

Latin American Strategy Forum for Research Infrastructures for High Energy, Cosmology, Astroparticle Physics

LASF4RI for HECAP

Latin American Strategy for HECAP

2026 Update

Document submitted to the High Level Strategy Group

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1. Executive Summary

The Latin American Strategy Forum for Research Infrastructures for High Energy, Cosmology and Astroparticle Physics (LASF4RI-HECAP) presents this 2026 Strategy Update, the first revision of the original 2020 strategy. The update is based on the [Latin American HECAP Physics Briefing Book 2025](#), which collected [48 white papers](#) from the scientific community submitted in response to a call issued in November 2023.

Latin America has experienced a remarkable growth in its HECAP community and scientific output since the first strategy was concluded in 2020. The region has matured towards a growing and increasingly structured participation in some of the most ambitious scientific endeavors worldwide. Key milestones since 2020 strategy include:

- The creation of the **Latin American Association for High Energy, Cosmology and Astroparticle Physics (LAA-HECAP)** in 2021.
- **Brazil** became an Associate Member State of CERN in March 2024.
- **Chile** became an Associate Member State of CERN in April 2026.
- International Cooperation Agreements (ICAs) have been signed between CERN and **Honduras** (2021), **Uruguay** (2024), and **Guatemala** (2025).
- **Costa Rica** became a full member of the LHCb collaboration in 2022.
- **Honduras** also joined LHCb.
- **The 43rd edition of the International Conference in High Energy Physics (ICHEP 2026)** will be held in Natal, Brazil — the first time this flagship conference takes place in Latin America.
- **The 40th International Cosmic Ray Conference (ICRC 2027)**, one of the leading conferences in astroparticle physics, will take place in Buenos Aires, Argentina, the fourth edition ever held in Latin America.
- Brazilian funding agencies approved US\$ 41 million towards the **DUNE** experiment (2024), with hardware produced in Brazil.
- The **SWGO** site was confirmed at the Atacama Astronomical Park in Chile (2024).
- **Argentina** and **Mexico** joined the Vera Rubin Observatory/LSST.
- The **LAMBDA** laboratory was inaugurated in Argentina (2022), establishing world-class Skipper-CCD capability in the region.
- The **QUBIC** instrument began commissioning in 2025.
- Latin American participation in **CERN** experiments grew by 26.7% (to 711 participants) between 2020 and 2025, with authorship growing 77.4%.

The 2026 update also reflects the **expanded scope** of the Latin American HECAP community: new countries (Costa Rica, Honduras, Guatemala, Uruguay, Cuba) have joined experimental collaborations; theory and phenomenology groups are now explicitly mapped as part of the landscape; and the region's involvement in computing, instrumentation R&D, machine learning, and capacity building has deepened substantially.

This Strategy Document presents ten recommendations that build on and update those of 2020, reflecting both the progress achieved and the new opportunities and challenges that the next decade presents.

The figures below (also reproduced in the companion Physics Briefing Book) summarize the landscape of present and future participation in experiments related to High Energy Physics (Fig. 1) , Astroparticle, Cosmology and Gravitation (Fig. 2) and Neutrinos and Dark

Matter (Fig. 3), now including 14 countries, over 43 experiments and research programs, illustrating the breadth of Latin American engagement in global HECAP. The tabular form of these figures, including explicitly theory and phenomenology groups, is shown in Appendix A. Appendix B presents a glossary with the acronyms of the different experiments cited in this document.

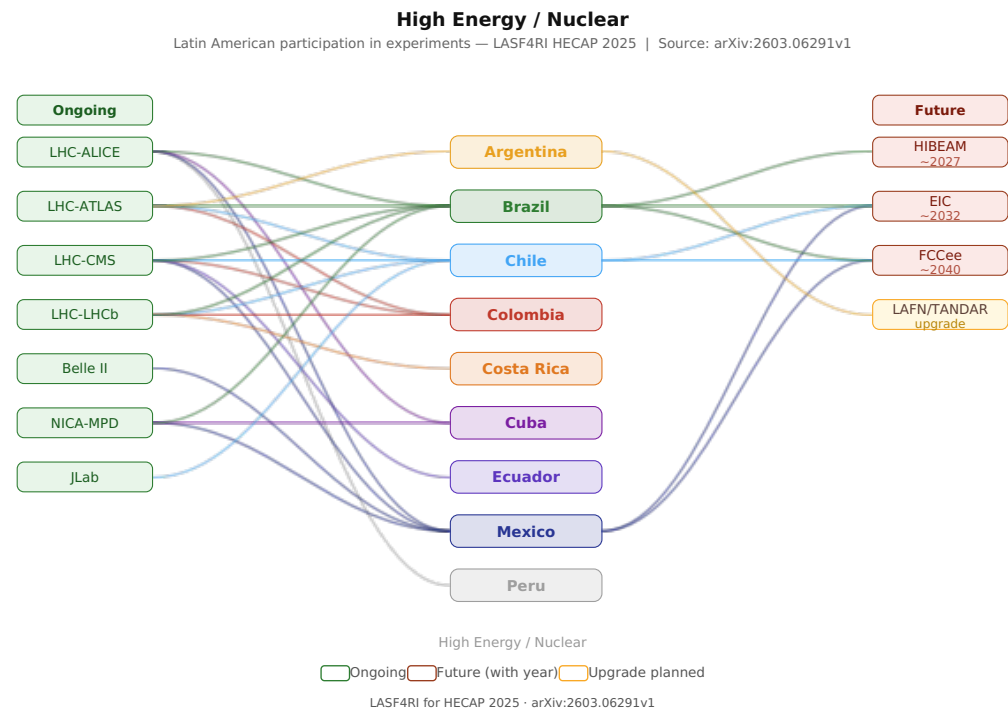


Figure 1: Ongoing and future experiments in High Energy and Nuclear Physics with Latin American participation. Source: Latin American HECAP Physics Briefing Book 2025 (arXiv:2603.06291).

