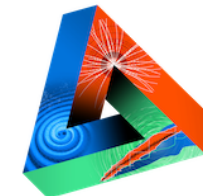




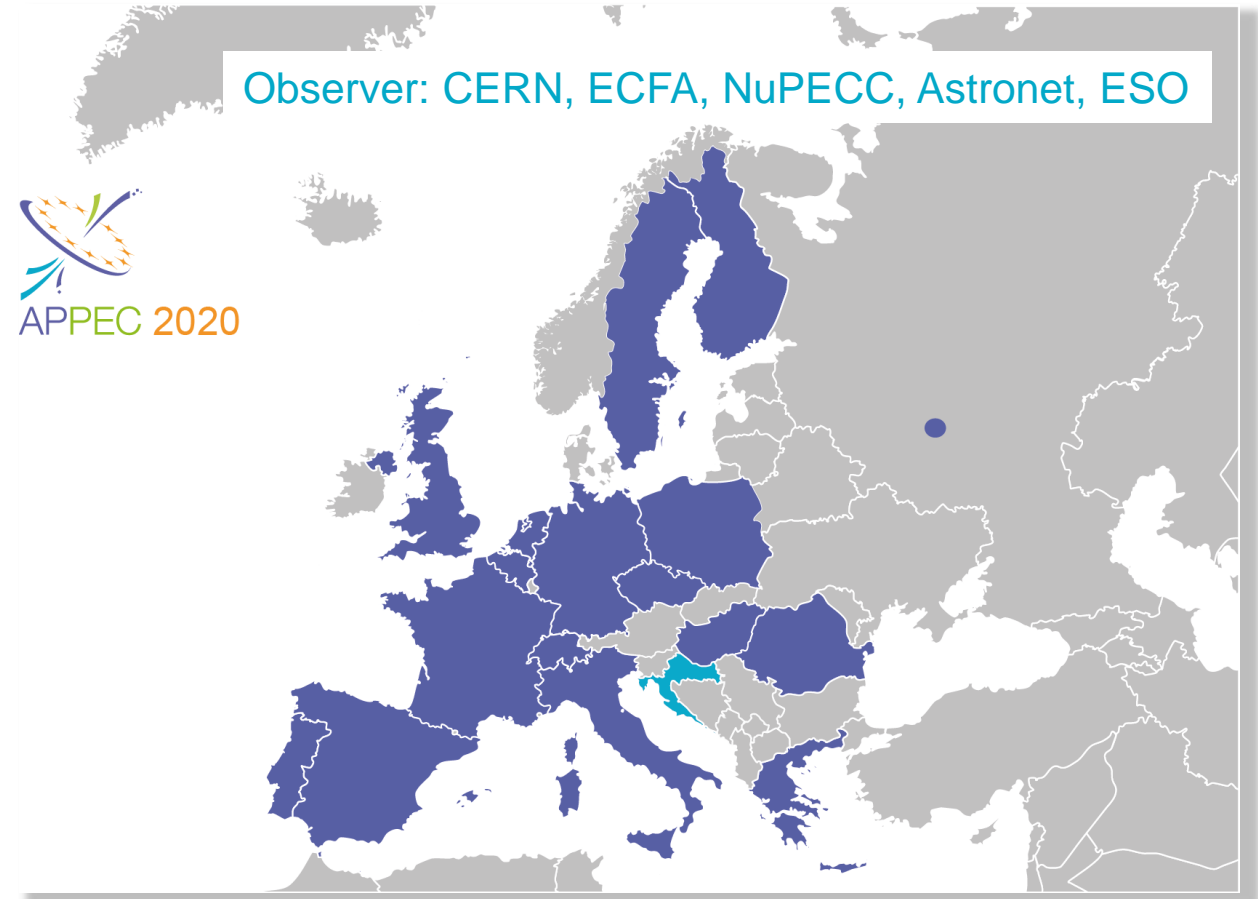
Astroparticle Physics European Consortium

Andreas Haungs | KIT – Institute for Astroparticle Physics
JENAA-EoI: iDMEu kick-off meeting | Online | 10-12 May 2021



JENAA
Joint ECFA-NuPECC-APPEC Activities

- Is the **A**stro**P**article **P**hysics **E**uropean **C**onsortium
- An international coordinating structure
- Founded in 2012
- APPEC boards:
 - General Assembly
 - Chair: A. Haungs (KIT);
 - Vice-Chair: A. Kouchner (APC)
 - Scientific Advisory Committee
 - Chair: S. de Jong (Nijmegen);
 - Vice-Chair: S. Pascoli (Durham)
 - Joint Secretariat
 - General Secretary: K. Henjes-Kunst (DESY)
- Has at the moment
 - 17 member countries
 - a budget of 70k€/a



