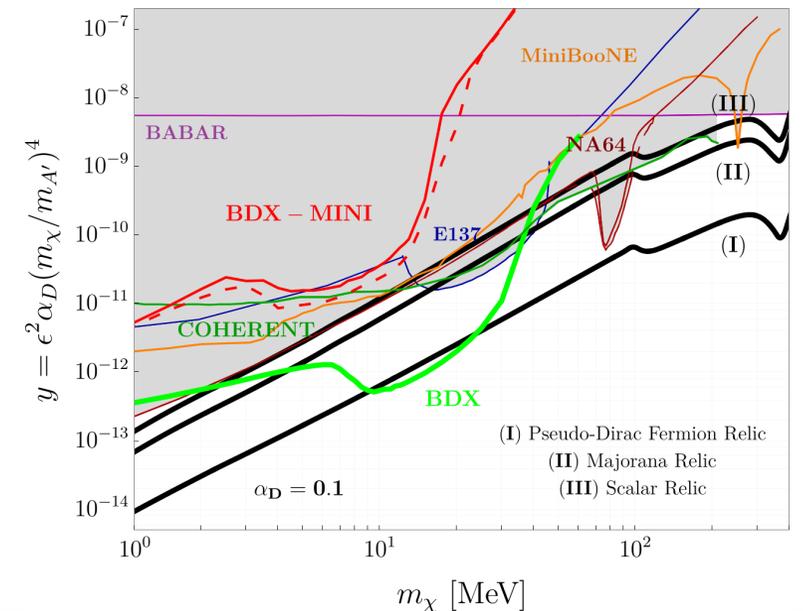
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- *Beam dump experiment* permetteranno di studiare zone ancora inesplorate dello spazio dei parametri della LDM





FINE

(?)