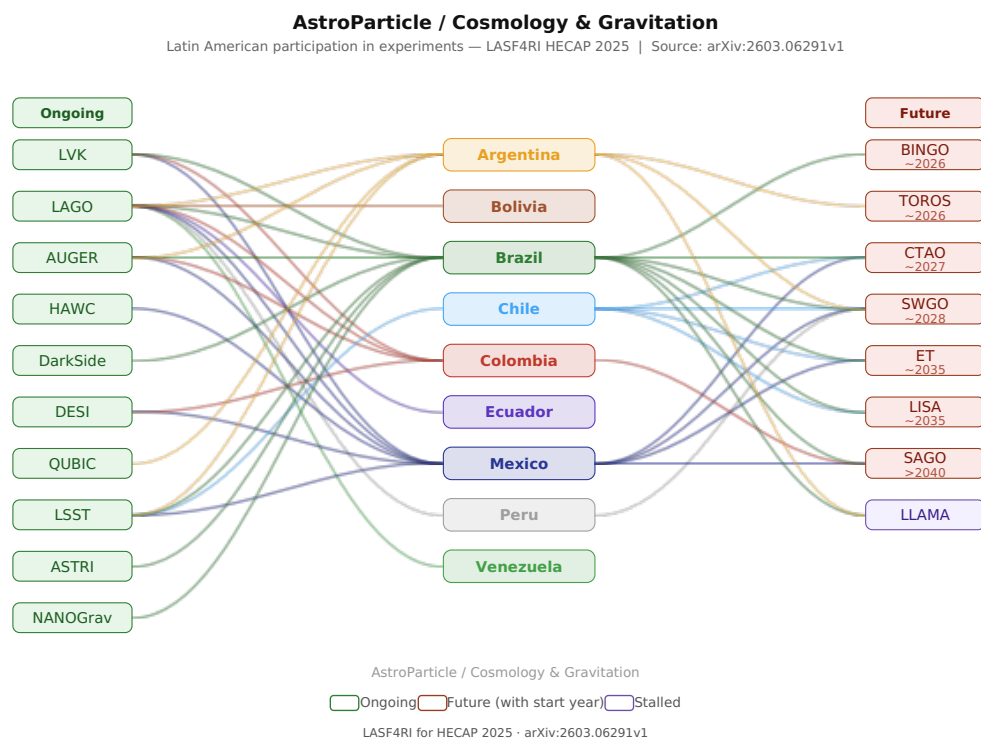


Figure 2: Ongoing and future experiments in Astroparticle, Cosmology and Gravitation with Latin American participation. Source: Latin American HECAP Physics Briefing Book 2025 (arXiv:2603.06291).

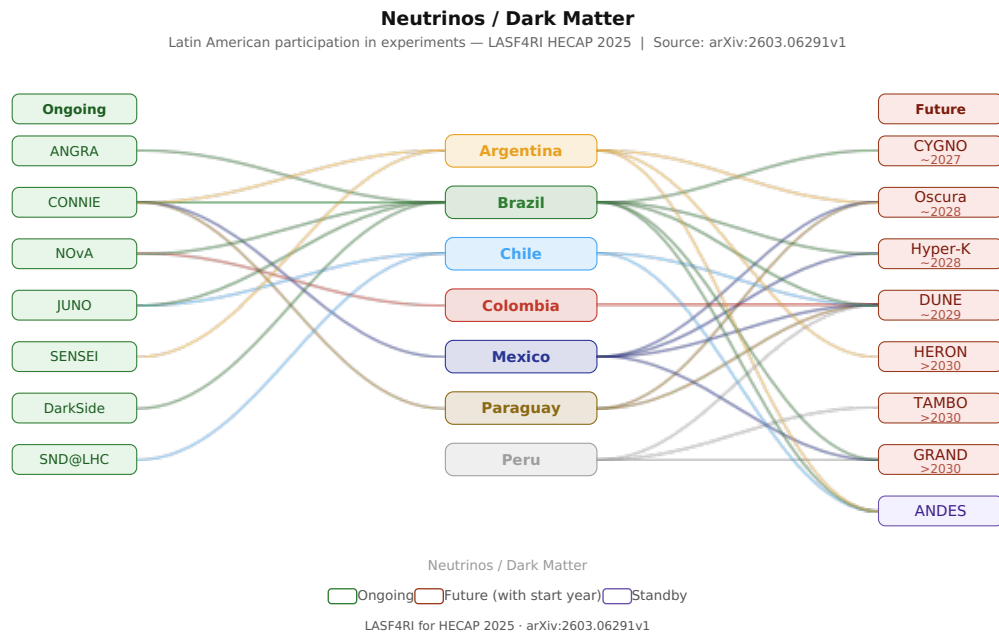


Figure 3: Ongoing and future experiments in Neutrino and Dark Matter Physics with Latin American participation. Source: Latin American HECAP Physics Briefing Book 2025 (arXiv:2603.06291).

2. Introduction

Latin American experimental and theoretical groups in high energy, cosmology and astroparticle physics have continued to develop and strengthen the strategy initiated through LASF4RI. This 2026 update, based on the [Latin American HECAP Physics Briefing Book 2025](#), follows the first [Strategy Document](#) concluded in October 2020, and represents the first formal update of that process, as recommended in the 2020 [endorsement letter](#) from the High Level Strategy Group.

The global context for HECAP strategy has also evolved significantly. In the United States, the Snowmass 2021 process culminated in the P5 report (2023), which sets the roadmap for US particle physics in 2025–2035. In Europe, the third update of the European Strategy for Particle Physics (ESPP) was launched in 2024, with a symposium in Venice in June 2025 and final recommendations to the CERN Council in 2026. The Latin American HEP community, represented by LAA-HECAP, submitted a contribution to the ESPP process: [A Survey of the Latin American High Energy Physics community on the future flagship project at CERN for the ESPP Update](#).

The first LASF4RI-HECAP Physics Briefing Book (2021) identified a landscape rich in scientific potential but facing challenges in coordination, infrastructure access, and regional visibility. In the years since, many of these challenges have been partially addressed, as documented in the Latin American HECAP Physics Briefing Book 2025. At the same time, new challenges and opportunities have emerged: the advent of artificial intelligence and machine learning as transformative tools in physics; the increasing importance of high-performance computing and data infrastructure; the growth of the regional theory and phenomenology community; and the broader geographic coverage of Latin American participation in global experiments.

The main goals of this strategy update remain those established in 2020:

- To chart the updated landscape of experimental, theoretical and phenomenological expertise in the region.
- To define a Latin American scientific roadmap for current and future participation in regional and global experiments.
- To enable more effective development of Latin American research groups.
- To formulate specific recommendations for a more strategic approach to HECAP with the goal of increasing impact and benefits for the region.
- To inform Ministerial meetings, funding agencies and policy-making institutions.