APPEC tasks



Guarantee **Coordination** of European Astroparticle Physics in Europe between **funding agencies** and **visibility** at Ministry level through:

- Structured **scientific advising** (SAC, dedicated panels to specific challenges)
- Development and update of **roadmaps** based on scientific strategies and financial considerations
- Establish **relations** with other bodies in **companion fields**
- Express **collective views** on APP in international fora
- Organise **Town meetings**
- Support relevant **meetings/schools** of the community
- Organize **TechFora** and Open Calls
- Engagement with **society** (Outreach, Education,...)
- Contribute to **Working Groups** (R&D panel, Individual Recognition, Early Scientist career, Science WGs) and **Organisations** (EuCAPT...) and **JENA** to support the community



APPEC Roadmaps

<https://www.appec.org/roadmap>



2008



2011



2017



APPEC scientific topics

- High-energy gamma rays
- High-energy neutrinos
- High-energy cosmic rays
- Gravitational waves
- Dark Matter
- Neutrino mass and nature
- Neutrino mixing and mass hierarchy
- Cosmic microwave background
- Dark Energy
- Astroparticle theory
- Detector R&D
- Computing and data policies
- Unique infrastructures



APPEC Roadmap 2017-2026

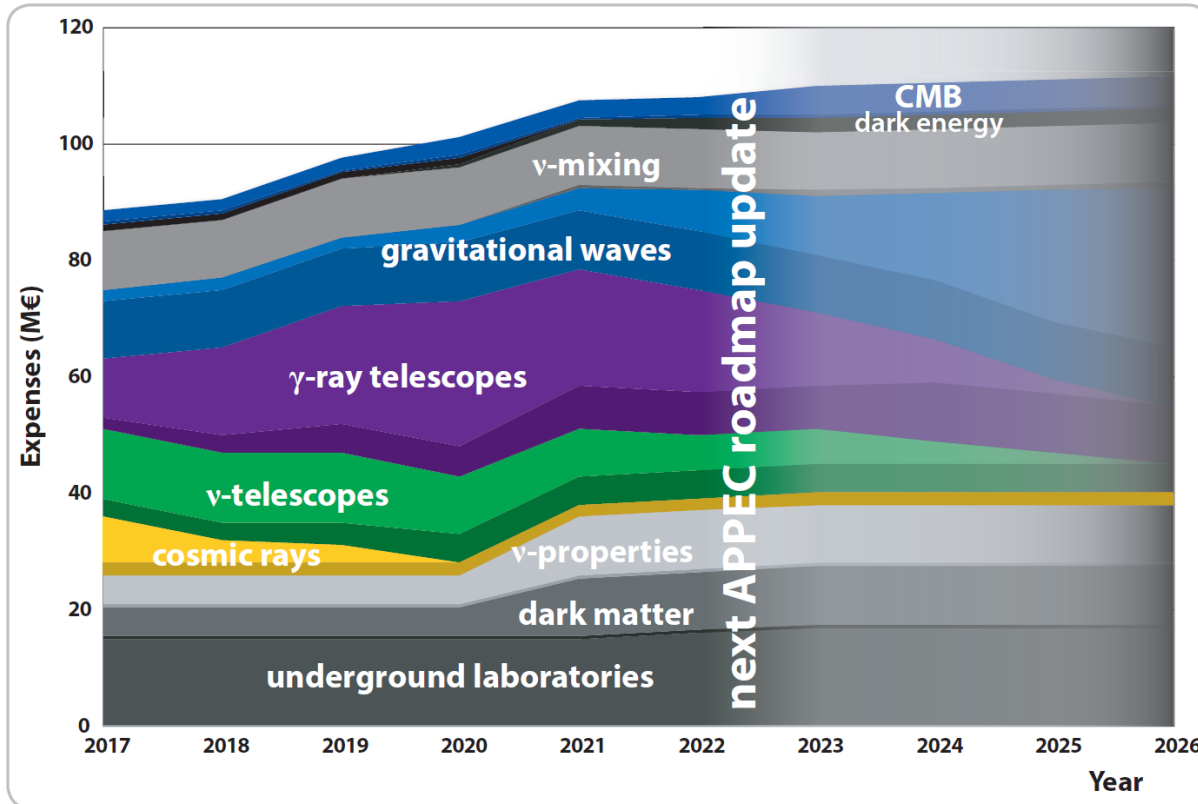


Dark Matter Recommendations (2017):

APPEC encourages the continuation of a diverse and vibrant programme (including experiments as well as detector R&D) searching for WIMPs and non-WIMP Dark Matter. With its global partners, APPEC aims to converge around 2019 on a strategy aimed at realising worldwide at least one 'ultimate' Dark Matter detector based on xenon (in the order of 50 tons) and one based on argon (in the order of 300 tons), as advocated respectively by DARWIN and Argo.



