APPEC

Astroparticle Physics European Consortium

Andreas Haungs | KIT – Institute for Astroparticle Physics

European Deep Underground Laboratories | LNGS | 28-29 April 2022

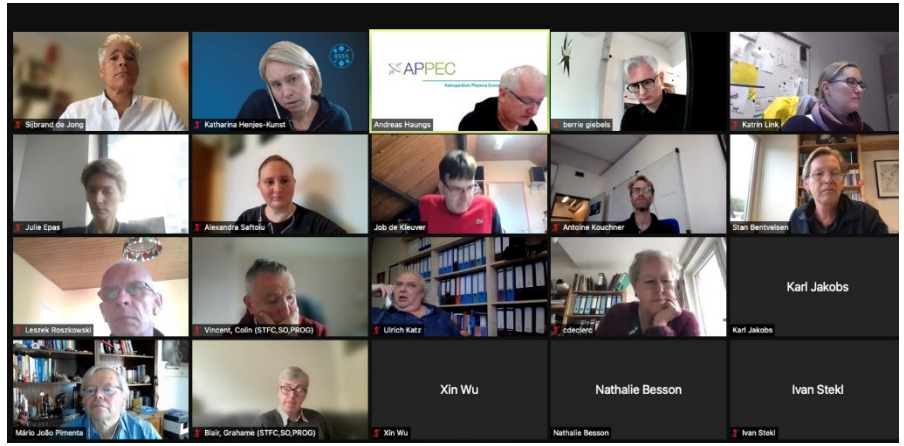
Workshop on EU Underground Laboratories

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
- Initiate activities within Horizon Europe
- Express collective views on APP in international fora
- Organize 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 Organizations (EuCAPT...) and JENA

to support the Astroparticle Physics community



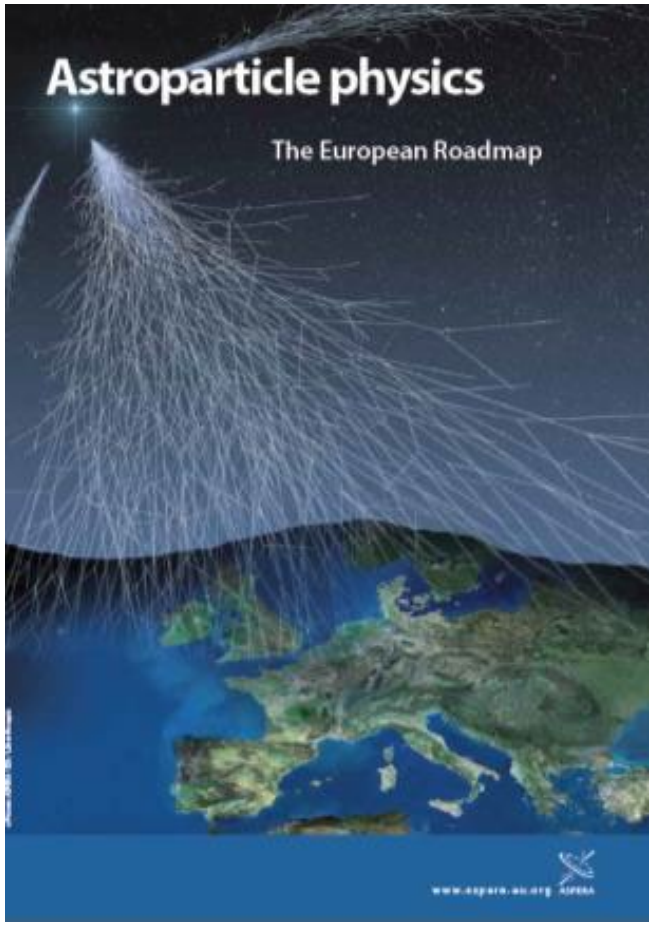
GA: since 2020 Online-meetings only

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 organisational & societal issues