The primary output of this process is the set of ten recommendations presented in Section 5. The *Latin American HECAP Physics Briefing Book 2025* ([arXiv:2603.06291](#)) provides the scientific and technical detail supporting each recommendation.

3. Roadmap

3.1. Roadmap Summary Table

Table 1: Roadmap of current and future experiments across HECAP with Latin American participation. Start of operations dates are approximate.

Field	Project	Scientific Driver	Status	Start
Astro	AugerPrime	UHECR	Ongoing	
Astro	LAGO	Space weather / CRs	Ongoing	
Astro	HAWC	γ -rays / DM	Ongoing	
Astro	CTAO/ASTRI	γ -rays	Construction	2027
Astro	SWGO	γ -rays / DM	Site confirmed	2028
Cos&Grav	LSST	DE / DM / survey	Ongoing	
Cos&Grav	BINGO	BAO radio	Construction	2026
Cos&Grav	QUBIC	CMB polarisation	Commissioning	2025
Cos&Grav	DESI (ext.)	BAO / DE	Ongoing	
Cos&Grav	LVK	GW detection	Ongoing	
Cos&Grav	LISA	GW detection	Design / R&D	2035
Cos&Grav	ET	GW detection	Design / R&D	2035
Cos&Grav	NANOGrav	GW detection	Ongoing	
Cos&Grav	SAGO	3G GW detector	Proposal / R&D	>2040
Cos&Grav	TOROS	GW follow-up	Commissioning	2026
DM	DarkSide	WIMP (LAr)	Operational	
DM	Oscura	Sub-GeV DM	Construction	2028
DM	SENSEI	Sub-GeV DM	Operational (2021)	
DM	CYGNO	Direc. detect.	R&D	~2027
Accelerator	CBAF@JLab	Nucleon structure	Operational	
Colliders	LHC (Run 3)	EW/Higgs/BSM/QCD	Operational	
Colliders	HL-LHC	EW/Higgs/BSM/QCD	Approved	2030
Colliders	Belle II	Flavour / τ	Ongoing	
Colliders	EIC-BNL	Hadron structure	Construction	2032
Colliders	NICA-MPD	QGP / QCD phase	Construction	2026
Colliders	FCC	EW/Higgs/BSM/QCD	Future	>2040
Colliders	HIBEAM/NNBAR	$n\bar{n}$, baryogenesis	R&D	~2030
Neutrinos	NOvA	ν oscillations	Ongoing	
Neutrinos	ν -ANGRA	Reactor safeguards	Ongoing	
Neutrinos	CONNIE	CE ν NS / DM	Ongoing	
Neutrinos	JUNO	Mass hierarchy / BSM	Ongoing	
Neutrinos	SND@LHC	Neutrino scattering	Ongoing	
Neutrinos	DUNE	ν props / CP / BSM	Construction	2031
Neutrinos	Hyper-K	CP violation / BSM	Construction	2028
Neutrinos	TAMBO	ν_τ astronomy	Development	>2030
Neutrinos	GRAND	Cosmogenic ν	R&D / prototype	>2030
Neutrinos	HERON	UHE ν	R&D	>2030
Neutrinos	ANDES	DM / $0\nu\beta\beta$ / geo	Standby (R&D)	TBD

3.2. Research Infrastructures

3.2.1. Astronomy, Astrophysics and Astroparticles

Latin America plays a prominent and growing role in astroparticle physics and multi-messenger astronomy. The region hosts several major international observatories and is engaged in the construction of the next generation of facilities:

- The **Pierre Auger Observatory** (AugerPrime upgrade complete, 2025) continues to study ultra-high-energy cosmic rays with a renewed collaboration agreement through 2034. Argentina, Brazil, Mexico and Colombia are central participants.
- **LAGO** operates across ten countries and Antarctica, with a new CYTED grant for long-term sustainability.
- **CTAO** is under construction; Brazil chairs the Consortium Board.
- **ASTRI** Mini-Array involves Brazilian institutions.
- **HAWC** The High-Altitude Water Cherenkov (HAWC) Observatory in Mexico continues its operation with important results in gamma-ray astronomy.
- **SWG0** has selected its site (Atacama Astronomical Park, Chile) and is finalising its conceptual design. Argentina, Brazil, Chile, Mexico and Peru are participating with key roles.

3.2.2. Cosmology and Gravitation

The cosmology landscape has expanded significantly, with Argentina and Mexico joining LSST (first images in June 2025) and active participation from Colombia and Mexico in DESI (three-year results in 2025). The number of researchers dedicated to gravitational wave physics has increased, alongside broader participation in collaborations involving both second- and third-generation detectors. Key experiments and infrastructures with LA participation are:

- **BINGO** (Brazil): Under construction in Paraíba.
- **QUBIC** (Argentina): Commissioning began 2025.
- **LSST**: Brazil (iDAC), Chile (host), Argentina and Mexico joined.
- **DESI**: Mexico (RPG) and Colombia (Uniandes) active participants.
- **TOROS** (Argentina): Commissioning and infrastructure-upgrade phase.
- **LIGO/Virgo/KAGRA (LVK)**: 6 Latin American groups (2 in Brazil, 1 in Colombia, and 2 in Mexico).
- **Einstein Telescope (ET)** Collaboration: 6 Latin American institutions (2 in Chile, 1 in Mexico, and 4 in Brazil).
- **LISA Collaboration**: 4 Latin American institutions (3 in Brazil and 1 in Chile).
- **NANOGrav**: 2 members currently working in Brazil.
- **SAGO**: A long-term initiative involving groups in Mexico, Brazil, and Colombia that are active in gravitational-wave science. The primary goal is to increase participation in laser interferometer projects to at least 100 researchers—approximately twice the current number—with a focus on instrumental science, detector characterization, and calibration/commissioning.

3.2.3. Dark Matter

The Latin American community has been involved in a series of projects aimed to detect dark matter, developing also technological expertise in skipper CCDs for some of these

experiments. These experiments, ongoing and planned, involve direct, indirect and collider searches of dark matter.

- **Direct detection:** DarkSide (Brazil), Oscura (Argentina, Brazil, Mexico and Paraguay), CYGNO (Brazil), SENSEI (Argentina).
- **Indirect detection:** CTAO, SWGO, HAWC.
- **Collider searches:** LHC experiments (all), EIC.
- **Novel probes:** CONNIE+Atucha-II (millicharged particles, world-leading limits).

