

2nd Workshop on Onubb search in Xe - next generation experiment, Manchester

European AstroParticle Physics Strategy 2027-2036

The European AstroParticle Physics Strategy is mandated, and must be approved, by the General Assembly:

GENERAL ASSEMBLY <https://www.appec.org/consortium/the-general-assembly/>

Strategic, decision-making, and supervisory body of APPEC. It is responsible for the general policy and the procedures of APPEC. Representatives of the General Assembly are appointed by their participating institution. The representatives are in general the **directors of major** astroparticle physics **institutes or agencies**, or **managers of major national** astroparticle physics **programmes**.

Chair: CPG; Vice-Chairs: A. Kouchner, L. Roszkowski

STRATEGIC OBJECTIVES <https://www.appec.org/about/objectives/>

Provide a discussion forum for the coordination of European Astroparticle Physics and **express collective views** on astroparticle physics in international fora.

Develop and update **long term strategies** (e.g. roadmap for European astroparticle physics) and participate in European scientific strategy such as the European Strategy Session of CERN Council and ESFRI.

Develop **closer relationships** with organisations involved in Astroparticle Physics research such as CERN, ESA, ESO.

BREAKING NEWS: *APPEC Consortium welcomes the Canadian funding agencies CFI and NSERC as New Partners (June 2026).*

The APPEC Consortium is pleased to announce the formal accession of Canada represented by the funding agencies CFI and NSERC. This marks a significant step forward in strengthening research-driven collaboration across the astroparticle scientific landscape.

By joining the APPEC Consortium, the Canadian funding agencies reaffirm their commitment to advancing our collective vision on European astroparticle research activities and priorities. Their participation signals a clear intention to prioritize the execution of the shared ambitions expressed in the upcoming European Astroparticle Physics Strategy 2027-2036, strengthening cooperation and accelerating progress across all joint initiatives.

Together, the APPEC Partners will engage in closely aligned collaboration in an ambitious partnership to advance astroparticle physics research and innovation, combining expertise and resources to accelerate progress in this well-established scientific field.

Canada representatives: Anne-Marie Thompson (NSERC) and Mohamad Nasser-Eddine (CFI)

3. EUROPEAN ASTROPARTICLE PHYSICS STRATEGY 2027-2036: MANDATE



After the 250+ inputs by the community (FIRST survey) discussed at the first town meeting in Zaragoza (September 2025) and summarized by the SAC on <https://indico.cern.ch/event/1516919/>, criteria to establish priorities was requested to the GA.

Mandate by APPEC GA: **Prioritize** projects, topic by topic, based on specific inputs provided by collaborations, which should include: project phase documentation, technological and infrastructure readiness, remaining technological challenges and possible risks, resources available/needed/requested, timeline with contingency and delivery history.

Guidelines: Prioritize **Delivery** on schedule of experiments and instruments currently in construction and **Completion of** missing experiments and instruments in the short and long term. **Evaluate** the timeline of instruments to optimize sky coverage and multi-messenger data. **Identify** the R&D efforts in key technologies (extended DRDs) and the computing & software technologies developments (JENA Computing Initiative).

Organization of the Roadmap with Science subjects distributed in three blocks: 1) **Multi-messenger:** Cosmic Rays, Gamma rays, Astrophysical neutrinos and Gravitational Waves. 2) **Elusives:** Neutrino Properties and Dark Matter. 3) **Universe:** CMB and Dark Energy.