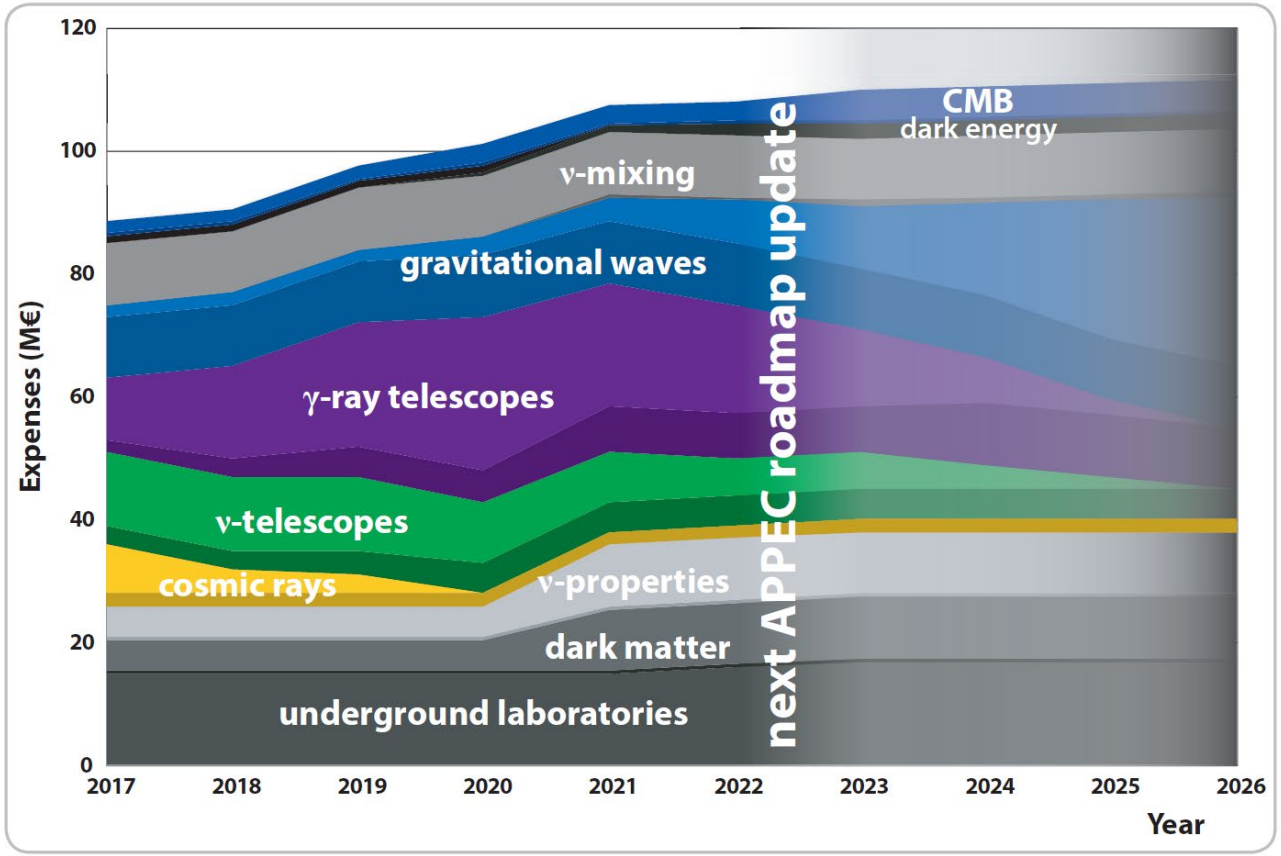
Organisational:

- European Commission
- European and global collaboration and coordination
- Astronomy and particle physics communities
- Interdisciplinary opportunities

Societal:

- Gender balance
- Education and outreach
- Open Science and Citizen Science
- Ecological impact and Industry

