iDMEu:
Initiative for Dark Matter in Europe and Beyond

Webpage: https://indico.cern.ch/event/869195/

iDMEu proponents:

Marco Cirelli (LPTHE, Paris), Elena Cuoco (EGO), Caterina Doglioni (Lund U.),
Gaia Lanfranchi (INFN-LNF) Jocelyn Monroe (Royal Holloway, London),
Silvia Pascoli (Durham U., UK) , Federica Petricca (Max Planck, Munchen),
Florian Reindl (Vienna U.)

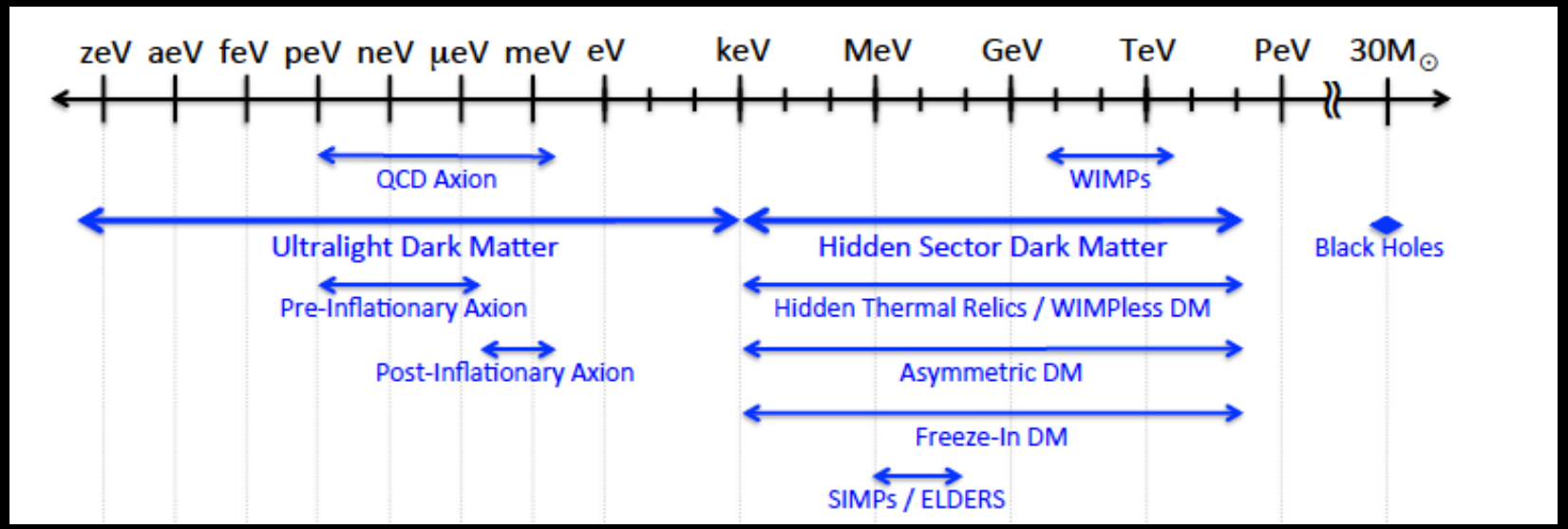
For a complete view of the physics case see talk at ICHEP:
https://indico.cern.ch/event/868940/contributions/3814888/attachments/2080826/3497817/iDMEu_ICHEP2020_Lanfranchi_v2.pdf

Why?

[why an EoI on Dark Matter ?]

Dark Matter: Where to start looking ? Very little clue on the mass scale…

Too small mass
→ won't fit in galaxy



From MACHOs searches

Cosmic Visions, arXiv:1707.04591

Going beyond the WIMP paradigm → ~ 80 orders of magnitude to explore

Synergy and complementarity among a great variety of experimental facilities are paramount, calling for a deep collaboration and cross-fertilization across different communities.

Why?

[why an EoI on Dark Matter?]

iDMEu EoI: a joint-venture ECFA-APPEC-NuPECC

JENAS EoI: Initiative for Dark Matter in Europe and beyond: Towards facilitating communication and result sharing in the Dark Matter community (iDMEu)

Main reasons:

The broad community working on dark matter is active and diversified.
It includes particle physics theorists and astrophysicists with a wide range of interests, as well as particle physics experimentalists focusing on collider, fixed-target, beam-dump, direct and indirect DM detection experiments, as well as dedicated axion/ALP, and neutrino experiments.
A broad approach to dark matter research is necessary given the nature of the challenge.