3. EUROPEAN ASTROPARTICLE PHYSICS STRATEGY 2027-2036: TIMELINE

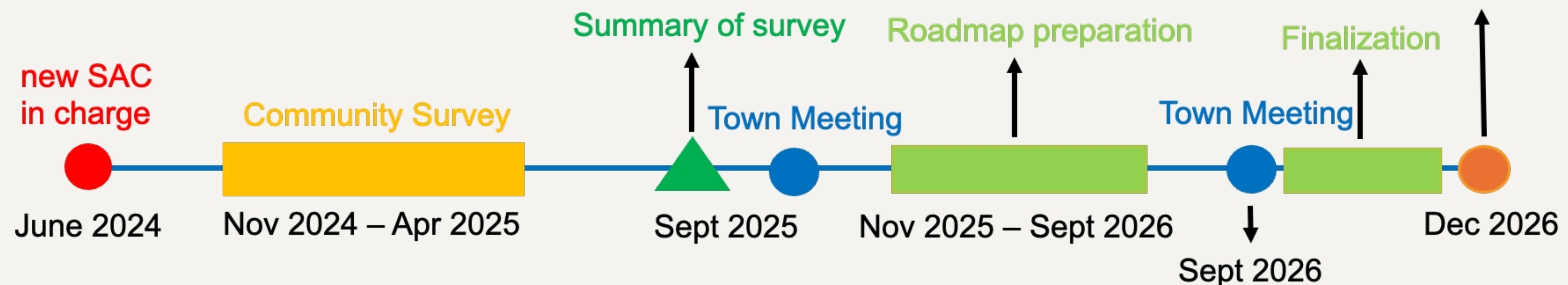


Feb-April: inputs by **70 astroparticle physics collaborations** (SECOND survey) with requested information on budget needed in construction and operation, timeline, technological challenges and readiness, human resources and governance. **Iteration was needed**, in some cases.

May-June: Inputs discussed by committees built by representatives from the APPEC functional centers and the Scientific Advisory Committee. First draft of the topic by topic strategy based on inputs by **78 astroparticle physics collaborations**.

July: Drafting the executive document with priorities, classified in terms of fully prioritized, strongly supported and encouraged.

Roadmap with priorities shared with the AstroParticle Physics community and discussed in the second Town meeting (Geneva, 2-3 Sep 2026), dedicated to the preparation of the European AstroParticle Physics Strategy, <https://indico.cern.ch/event/1648605/>.



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Goal of the 2nd APPEC Town Meeting
(Geneva, Sep 2-3, 2026): collect further
inputs and receive **feedback on the**
drafted recommendations made by
the APPEC Scientific Advisory
Committee (SAC) members and
collaborators.

Inputs by **78 astroparticle physics collaborations:**

AION, ALPHA, **AMoRE**, ANAIS, ALPS II, AUGER, BICEP, BULLKID-DM, CDEX, CLASS, COSINE, CREDO, CRESST, CTAO, **CUORE**, **CUPID**, CYGNO, DAMIC-M, DAMPE, DarkSide-20k, DELight, DESI, DUNE, ECHo, EPTA, ET, FLASH, FOSSIL, GCOS, GRAND, GroundBIRD, HERON, HESS, HIBEAM/NNBAR, Hyper-Kamiokande, HOLMES, IceCube, IceCube-Gen2, JEM-EUSO, JUNO, KAGRA, KATRIN, KATRIN++, KM3NET, **LEGEND-200**, **LEGEND-1000**, LGWA, LISA, LiteBIRD, LSPE, **LZ**, MADMAX, MAGIC, **NEXT-100/NEXT-100U**, NIKA2, **PandaX**, PEPS, POEMMA, P-ONE, Project 8, Ptolemy, QTNM, QUAX, QUBIC, RNO, RES-NOVA, RET-CR, **SNO+**, SO, SPEC-S5, SPT-3G+, **SuperNEMO**, SWGO, TAMBO, TESSERACT, Virgo, **XENONnT**, **XLZD**.

which filled the survey (or addressed them by email) with requested information on budget needed in construction and operation, timeline, technological challenges and readiness, human resources and governance. **Iteration was needed**, in some cases.

3. EAPS 2027-2036: INPUTS with a look to the leading competitors (and collaborators).



MEXT Frontier Projects (as of 2026)

令和8年度 学術研究の大型プロジェクトの一覧

大規模学術フロンティア促進事業(12事業)

データ駆動による課題解決型人文学の創成
～データ基盤の構築・活用による次世代型人文学研究の開拓～
(人間文化研究機構国文学研究資料館)

国内外機関等との連携による更なる画像データの拡充、画像データのAI利活用等によるテキストデータ化、データ分析技術開発の推進など、国文学を中心とするデータインフラを構築し、様々な課題意識に基づく国内外・異分野の研究者との共同による大規模データを活用した次世代型人文学研究を開拓する。

大型光学赤外線望遠鏡による国際共同研究の推進 (すばる)
(自然科学研究機構国立天文台)