3.2.4. High Energy and Nuclear Physics

Latin American participation in **CERN** experiments grew by 26.7% between 2020 and 2025, and Brazil and Chile became associate members. The community is also active in other ongoing and future projects.

- **CEBAF:** Chile participates in experiments at JLab.
- **LHC:** ATLAS, CMS, LHCb, ALICE — ongoing with growing participation.
- **HL-LHC:** Starting 2029; major hardware commitments from multiple countries.
- **EIC (BNL):** Theoretical physics engagement from Mexico, Brazil, Colombia, Argentina.
- **Belle II (KEK):** Mexico (only LA country; tau physics, LABM upgrade).
- **NICA-MPD (JINR):** Mexico (since 2016), Brazil (cooperation agreement 2025), Cuba.
- **HIBEAM-NNBAR (ESS):** Brazil (4 institutions).
- **Future colliders (FCC/ILC/CEPC):** Engagement growing; community survey submitted to ESPP 2025.

3.2.5. Neutrinos

Latin America has a prominent role in the next neutrino flagship experiment, the Deep Underground Neutrino Experiment (DUNE), under construction in the USA. Photodetectors developed in Brazil will be used in DUNE. In addition, members of our community are actively working in many other ongoing and planned neutrino experiments

- **Ongoing:** NOvA (Colombia, Brazil), ν -ANGRA (Brazil), CONNIE (Brazil, Argentina, Mexico and Paraguay), SND@LHC (Chile).
- **Mid term:** DUNE (Brazil, Colombia, Chile, Mexico, Peru and Paraguay), Hyper-K (Brazil, Mexico), JUNO (Brazil, Chile).
- **Long term:** TAMBO (Peru), GRAND (Brazil, Mexico, Peru), HERON (Argentina), ANDES.

3.3. Theory and Phenomenology

Several networks were formed in the region, such as the LANEMqcd network (27 members, 6 countries, 20 institutions) dedicated to electromagnetic effects in strongly interacting matter, the Colombian Network on High Energy Physics (CONHEP) and the MexNICA group (18 researchers) focused on QCD matter theory relevant to NICA and heavy-ion physics. There are active QCD and hadron structure groups in Mexico, Brazil, Colombia, Chile and Argentina, contributing to the muon ($g-2$), EIC physics and pion and kaon structure, among other topics. There are also theory groups in Argentina, Brazil, Chile, Colombia, Mexico, Guatemala, Honduras and Ecuador engaging in the physics of the SM, BSM, cosmology and gravitational waves.

The interaction between theorists and experimentalists remains essential. The SILAFEA symposium (biennial, since 1996) is the natural forum for this interaction in our community. In addition, regional workshops in HECAP are being organized, such as the 2nd edition of the PHENOEXP Workshop taking place in 2026 at ICTP-SAIFR.

3.4. Software, Computing and Data Infrastructure

The computing landscape for HECAP is rapidly evolving. Artificial intelligence and machine learning are now central tools across all experiments and theory groups. The region has demonstrated leadership in ML applications. Some examples include: the NeuralRinger algorithm (Brazil) is the standard online electron identification method in ATLAS Run 3; the ATLAS/Brazil cluster has been at the forefront of real-time ML for calorimetry.

The huge amount of data generated by LHC experiments and future facilities such as DUNE, LSST and SWGO will require a coordinated effort to optimize computational resources in the region.

4. Social and Economic Impact

Research in HECAP delivers important social and economic benefits for Latin America, beyond the scientific outputs themselves. The activities mentioned below are underpinned by a clear social and economic case.

4.1. Advanced Training for Highly Qualified Human Resources

Advanced training is a core output of the Latin American HECAP program. There has been a steep increase in graduate-level schools, workshops and outreach activities in HECAP. The region now hosts an extensive training ecosystem spanning online courses, intensive schools, skills bootcamps and doctoral programs. LAA-HECAP participation in the ESPP survey (2025) demonstrates that the community is globally connected and recognized. An example is the EL-BONGO physics program, which is a follow up of LA-CONGA including Central American countries. The ICTP South American Institute for Fundamental Research (ICTP-SAIFR) has been providing high-level graduate courses in HECAP continuously for more than 12 years.

A critical challenge is the prevention of brain drain. Investments in regional doctoral and postdoctoral programs, mobile scholarships, and local research infrastructure are essential to retain talent. The PPGCosmo model (joint supervision, mandatory mobility, pooled instrumentation) demonstrates that structural innovation can achieve globally competitive training within the region.

4.2. Enabling Technologies and Industrial Connections

HECAP technology transfer to industry is substantial and growing. Latin American contributions to HECAP hardware have created industrial capabilities with direct economic applications: chip design (SAMPA, Brazil; OpenIPMC, Brazil), detector R&D (Skipper-CCDs, Argentina and Brazil), fast electronics (DAPHNE, Colombia; muon trigger, Brazil), radiation-hard sensors (Chile), SiPM-based detectors (Mexico). The LAMBDA laboratory in Argentina is developing capabilities with direct applications in nuclear monitoring, medical physics and geological survey. The BINGO telescope is being constructed by Brazilian companies. Brazilian industries are contributing to advanced liquid argon (LAr) purification systems for DUNE.

4.3. Citizen Science and Outreach

LAGO is the exemplary regional citizen science project: its distributed network across ten countries and Antarctica combines scientific research with space weather monitoring, education and public engagement. In addition, IPPOG Masterclasses, and EL-BONGO and ICTP-SAIFR courses and outreach activities by groups across the region maintain engagement with younger generations. The realization of ICHEP 2026 in Natal, Brazil, the first time ICHEP is organized in the region, is an exceptional opportunity for public engagement and visibility of Latin American HECAP.

5. Recommendations

A key element for a coordinated local and international strategy remains the need to make research infrastructures multi-disciplinary and multi-purpose, ensuring a positive impact on society. This section presents the updated recommendations resulting from the 2025 strategic process.

Recommendation 1

Support the development and operation of current- and next-generation projects in astronomy, cosmology, gravitation and astroparticle physics located in Latin America, enhancing leadership roles in these strategic projects and participation in relevant frontier experiments outside the region that drive capacity building and technological development.

Latin America hosts some of the world's leading observatories in astroparticle physics and multi-messenger astronomy, benefiting from exceptional geographical conditions — high-altitude Andean sites, dry atmospheric conditions, and access to both the Galactic Centre and unique southern hemisphere sky. These advantages have attracted major international projects and generated local scientific ecosystems that must continue to be nurtured.