Main goals: **build a permanent platform** where different DM communities can discuss, exchange results, and exploit cross-fertilization opportunities for mutual benefits.

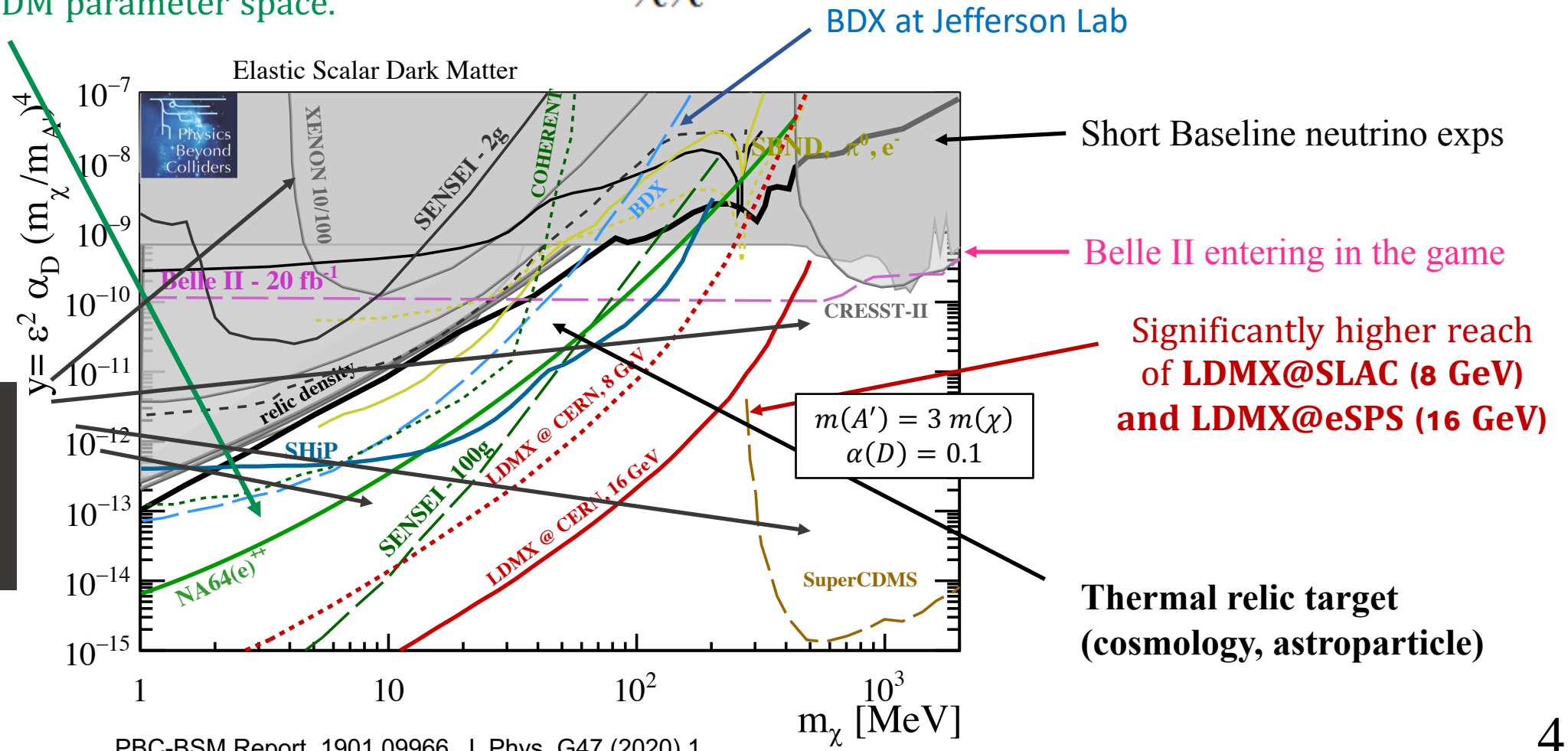
Example of synergy across communities: MeV-GeV range

Light DM with thermal origin via Vector Portal

[accelerator-based exps vs DM direct detection experiments vs cosmological bounds]

Unique **NA64++(e)** short term opportunity to explore relevant DM parameter space.

$$A' \rightarrow \chi\chi$$



Some of the LDM **direct detection experiments** [SuperCDMS, CRESST-II, XENON, SENSEI, etc.]