Midterm Evaluation of the Roadmap



From Roadmap 2017: Projected annual capital investment

- A resource aware roadmap

  (darker colors also show M&O of RI)
- Midterm Evaluation: Preparation of roadmap update
  - Direct Dark Matter working group
  - Double Beta Decay APPEC Sub-Committee
  - Multi-Messenger Discussion Workshop
  - European DUL Coordination
- Goals
  - Identify new developments and new topics
  - Update recommendations
  - Update time and cost line
- Timeline
  - Provide information to the communities (2021)
  - Discussion at the Town Meeting 9+10/6/2022 (Berlin) https://indico.desy.de/event/25372/

ILIAS – Integrated Large Infrastructure for Astroparticle Science

ILIAS was an Integrated Infrastructure Initiative (I3), with 20 contractors, funded under the European Commission's Sixth Framework Programme (FP6).

Based on a set of networks and joint research projects, the programme focused on three key areas:
- the search for double beta decay,
- the search for dark matter,
- the search for gravitational waves.

It also includes a programme for coordinating, for the first time, the deep underground laboratories in Europe, and a network on theoretical astroparticle physics.

ILIAS started on April 1, 2004 with a total budget of 10 M€ (EU support 7.5 M€) and comprised >1000 scientists.

ILIAS is an initiative supported by the *European Union* with the aim to support the European large infrastructures operating in the astroparticle physics sector.

Roadmap 2009

APPEC

8. The infrastructures of astroparticle physics

Astroparticle physics relies on a variety of distributed platforms: large underground laboratories, observatories at very remote locations and satellites. Construction and sustainable operation of these infrastructures are of key importance for future progress.

Recommendations: APPEC also supports

- ....
- The concept of a cooperative network of deep underground laboratories!
- ....

Roadmap 2017

Part 1: Strategy Recommendations

13. Unique infrastructures: deep-underground laboratories

Shielded by thousands of metres of rock, deep underground laboratories host a diverse suite of extremely low-background experiments that are often unique. These facilities also provide a platform for multidisciplinary collaboration.

With a view to maintaining a good match between available capacity and planned activities, APPEC fosters continued support for and cooperation between underground laboratories – as advocated, for example, by the DULIA (Deep Underground Laboratory Integrated Activity) initiative.

Towards Midterm Evaluation of the Roadmap

Direct Detection of Dark Matter

- 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

APPEC SAC 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

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*.**

Towards Midterm Evaluation of the Roadmap

Double Beta Decay APPEC Report

- Report: https://www.appec.org/documents
- arXiv: https://arxiv.org/abs/1910.04688
- Recommendations:
  1. Priority of $0\nu\beta\beta$ search
  2. Enhanced experimental program
  3. Multi-isotope program
  4. Coordinated R&D
  5. European Infrastructure for Underground Science
  6. Continuation of diverse theoretical activity

APPEC SAC Subcommittee:
Andrea Giuliani – IN2P3,
J. J. Gomez Cadenas -- Donostia,
Silvia Pascoli – Bologna; chair,
Ezio Previtali -- LNGS,
Ruben Saakyan -- UCL,
Karoline Schäffner -- MPP,
Stefan Schoenert -- TUM

Recommendation 5. The European underground laboratories should provide the required space and infrastructure for next generation double beta decay experiments. A strong level of coordination is required among European laboratories for radiopurity material assays and low background instrumentation development in order to ensure that the challenging sensitivities of the next generation experiments can be achieved on competitive timescales.

APPEC

- discusses now the strategy for the implementation of the recommendations
- Organizes the Town Meeting (midterm evaluation of the roadmap)
- supports EU activities, e.g. APOGEIA
- Coordinate activities with neighboring fields, e.g. Geo, JENA Activities, Astronet

…and further foster and coordinate the European Astroparticle Physics

➔ Looking forward to the results of this DUL workshop!!!

APPEC

Invitation to participate and contribute to the APPEC Town Meeting: 9–10 June 2022, Berlin !

APPEC TOWN MEETING BERLIN 2022

https://indico.desy.de/event/25372/