The Pierre Auger Observatory celebrated the completion of its AugerPrime upgrade (surface scintillators, underground muon detectors, advanced electronics) in 2025, extending its science reach well into the 2030s under a renewed international collaboration agreement. The LAGO network, now spanning over 29 institutions in ten countries and Antarctica, received a four-year CYTED grant to consolidate its infrastructure and long-term sustainability. The SWGO collaboration selected the Atacama Astronomical Park in Chile as its site (July 2024) and is moving toward a conceptual design. The CTAO, with Brazil, Chile and Mexico in the Consortium, is under construction in Chile and Spain. The ASTRI Mini-Array is engaging Brazilian groups. Short-term landscape experiments in cosmology that involve the development of local facilities and resources include the Brazilian-led BINGO experiment, and the global international projects: QUBIC, and Rubin Observatory's LSST. Looking ahead to the long-term future and the frontier of gravitational-wave (GW) research, the SAGO proposal envisages the location of a third-generation (3G) GW experiment in the region.

Experiments with Latin American leadership and participation in astroparticle, cosmology and gravitation:

- **Ongoing:** AUGER (AugerPrime), LAGO, HAWC, LVK, NANOGrav, LSST and DESI
- **Short term (<3 years):** QUBIC (commissioning 2025), BINGO, TOROS, LLAMA (unfortunately stalled at the moment)
- **Mid term (3–10 years):** CTAO/ASTRI, SWGO (approved site 2024), ET
- **Long term (>10 years):** GRAND200K, SAGO

Recommendation 2

Maintain strong advocacy for ANDES, and support SWGO as a new premier regional research infrastructure project driven by robust Latin American collaboration.

The Agua Negra Deep Experiment Site (ANDES) was the top priority of the 2020 Strategy

Document. Since then, the Agua Negra Tunnel project — the civil engineering infrastructure on which ANDES depends — has remained stalled. Nevertheless, scientific activities continue: collaboration between Argentina (ITeDA) and Chile (Universidad de La Serena) has produced two innovative muon-veto telescope prototypes now being installed at underground sites in San Juan and Coquimbo. These activities preserve momentum and provide training.

The pursuit of ANDES remains a priority. Its unique geographic location under the Andes at depths exceeding 1700 m water equivalent offers a world-class environment for dark matter searches, neutrinoless double-beta decay, low-background physics, geology and biology. No other underground laboratory of comparable depth exists in the Southern Hemisphere. Its realization would transform the region into a global center for underground physics and elevate Latin America's strategic position in this frontier.

The Latin American community should continue to advocate for this project at the governmental level and maintain the technical and scientific readiness to move rapidly if the tunnel project is reactivated.

The SWGO (Southern Wide field Gamma ray Observatory) project, to be built at the Atacama Astronomical Park in Chile, is a major research infrastructure that gathers the participation of the Latin American community from its inception. It is designed to be the first high-altitude, wide-field gamma-ray observatory in the Southern Hemisphere, aiming to survey the sky in very-high-energy (VHE) and ultra-high-energy (UHE) gamma rays. The SWGO Collaboration is formed by scientists from institutions of about 15 countries, with Argentina, Brazil, Chile, Mexico and Peru from Latin America, some of which are playing leading roles. As such, SWGO should be viewed as a flagship research infrastructure in the region.

Recommendation 3

Support and expand Latin American participation in collider experiments at the LHC, HL-LHC and Belle II, consolidate involvement in upcoming facilities including the EIC and NICA-MPD, and develop coordinated engagement in future collider projects.

Latin American participation in LHC experiments has grown substantially: from 561 participants in 2020 to 711 in 2025 (a 26.7% increase), with the number of publication authors growing by 77.4%. Brazil, Chile, Colombia, Argentina, Mexico, Ecuador, Uruguay, Costa Rica and Honduras are now represented. New associate membership agreements with CERN (Brazil 2024, Chile 2026) and ICAs (Honduras, Uruguay, Guatemala) reflect this deepened integration.

Key developments:

- **Argentina** participates on key areas of ATLAS experiment with leading responsibilities on physics analyses and trigger and contributes to the ATLAS Phase-II upgrade for HL-LHC with firmware and hardware for the trigger system.
- **Brazil** plays leading roles in ATLAS (trigger electronics, calorimetry), CMS (OpenIPMC boards for HL-LHC upgrades, shipped to CERN), LHCb (VELO, SciFi, RTA), ALICE (FoCal, ALICE 3 magnet project in 2025) and the PPS.
- **Chile** has groups working in CMS and ATLAS, in the latter with the upgraded muon tracking system, part of which was constructed in Chile.
- **Mexico** participates in ALICE (ALICE 3 MID design), CMS, Belle II (the only Latin American country), and has theory and phenomenology groups engaged with the EIC pro-

gram.

- **Colombia** contributes to ATLAS, CMS and LHCb
- **Costa Rica** became a full LHCb member (2022) and plans R&D for LHCb Upgrade II.
- **Brazil, Mexico and Cuba** contribute to NICA-MPD at JINR; Brazil signed a cooperation agreement with JINR in 2025.
- **Mexico, Brazil, Colombia and Argentina** participate with 16 scientists in the early-stage physics for the EIC at BNL.

Looking ahead, the region should engage proactively in the decision about the future flagship collider project at CERN (FCC-ee, FCC-hh) and in the ILC and CEPC discussions. A survey of the Latin American HEP community on future flagship projects was submitted to the ESPP in 2025.

Roadmap:

- **Ongoing:** LHC (Run 3), Belle II
- **Mid term:** HL-LHC (starting 2029), NICA-MPD, EIC
- **Long term:** FCC/ILC/CEPC (>2035)

Recommendation 4

Consolidate and expand Latin American participation in neutrino physics experiments, with particular emphasis on DUNE, Hyper-K, JUNO and the unique regional experiments, future neutrino experiments as ANDES, HERON and TAMBO.

Neutrino physics engages the broadest coalition of Latin American countries in a single physics area. Argentina, Brazil, Chile, Colombia, Mexico, Paraguay and Peru contribute to the global neutrino program.

The most significant development since 2020 is the major Brazilian commitment to DUNE: US\$36 million towards the liquid argon purification system (May 2024) and US\$5 million towards the photon detection system (2024). Production and assembly are being performed in Brazil. Colombia has developed the DAPHNE boards for the DUNE far detector — a significant Latin American hardware contribution to a neutrino experiment. Chile contributed 400 HVS and 200 UWB for JUNO, completed in 2022. Mexico will produce the first full batch of 19-channel multi-PMTs for Hyper-Kamiokande (2027 installation campaign), supported by a 2024 SECIHTI grant. Brazil participates in Hyper-K physics studies.