PBC-BSM Report, 1901.09966, J. Phys. G47 (2020) 1

Example of complementarity across communities: sub-eV vs MeV-GeV

axion/ALP with photon coupling

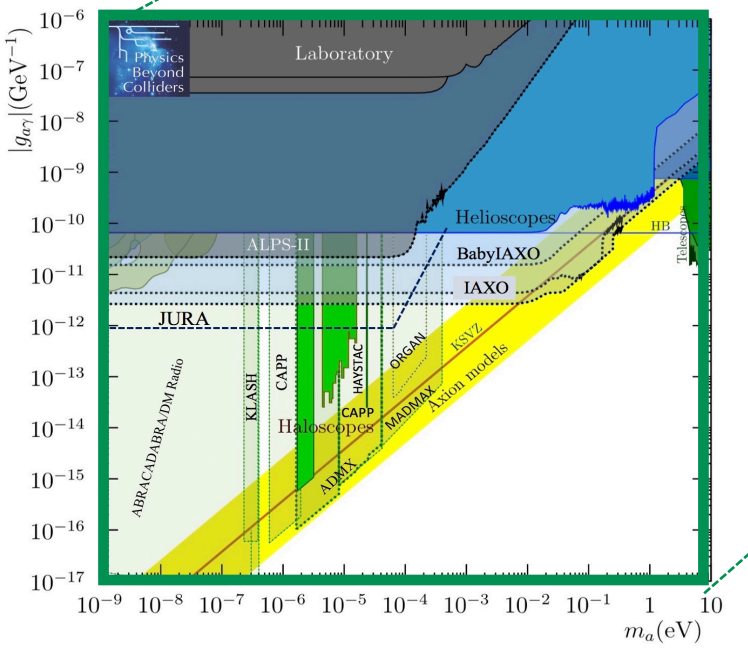
[accelerator-based exps vs axion/ALP exps vs astroparticle bounds]

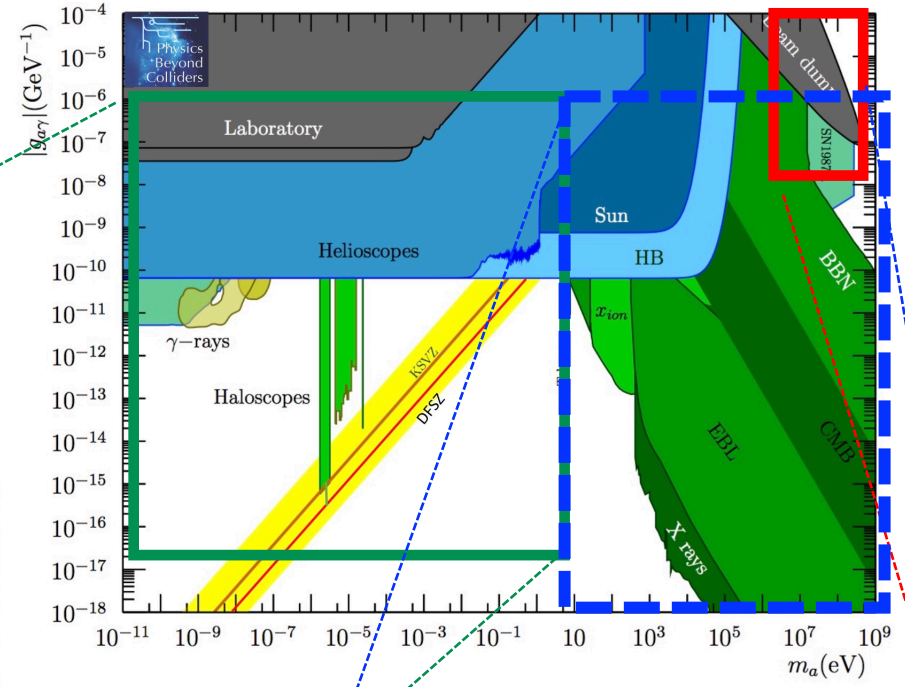
sub-eV range accessible at helioscopes and haloscopes

