



APPEC Report

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CHIPP Plenary meeting,
June 11, 2021



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Since last report at the Plenary last October at Kandersteg ...

- **The 18th APPEC Generally Assembly, Dec 9, 2020, on Zoom**
 - Elected new Chair and General Secretary
 - Chair: Andreas Haungs (KIT, Germany), 2-year, not consecutively repeatable
 - General secretary: Katharina Henjes-Kunst (DESY)
 - Neutrinoless double beta decay strategy
 - SAC report: Direct DM detection, roadmap mid-term evaluation, EuCaPT, ...
 - Joint ECFA-NuPECC-APPEC activities
- **The 19th APPEC Generally Assembly, April 1, 2021, on Zoom**
 - Endorsed choice of Vice-chair proposed by the chair
 - Antoine Kouchner (APC France)
 - Direct DM detection: APPEC committee report endorsed (and published)
 - Chair report
 - Double Beta Decay, ASTRONET Roadmap, ECFA R&D Roadmap
 - Joint ECFA-NuPECC-APPEC activities, diversity charter
 - Implementation of a distributed and sustainable APPEC workforce model
 - **APPEC Town Meeting: June 9-10, 2022, Berlin**

Direct Dark Matter Detection committee report

- Direct Dark Matter Detection committee report is now published
 - <https://arxiv.org/abs/2104.07634>: 7 recommendations included (see next page)
- Follow-up questions from the Chair chair
 - Sent replies prepared with a few people involved (Laura, Ben, Teresa, ...)

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1) Are there priorities in your country in direct dark matter detection?

Yes. The priorities in Switzerland are XENONnT, DARWIN and DAMIC/DAMIC-M. Switzerland has also a special interest in the search for DM candidates that are outside of the standard WIMP candidates.

2) Would you support an initiative for a European Laboratory of Underground Science?

Yes. It is important that the initiative is strongly supported by a large existing laboratory (e.g. LNGS). Integrating smaller labs into a network should also be investigated (in Switzerland there is a small lab in Vue des Alpes). A staged approach, for example with a European underground material screening center as the first stage, could also be envisaged.

3) Do you expect specific follow-up actions by APPEC?

We expect that topical workshop(s) to be organized to discuss the implementation of the recommendations, where experts from each countries can present their ideas. We also suggest that an international forum leading to agency level agreements, recommendations and actions be organized.

DDMD committee recommendations

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.

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.

Neutrinoless double beta decay strategy

- Teresa Montaruli (as APPEC Chair up end of 2020, and continue as asked APPEC) has been leading (from the European side) the effort to develop a global (Europe-North America) strategy
 - Participation in the Snowmass process, discussions with DOE, dedicated meeting of interested funding agencies, ...
 - Strategy plan produced and presented at the Dec. 9 GA meeting (next page)
- An European-North American Summit organized (by Teresa and Marco Pallavicini) at Gran Sasso, Italy on Sept 29 -Oct 1, 2021
 - SNSF declined to participate and suggested CHIPP
 - CHIPP chair is in contact with SERI to obtain mandate

Summary of strategic vision towards a global investment on neutrinoless double beta decay