Midterm Evaluation of the Roadmap



From Roadmap 2017: Projected annual capital investment

- A resource aware roadmap (darker colors also show M&O of RI)
- Now: Preparation of the roadmap update
- Direct Dark Matter working group
- Double Beta Decay APPEC Sub-Committee
- Support ESFRI projects (e.g. for Einstein Telescope)
- Goals
 - Identify developments and new topics
 - Update addendum to the roadmap
- Timeline
 - Provide information to the communities early next year
 - Discussion at the Town Meeting in spring 2022 (Berlin)

Midterm Evaluation of the Roadmap



Direct Detection of Dark Matter

- APPEC SAC Subcommittee
- Report: <https://www.appec.org/documents>
- arXiv: <https://arxiv.org/abs/2104.07634>
- Recommendations:
 1. Priority of Dark Matter Search
 2. Diversified Approach Needed
 3. Direct search for WIMPs down to neutrino floor
 4. Coordinated detector R&D
 5. European Infrastructure for Underground Science
 6. Studying of the axion/ALPs mass range
 7. Continuation of diverse theoretical activity

Subcommittee:

Julien Billard (France) – EDELWEISS
Mark Boulay (Canada) – DEAP-3600
Susana Cebrian (Spain) – ANAIS
Laura Covi (Germany) – theory
Giuliana Fiorillo (Italy) – DARKSIDE
Anne Green (UK) – theory
Joachim Kopp (Germany) – theory
Béla Majorovits (Germany) – MADMAX
Kimberly Palladino (USA → UK) – LZ
Federica Petricca (Germany) – CRESST
Leszek Roszkowski (Poland) – theory (chair)
Marc Schumann (Germany) – XENON

Recommendations of the Direct Dark Matter Sub-Committee

<https://www.appec.org/documents>



Recommendation 1. The search for dark matter with the aim of detecting a direct signal of DM particle interactions with a detector should be given top priority in astroparticle physics, and in all particle physics, and beyond, as a positive measurement will provide the most unambiguous confirmation of the particle nature of dark matter in the Universe.

Recommendation 2. The diversified approach to probe the broadest experimentally accessible ranges of particle mass and interactions is needed to ensure the most conservative and least assumption-dependent exploration of hypothetical candidates for cosmological dark matter or subdominant relics.

Recommendation 3. The experimental underground programmes with the best sensitivity to detect signals induced by dark matter WIMPs scattering off the target should receive enhanced support to continue efforts to reach down to the so-called neutrino floor on the shortest possible timescale.

Recommendation 4. European participation in DM search programmes and associated, often novel, R&D efforts, that currently do not offer the biggest improvement in sensitivity should continue and be encouraged with view of a long-term investment in the field and the promise of potential interdisciplinary benefits. We recommend that coordinated programmes are established for dark matter detector development.

Recommendations of the Direct Dark Matter Sub-Committee

<https://www.appec.org/documents>



Recommendation 5. The long-term future of underground science in Europe would strongly benefit from creating a distributed but integrated structure of underground laboratories for the needs of the forthcoming generation of new experiments, and beyond. This strategic initiative would be most efficiently implemented by forming the *European Laboratory of Underground Science*.

Recommendation 6. European-led efforts should focus on axion and ALPs mass ranges that are complementary to the established cavity approach and this is where European teams have a unique opportunity to secure the pioneering role in achieving sensitivities in axion/ALP mass ranges not yet explored by experiments conducted elsewhere. In parallel, R&D efforts to improve experimental sensitivity and to extend the accessible mass ranges should be supported.

Recommendation 7. Continuing dedicated and diverse theoretical activity should be encouraged not only in its own right but also as it provides some highly stimulating, and mutually beneficial, interdisciplinary environment for DM and new physics searches.

➔ APPEC discusses now strategy for the implementation of the recommendations!