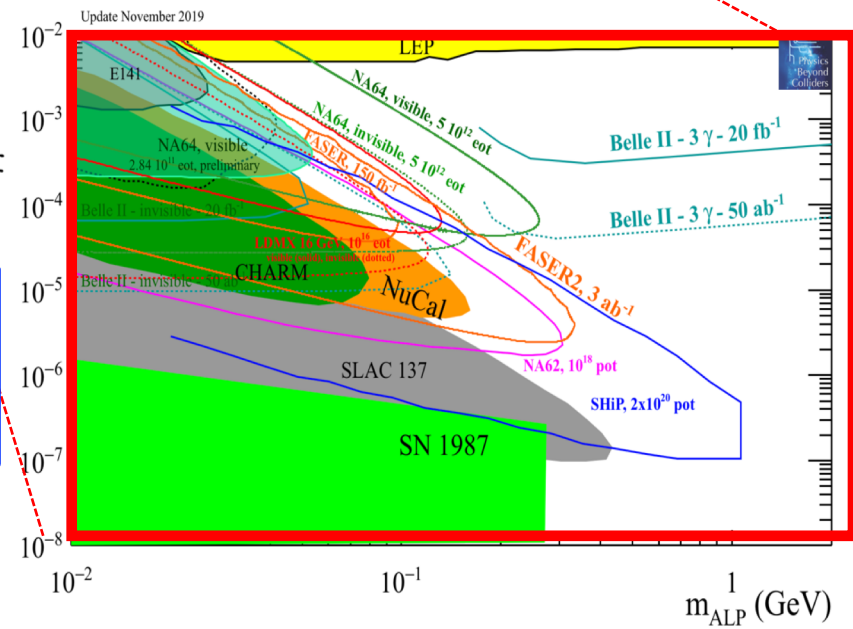
MeV-10 GeV range accessible at accelerator based experiments

Here axions/ALPs can be DM

Here ALPs can be SM-DM mediators







Astroparticle realm:
BBN, CMB, X-rays, SN1987,
Solar lifetime, etc..

ADMX, CAST and MADMAX, ABRACADABRA, IAXO,….

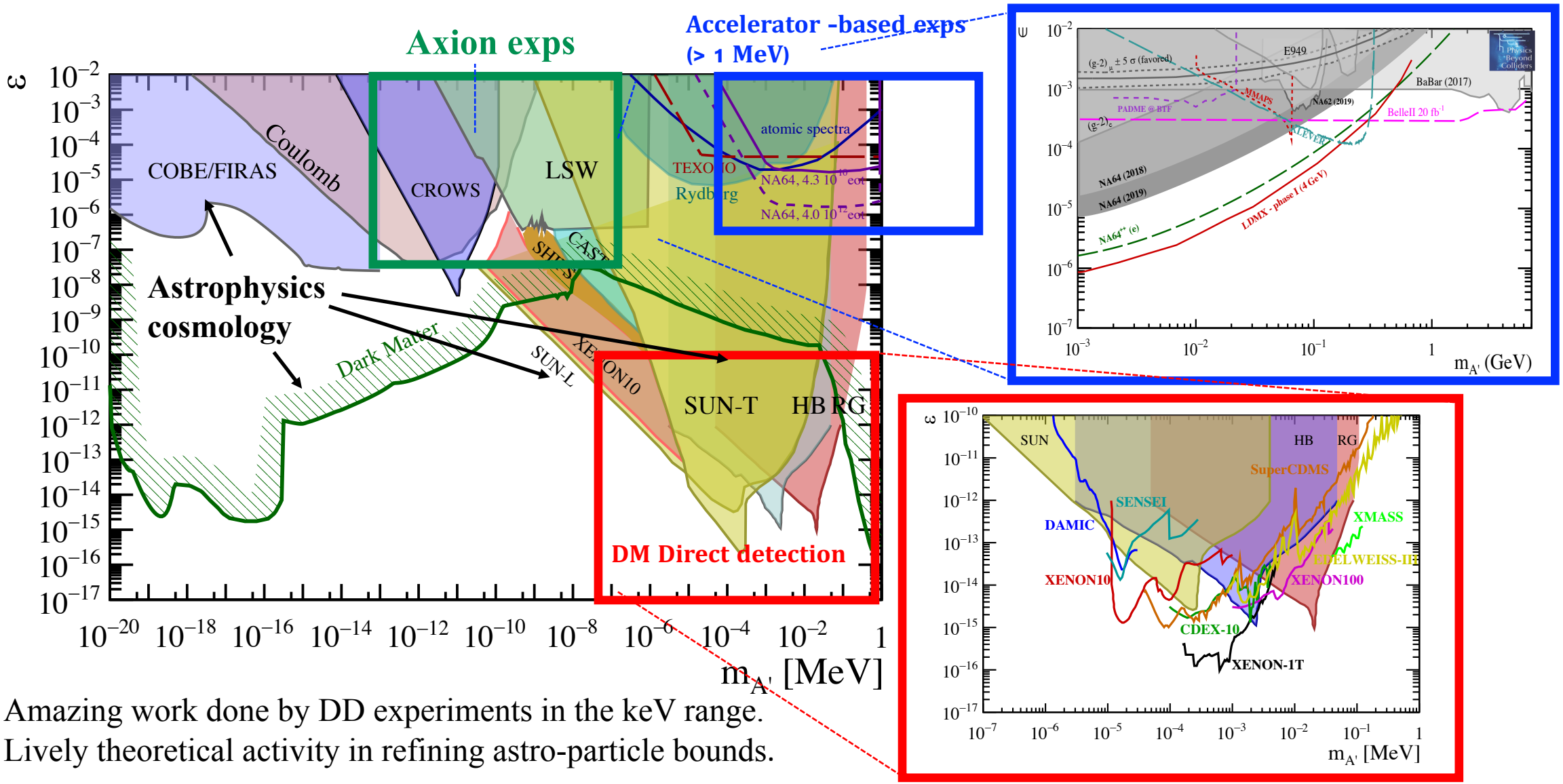
PBC-BSM Report, 1901.09966, J. Phys. G47 (2020) 1