米国ハワイ島に建設した口径8.2mの「すばる」望遠鏡により、銀河が誕生した頃の宇宙の姿を探る。太陽系の最も遠くで発見された天体の記録を更新するなど、多数の観測成果。

宇宙と生命の起源を探究する大型ミリ波サブミリ波望遠鏡アルマ2計画
(自然科学研究機構国立天文台)

日米欧の国際協力によりチリに建設した口径12mと7mの電波望遠鏡からなる「アルマ」により、生命関連物質の探索や惑星・銀河形成過程の解明を目指す。

30m光学赤外線望遠鏡 (TMT) 計画の推進
(自然科学研究機構国立天文台)

日米加印の国際協力により口径30mの「TMT」を米国ハワイ島に建設し、太陽系外の第2の地球の探索、最初に誕生した星の検出等を目指す。(※2021年度に計画期間終了)

KEK スーパーBファクトリー計画
(高エネルギー加速器研究機構)

加速器のビーム衝突性能を増強し、宇宙初期の現象を多数再現して「消えた反物質」「暗黒物質の正体」「質量の起源」の解明など新しい物理法則の発見・解明を目指す。前身となる装置では、小林・益川博士の「CP対称性の破れ」理論(2008年ノーベル物理学賞)を証明。

大強度陽子ビームで究める宇宙と物質の起源と進化 (J-PARC)
(高エネルギー加速器研究機構)

日本原子力研究開発機構と共同で、世界最大級のビーム強度を持つ陽子加速器施設を運営。ニュートリノなど多様な粒子ビームを用いて基礎研究から応用研究に至る幅広い研究を推進。

高輝度大型ハドロン衝突型加速器 (HL-LHC) による素粒子実験
(高エネルギー加速器研究機構)

CERNが設置する大型ハドロン衝突型加速器の増強計画として、既存のLHCよりも高い質量領域での新粒子探索や暗黒物質の直接生成等を目指す国際共同プロジェクト。日本はLHCにおける国際貢献の実績を活かし、引き続き加速器及び検出器の製造を国際分担。

カムランド高性能化計画 (極低放射能環境でのニュートリノ研究)
(東北大学ニュートリノ科学研究センター)

世界をリードするカムランド実験装置の光収集量を5倍にする高性能化により、大発見となるニュートリノ二重ベータ崩壊の発見確立を大幅に高めるとともに、地球内部の組成や活動様式解明に挑む地球ニュートリノ観測、さらに特徴的な低エネルギーニュートリノ天文学を展開。

「スーパーカミオカンデ」によるニュートリノ研究の新展開
(東京大学宇宙線研究所)

ニュートリノの観測を通じて、その性質の解明やニュートリノを利用した宇宙観測を目指す。(2015年梶田博士はニュートリノの質量の存在を確認した成果によりノーベル物理学賞を受賞。また、2002年小柴博士は、前身となる装置でニュートリノを初検出した成果により同賞を受賞。)

大型低温重力波望遠鏡 (KAGRA) による重力波研究の展開
(東京大学宇宙線研究所)

一辺3kmのL字型のレーザー干渉計により重力波を観測し、ブラックホールや未知の天体等の解明を目指すとともに、日米欧による国際ネットワークにより、重力波天文学の構築を目指す。

大型先端検出器による核子崩壊・ニュートリノ振動実験 (ハイパーカミオカンデ計画の推進)
(東京大学宇宙線研究所、高エネルギー加速器研究機構)

ニュートリノ研究の国際協力による次世代計画として、新型の超高感度光検出器を備えた大型検出器の建設及びJ-PARCの高度化により、ニュートリノの検出性能を著しく向上。素粒子物理学の大統一理論の鍵となる陽子崩壊の初観測や、CP対称性の破れなどのニュートリノ研究を通じ、新たな物理法則の発見、宇宙の謎の解明を目指す。

ヒューマンライコムプロジェクト
(東海国立大学機構、自然科学研究機構、創価大学)

多くの生命現象や疾患に関与するものの全容が未解明である「糖鎖」について、ヒトの糖鎖情報を網羅的に解読し、医学をはじめ幅広い研究分野との新たな連携を産み出す糖鎖情報の基盤を構築。ヒトの生命現象の解明、老化・認知症・がん、感染症等に関する革新的な治療法・予防法の開発を通じ、生命科学の革新、病気で苦しむことのない未来を目指す。