Regional experiments continue to produce world-class results: CONNIE (Brazil) and the Atucha-II experiment (Argentina) set best-to-date limits on millicharged particle parameters using Skipper CCDs. The ν -ANGRA experiment in Brazil remains active on reactor safeguards. TAMBO, in the Peruvian Andes (Colca Valley, Arequipa), is progressing toward deployment for tau neutrino detection from astrophysical sources. Supported by an ERC Synergy Grant 2025, the HERON project will advance the final optimization of its instrumentation and acquisition systems, moving toward the construction of a novel ultra-high-energy neutrino observatory in the Andes region of San Juan, Argentina.

Neutrino experiment roadmap:

- **Ongoing:** NOvA, ν -ANGRA, CONNIE, JUNO, SND@LHC
- **Mid term:** DUNE, Hyper-K
- **Long term:** TAMBO, GRAND, HERON, ANDES

Recommendation 5

Develop coordinated support for dark matter searches in the region, leveraging both regional laboratories and participation in international experiments, with special attention to the unique capabilities of Skipper-CCD technology developed in Latin America.

The dark matter search program in Latin America has strengthened considerably since 2020. The LAMBDA laboratory (inaugurated July 2022, University of Buenos Aires) provides world-class Skipper-CCD capabilities in the region and serves as a hub for DM, neutrino and BSM searches. Argentina participates in the ongoing SENSEI skipper-CCD experiment at SNOLAB in Canada. The Oscura experiment (next-generation Skipper-CCD, 30 kg-year exposure) has the participation of scientists from Mexico, Argentina, Brazil and Paraguay. Brazil participates in DarkSide and the CYGNO experiment.

Latin America's contribution to DM indirect searches is growing through CTAO, SWGO and HAWC. The Brazilian theoretical DM community has been particularly active, with a comprehensive white paper submitted to the 2025 strategy update. Groups in Mexico, Colombia, Chile and Argentina pursue active DM theory and phenomenology programs.

An opportunity exists for the region to coordinate its Skipper-CCD expertise — distributed across Argentina (LAMBDA, CNEA), Brazil (CBPF, UFRJ) and Mexico (UNAM) — into a coherent regional program for low-mass DM searches.

Recommendation 6

Strengthen theory and phenomenology groups across the region, ensure their integration with experimental efforts, and support the networks and schools that foster this interaction.

The 2025 Briefing Book documents, for the first time in detail, the landscape of Latin American theory and phenomenology groups in HECAP. This is a mature community with internationally recognized contributions in: QCD and hadron structure, electroweak phenomenology, BSM model building, dark matter theory, neutrino theory, gravitational waves, and QCD under extreme conditions.

Key networks and groups include:

- The **LANEMqcd** network (27 members, 6 countries, 20 institutions) on electromagnetic effects in strongly interacting matter.
- The **MexNICA** group (18 researchers) focused on QCD matter theory relevant to NICA and heavy-ion physics.
- Active QCD and hadron structure groups in Mexico (UNAM, Cinvestav, Michoacán, Sonora, Colima), Brazil (multiple institutions), Colombia, Chile and Argentina contributing to the muon $g - 2$, EIC physics and pion/kaon structure.
- Theory groups in Guatemala, Honduras and Ecuador engaging in BSM, scattering amplitudes and cosmology.
- The 2nd edition of the **PHENOEXP** Workshop is taking place in 2026 continuing its mission of strengthening the dialogue between phenomenologists and experimentalists engaged in the LHC physics programme, especially for researchers in South America.
- Active cosmology and gravitation theory across Argentina, Brazil, Chile, Colombia and Mexico.
- The Colombian Network on High Energy Physics (**CONHEP**): a cluster of researchers

nationwide advancing theoretical and experimental projects across HEP, cosmology, and astroparticle physics.

The interaction between theorists and experimentalists remains essential. The **SILAFAE** symposium (biennial, since 1996) is the natural forum for this interaction and should continue to receive institutional support. Regional workshops and the LAA-HECAP coordination body should explicitly foster theory–experiment connections.

Recommendation 7

Support and develop advanced training programs that harness regional capacities, address the HECAP training gap, and build a coherent continent-wide training ecosystem from schools through doctoral programs.

The training landscape has diversified substantially since 2020. The 2025 Briefing Book documents an extensive ecosystem of training activities: the CERN Latin-American School of High-Energy Physics (CLASHEP, hosted in Costa Rica in 2025), the Joint ICTP-SAIFR/ICTP-Trieste Schools in Particle Physics and in Cosmology, the LA-CoNGA physics and EL-BONGÓ networks (ERASMUS+), the IIP Programs (Natal), the *Escuela Mexicana de Partículas y Campos*, the Giambagi Winter School, the Brazilian School of Cosmology and Gravitation, and the *Diplomado en Física Teórica* UNACH–ICTP (fully online, free, since 2021).

Nevertheless, gaps remain: systematic training in GPU programming, ML deployment on FPGAs, data-centric algorithm design, and detector instrumentation is not yet continent-wide. Postdoctoral opportunities and long-term mobility funding remain scarce.

A coherent training pathway should be established:

1. **Foundation:** Online pre-courses and modular diplomas (accessible from anywhere).
2. **Immersive schools:** One to two weeks at funded international schools.
3. **Skills bootcamps:** Detector instrumentation, computing, ML applications.
4. **Mentored research:** Integration into experimental and theoretical programs.

Regional coordination with CLAF or the creation of a new Latin American Physics Training Consortium, which can share scholarship pools and training plans to make this pathway sustainable and inclusive.

Recommendation 8

Foster R&D capabilities in key technologies across HECAP, including instrumentation, detector development, electronics, and artificial intelligence, enabling industrial connections and broader societal impact.

Latin American groups have demonstrated capacity for significant hardware contributions: OpenIPMC (Brazil, for CMS and ATLAS HL-LHC upgrades), DAPHNE boards (Colombia, for DUNE), Arapuca photodetectors (Brazil, for DUNE), the liquid argon purification system (Brazil, for DUNE), HVS/UWB (Chile, for JUNO), multi-PMTs (Mexico, for Hyper-K), Skipper-CCDs (Argentina, Brazil, Mexico), the NeuralRinger algorithm (Brazil, standard for ATLAS online electron identification), and detector R&D for ALICE 3 (Brazil, Mexico), LHCb Upgrade II (Costa Rica, Brazil), and gas-mixture R&D for CMS (Brazil).