NA62, NA64, FASER, Belle II, ….

Example of complementarity across communities: < 1 MeV

Dark Photon as Light DM candidate (mass < 1 MeV)

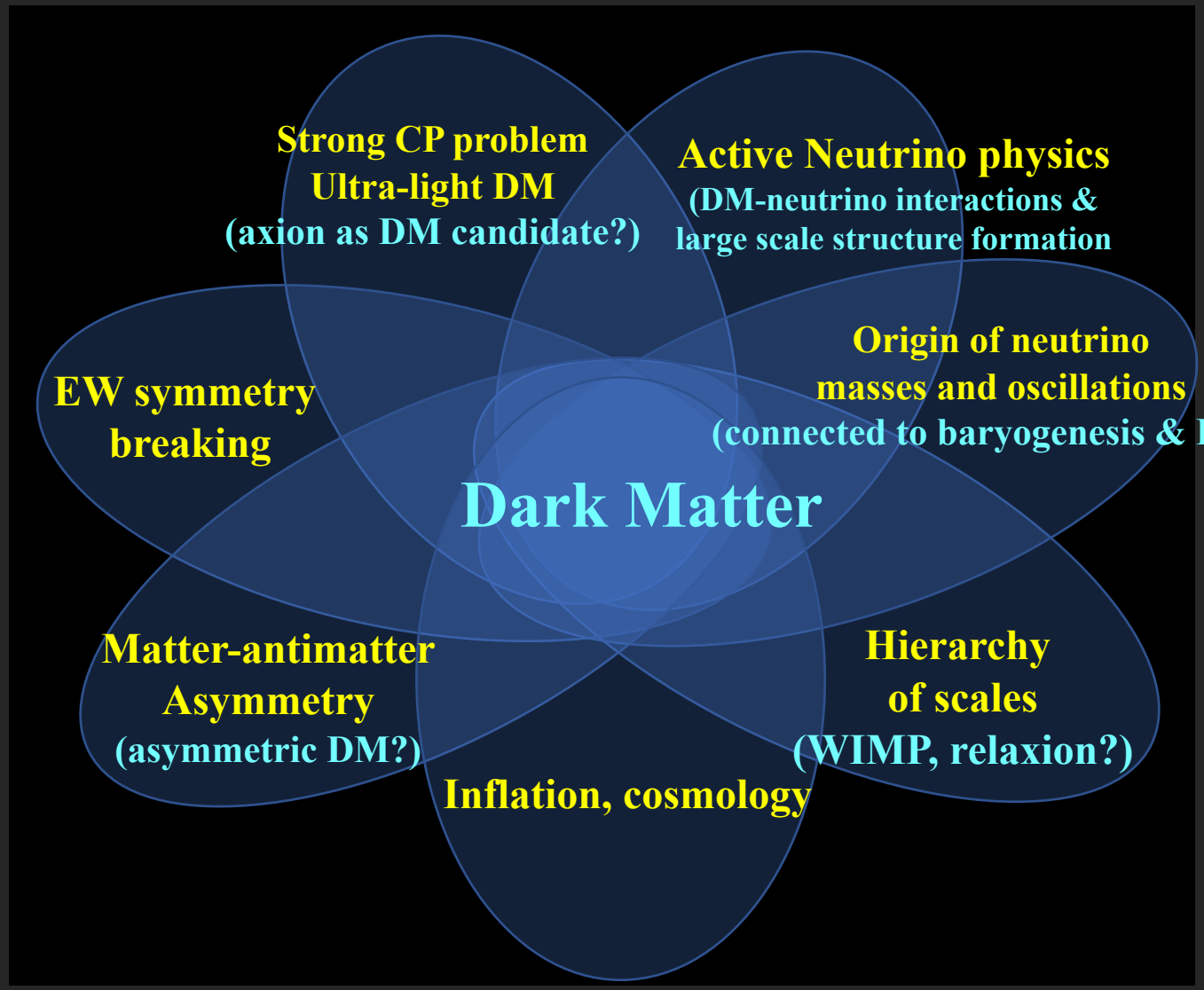
[accelerator-based exps vs DM direct detection vs astroparticle bounds]