- 1) Neutrinoless double beta decay is recognized in the European and North American scientific communities as fundamental for the exploration of the nature of the neutrino mass and of lepton number violation (APPEC Roadmap, Double Beta Decay APPEC Committee Report arXiv:1910.04688, 2015 Long Range Plan For Nuclear Science)
- 2) To ensure timely validation and ultimately the success of $0\nu\beta\beta$ research, the funding agencies accept the conclusion of the scientific community that there **must be at least two ton-scale experiments** capable of exploring the **10-15 meV region**, on the time-scale of a decade or less after construction is completed
- 3) **Three isotopes, ^{100}Mo , ^{76}Ge and ^{136}Xe have potential to address the 10-20 meV** mass scale of the lightest neutrino and fully explore the **inverted ordering region** of the neutrino mass pattern with energy resolution better than $\sim 0.2\%$ at $Q_{\beta\beta}$ and background at the level of 10^{-4} counts $\text{keV}^{-1} \text{kg}^{-1} \text{yr}^{-1}$.
- 4) In view of the technological and logistical challenges identified and by the scientific community, the interested funding agencies in Europe and the North America agree that a **global approach to supporting this phase of $0\nu\beta\beta$ research** will be optimal to ensure efforts are **fully coordinated on ton-scale research**, enabling it to be successful and impactful. Coordination between North America and Europe is necessary.
- 5) If 2 experiments are to be pursued, the funding agencies accept the wisdom of the scientific community that they should be based on **complementary technologies**, having different, well **controlled systematics and directly comparable results**.
- 6) The funding agencies view that the above consideration do not prevent other smaller scale “targets of opportunity” from being pursued as interest and resources permit and that it is the view of the scientific community that R&D funding to develop G4 technology for experiments capable of exploring the region of the normal hierarchy must be continued.

From T. Montaruli's presentation at the APPEC GA, Dec 9, 2020

ASTRONET Roadmap

- ASTRONET (consortium of European funding agencies in astronomy) is preparing a roadmap “*Science Vision & Infrastructure Roadmap 2020-2030*”
 - <https://www.astronet-eu.org/science-vision-infrastructure-roadmap-2020-2030>
- First draft reports available, currently under community consultations
 - <https://www.astronet-eu.org/forums/roadmap-community-consultation>
- Astronet webinar “*Defining a science vision and infrastructure roadmap for European Astronomy*”: 11 June 2021
 - https://unige.zoom.us/webinar/register/WN_xWzlduTfQ6i5AZKJVJ-RmQ
- APPEC is following this process and prepared to provide concerted feedback in due time
 - Individual feedback have been sent to APPEC and to the ASTRONET community consultation

JENA and APPEC Town meeting

- JENAA: Joint ECFA-NuPECC-APPEC activities (<http://nupecc.org/jenaa/>)
 - Cooperation of nuclear, particle and astroparticle physics communities (ECFA, NuPECC, APPEC)
- JENAS (Joint ECFA-NuPECC-APPEC Seminar)
 - First edition Oct 14-16, 2019 in Orsay, France
 - Next edition (JENAS2022): May 3-6, 2022, Madrid
- Call of EoI for JENAA synergy topics: 5 EoIs received, discussed and supported
 - <http://www.nupecc.org/jenaa/?display=eois>
 - iDMEu, "Initiative for Dark Matter in Europe and beyond", kick-off meeting on May 10-12, 2021 (<https://indico.cern.ch/event/1016060>)
- JENA Diversity Charter: <http://nupecc.org/jenaa/?display=diversity>
 - *“The three organisations joined together to propose a [Diversity Charter](#) to be signed by research organisations, collaborations and conferences within the fields of Particle Physics, Nuclear Physics and Astroparticle Physics, who value diversity and commit to promote equal opportunities at all levels.”*
- APPEC Town Meeting
 - June 9-10, 2022, Belin

Towards a more sustainable APPEC

- A distributed workforce model already adopted in the June 2020 GA
- Tasks and size of APPEC Work force evaluation: at least 4 FTE (currently 2.95)
 - Endorsed by the April 2021 GA
- Currently ~2.95 FTE, with 2.5 FTE pending

Interests APPEC partners							
DESY	KIT	LSC	NWO/Nikhef	INFN	CNRS	CEA	STFC
1 fte	0.4 fte	1 fte	0.3	0.5	1 fte	0.25	p.m.
Katharina + NN	Katrin	interested	Job + some NIKHEF effort outreach possible	LNGS/ in contact	job opening		In-kind contributions for outreach/ events

Please follow the APPEC activities with the APPEC Newsletters!

- <https://www.appec.org/latest-news/newsletters>