Machine learning and AI are transforming HECAP at every level, from trigger systems to of-

fine analysis. Latin American groups are active in this transformation. Coordinated regional ML schools for HEP and a continent-wide initiative in ML-enhanced detector development would greatly enhance capacity.

R&D in areas common to multiple experiments — software and computing protocols, detector technologies, data acquisition and fast electronics — should be explicitly funded as strategic regional priorities. Industrial connections arising from these efforts (medical imaging, radiation monitoring, high-performance computing, chip design) should be cultivated.

Recommendation 9

Enhance high-performance computing infrastructure, internet connectivity, and data infrastructure in the region, establishing a Latin American Science Cluster aligned with open-science principles.

Computing and data infrastructure are indispensable for all modern HECAP experiments. The data volumes from LSST, CTAO, SWGO, and the HL-LHC experiments will require significant regional computing capacity.

Recommendations for computing and data infrastructure include:

- Prepare an inventory of existing HECAP computing, storage, software and network resources in the region.
- Establish a Latin American Science Cluster, inspired by ESCAPE ¹, the European Science Cluster of Astronomy and Particle Physics, integrating HECAP computing resources from across the region. This effort should enable coordinated open-data policies, provide shared AI laboratories and support FAIR data principles.
- Invest in regional high-performance computing centres accessible to HECAP groups. This can be done in cooperation with SCALAC (Servicio de Computo Avanzado para Latinoamérica y el Caribe²) in cooperation with RedCLARA connectivity
- Develop a coordinated open-data policy for experiments hosted in Latin America.
- Support AI/ML training programs specifically targeted at HECAP applications.
- Strengthen RedCLARA connectivity to ensure reliable high-bandwidth links for data-intensive experiments. Connectivity through SCALAC-RedCLARA must be enhanced and sustained.

Recommendation 10

Develop formal, stable mechanisms for coordination and funding among research councils and funding agencies at the regional level, consolidate LAA-HECAP as the coordinating body, and encourage outreach, citizen science and societal engagement.

The creation of LAA-HECAP in 2021 was a major step in addressing the coordination gap identified in the first strategy. This body should be strengthened with:

¹<https://projectescape.eu/>

²The Advanced Computing System for Latin America and the Caribbean (SCALAC) is an international non-profit association that brings together supercomputing centers, academic networks, and scientific communities to facilitate access to advanced computing services <https://scalac.redclara.net>

- Stable intergovernmental agreements that enable multi-year, multi-country funding commitments.
- Permanent contact with funding agencies in the region.
- A regional coordination mechanism for HECAP priorities analogous to national P5 and European Strategy processes.
- A unified voice of the community in conversations with IUPAP, CERN, Fermilab and other US national laboratories, KEK, JINR and other international institutions.

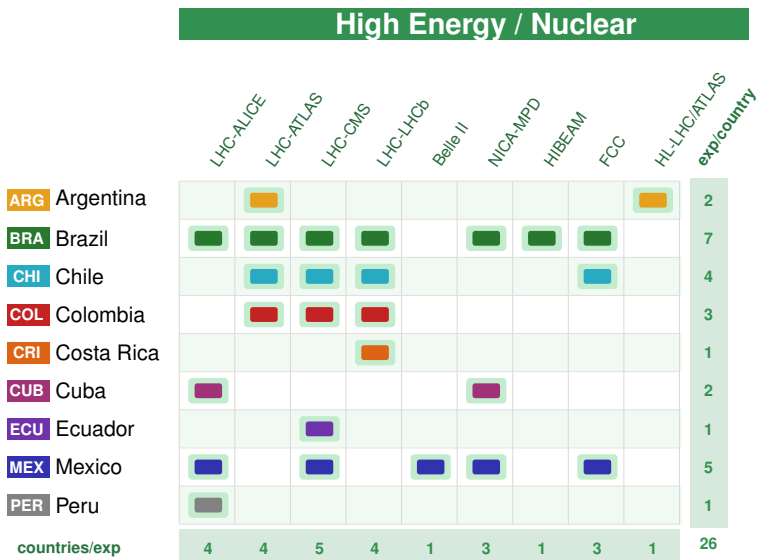
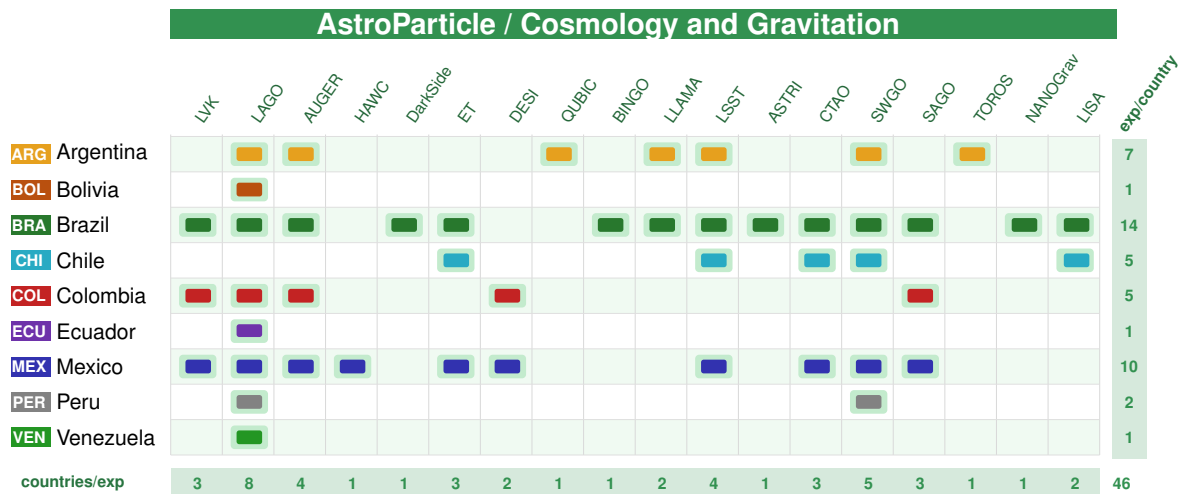
Outreach and citizen science remain important for sustaining public and governmental support. LAGO's unique model — a network of detectors that simultaneously serves science, space weather monitoring, education and outreach — exemplifies the multi-purpose value of regional infrastructure. The Masterclasses program (in the context of IPPOG) and citizen science projects across the region should receive institutional support.