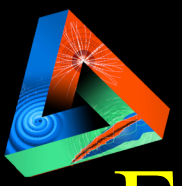


Amazing work done by DD experiments in the keV range.
Lively theoretical activity in refining astro-particle bounds.

Dark Matter and fundamental physics questions

Fundamental physics questions might be naturally intertwined.





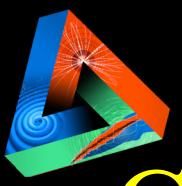
First step: iDMEu kick-off meeting

Talks for each community with a concrete set of questions to be addressed, such as:

- Brief report on status
- Problems in comparison of results within community (assumptions, statistics ...)?
- Problems in comparison of results outside community?
- Not only comparison, but (re-)interpretation with different models
- How are data shared within the community?
- What inputs from other communities are or could be used?
- What do you expect from this event: wishlist.

Have such talks from theory and experimental perspective

To be held either online in Winter or (we hope) in person in Spring 2021



Communities that will be contacted / involved

- ✓ - Physics Beyond Colliders
- ✓ - Long Lived Particles Working Group / Community organizers
- ✓ - LHC Dark Matter Working Group organizers
- ✓ - Axion community (European Strategy Input #112 on WISPs)
- ✓ - Direct detection community, via APPEC DM subcommittee
- ✓ - Indirect detection community - is there an APPEC super-partes contact?
- ✓ - Astrophysics and cosmology, via EuCAPT / APPEC
- ✓ - Particle and astroparticle theory:

  Strong involvement of the theoretical astroparticle and cosmology community, thanks to the link with EuCAPT which has endorsed iDMEu.

The iDMEu homepage: a meta-repository for the community

Meta-repository: don't duplicate what exists already, it's mostly going to be links to existing resources, along the lines of Neutrino Unbound http://www.nu.to.infn.it.

The iDMEu homepage could have a number of tabs containing information about:

1. Experiments and telescopes, with name / homepage / description / timeline / results / contact
2. Repositories of results
   a. Examples: DMTools, limitPlotter (direct detection), HEPData (colliders)
3. Data (at a later stage)
   Example of Cosmic Ray DataBase https://lpsc.in2p3.fr/crdb/
   People can submit material (data), and it is inserted in database after moderation
4. Theory & astro tools
   Example: DarkSUSY, Micromegas, GalProp…
5. Scientific events (e.g. workshops and conferences)
6. Outreach
   Events (e.g. Dark Matter day)
   Resources (e.g. presentations and videos)

This is the first time we meet the panel and the ECFA/APPEC/NuPECC representatives, so this is our chance to start a dialogue

Your questions?