学術研究基盤事業(3事業)

研究データの活用・流通・管理を促進する次世代学術研究プラットフォーム (SINET)
(情報・システム研究機構国立情報学研究所)

国内1,000以上の大学等と結び、340万人以上の研究者・学生が利用する高速通信回線網である「学術ネットワーク基盤」及び研究データの「管理」「公開」「検索」を促進する「研究データ基盤」を一体的に運用し、データ駆動型研究とオープンサイエンスを促進。

南極地域観測事業
(情報・システム研究機構国立極地研究所)

国立極地研究所を中核機関とし、関係省庁が連携・協力して研究観測の企画・実施、観測に関わる昭和基地等の設置活動を行っている。新たにドームふじ観測拠点Ⅱにおいて約3,000mの深層掘削を開始。100万年を超える最古級のアイスコアを採取し、地球環境変動の解明を目指す。これまでオゾンホール発見など多くの科学的成果を獲得。

超高温プラズマの「ミクロ集団現象」を中核とした核融合科学の学術研究基盤計画
(自然科学研究機構核融合科学研究所)

フュージョンエネルギー実現への中心課題の原理を、集団現象を創発するミクロ階層に分け入ることによって解明し、プラズマ物理と核融合科学のフロンティアを切り拓く。世界トップの精密な計測と制御の粋を集めた研究プラットフォームを整備し、領域を超えた学際的展開を図る。

Super-K

KAGRA

Hyper-K

SUBARU

ALMA-2

TMT

Super KEKB

J-PARC

HI-LHC

KamLAND2

Y. Ito
APPEC TM

3. Neutrino Properties: Preliminary Recommendations (as of Sep 3, 2026)



Three subtopics: **Neutrinoless double beta decay**, direct neutrino mass determination and neutrino oscillations, ordering and CP violation reviewed by O. Cremonesi, C. Gonzalez Garcia, A. Ianni (SAC chair), J. Kopp, M. Kuzniak, O. Lahav, N. Rossi, F. Simkovicz and Christian Weinheimer (chair).

APPEC fully prioritizes the construction of LEGEND-1000 based on Ge-76, the current experiment aiming to reach the highest sensitivity, and CUPID based on Mo-100. The APPEC-strongly-supported dark matter experiment XLZD experiment* as well as the gaseous Xe-136 NEXT program will have an important impact on 0nbb searches in Xe-136. The international competition in neutrinoless double beta decay searches makes timely funding a critical factor.

APPEC recognizes the need for a neutrino mass measurement in the lab and R&D for detecting the relic neutrinos. APPEC fully prioritizes the completion of coordinated R&D programs built on the successful KATRIN experiment, aim to reach ~ 50 meV sensitivity and beyond through innovations such as quantum sensing and sources with sharp spectral features like atomic tritium.

APPEC recognizes the complementarity of accelerator neutrinos and neutrino telescopes in determining neutrino parameters. APPEC fully prioritizes the large European contribution to the completion and exploitation of the long-baseline accelerator experiments Hyper-Kamiokande and DUNE and exploitation of the reactor experiment JUNO. APPEC recognizes the huge perspectives of coherent elastic neutrino nucleus scattering for neutrino physics.

C. Weinheimer, APPEC TM

* APPEC strongly supports the joint Xenon community in the full design and construction of the XLZD experiment in the coming decade

3. Summary and next steps



The European AstroParticle Physics Strategy is mandated, and must be approved, by the General Assembly. The APPEC SAC is responsible to draft the European AstroParticle Physics Strategy, currently revising the recommendations after feedback at the Town Meeting in Geneva.

Next steps:

- Revise recommendations after TM2026 (currently in progress, SAC meetings).
- Complete the prioritization document: R&D, Innovation, Software and Computing, Across fields and Internacional context, OS & CS, EDI & ECR, Society and Impact.
- Dedicated chapter to the coverage of experiments and instruments in the period 2027-2036.
- Dedicated chapter to the Budget Plan required to achieved the proposed strategy, distributed in 2027-2036.

Target: Present the European AstroParticle Strategy 2027-2036 at the next GA meeting (London, Nov 30-Dec 1) to request approval by the APPEC GA.

2nd Workshop on Onubb search in Xe - next generation experiment, Manchester