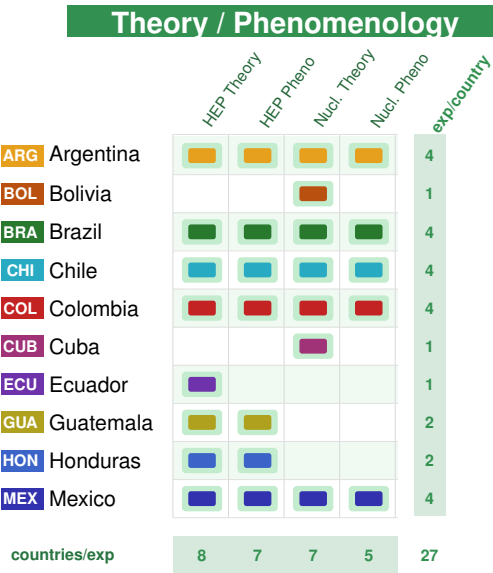
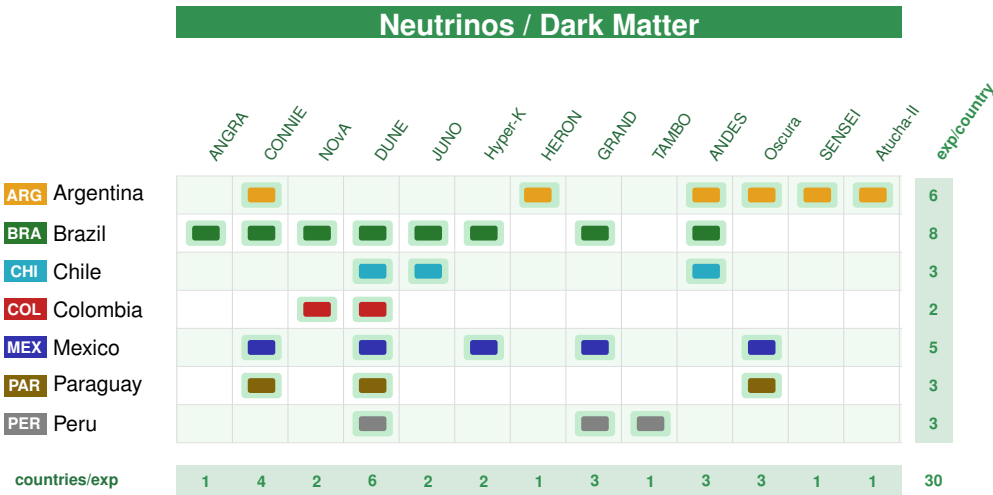
Scientific visibility must be actively pursued: the upcoming ICHEP 2026 in Natal, Brazil, and ICRC 2027 in Buenos Aires, Argentina, are exceptional opportunities to showcase Latin American contributions to the global community.

Appendices

A. Tabular Form of the Landscape

We present below the tabular form of the figures shown in the Executive Summary, including explicitly theory and phenomenology networks in the region.





B. Glossary of Experiments

Acronym	Full Name
ABRAS	Argentina-Brasil Astronomical Center
ALICE	A Large Ion Collider Experiment
ALPACA	Andes Large-area PArticle detector for Cosmic-ray physics and Astronomy
ANDES	Agua Negra Deep Experiment Site
ANGRA	Angra Dos Reis Nuclear Complex (Neutrinos-Angra Experiment)
ASTRI	Astrofisica a Specchi con Tecnologia Replicante Italiana
ATLAS	A Toroidal LHC ApparatuS
AUGER	Pierre Auger Observatory
Belle II	B detector at SuperKEKB
BINGO	BAO from Integrated Neutral Gas Observations
CEPC	Circular Electron-Positron Collider
CMS	Compact Muon Solenoid
CNEA TANDAR	Acelerador TANDAR, Comisión Nacional de Energía Atómica
CONNIE	Coherent Neutrino Nucleus Interaction Experiment
CTAO	Cherenkov Telescope Array Observatory
CYGNO	Directional Dark Matter Search
DAMIC	Dark Matter in CCDs
DarkSide	Two-phase TPC for Dark Matter Direct Detection
DESI	Dark Energy Spectroscopic Instrument
DUNE	Deep Underground Neutrino Experiment
EIC	Electron-Ion Collider
ET	Einstein Telescope
FCC	Future Circular Collider
GRAND	Giant Radio Array for Neutrino Detection
HAWC	High-Altitude Water Cherenkov Gamma-ray Observatory
HERON	Hybrid Elevated Radio Observatory for Neutrinos
HIBEAM	High Intensity Baryon Extraction and Measurement
HL-LHC	High Luminosity Large Hadron Collider
Hyper-K	Hyper Kamiokande
ILC	International Linear Collider
JUNO	Jiangmen Underground Neutrino Observatory
KAGRA	Kamioka Gravitational Radiation Detector
LAGO	Latin American Giant Observatory
LAFN	Tandem Accelerator at Laboratório Aberto de Física Nuclear
LAMBDA	Laboratorio Argentino de Mediciones de Bajo umbral de Detección y sus Aplicaciones
LHCb	Large Hadron Collider beauty
LIGO	Laser Interferometer Gravitational-Wave Observatory
LISA	Laser Interferometer Space Antenna
LLAMA	Large Latin American Millimetre Array
LSST	Legacy Survey of Space and Time (Vera Rubin Observatory)
MPD-NICA	Multi-Purpose Detector at the Nuclotron Ion Collider fAcility
NANOGrav	North American Nanohertz Observatory for Gravitational Waves

Acronym	Full Name
NNBAR	Neutron-to-Antineutron Oscillation Experiment (ESS)
NOvA	NuMI Off-axis ν_e Appearance
Oscura	Next-generation Skipper-CCD dark matter search
PPS	Precision Proton Spectrometer
QUBIC	Q&U Bolometric Interferometer for Cosmology
SAGO	South American Gravitational-Wave Observatory
SENSEI	Sub-Electron-Noise Skipper Experimental Instrument
SWG0	Southern Wide-field-of-view Gamma-ray Observatory
TAMBO	Tau Air Shower Mountain-Based Observatory
TOROS	The Transient Optical Robotic Observatory of the South
ν -ANGRA	Neutrinos-Angra Experiment