Strategic Plan
Appendices

The Abdus Salam International Centre for Theoretical Physics

IAEA International Atomic Energy Agency

unesco United Nations Educational, Scientific and Cultural Organization

Contents

Appendix A
New Initiatives

A.1 International Consortium for Scientific Computing (ICOMP)

Status

Rapid technological advancements have established computational sciences as the third pillar of the scientific method, alongside theory and experimentation. Scientific computing has provided insights where theory or experimentation alone could not, such as in projecting future climate changes, designing new materials for clean energy, and analysing cosmological observations. In recent years, the development of advanced data analytics techniques, combined with artificial intelligence (AI), has laid the foundation for a disruptive shift, where computational resources replace traditional laboratories. Today, AI enables previously inconceivable advancements, such as emulating numerical simulation outputs (significantly reducing computational time), building realistic digital twins, and identifying new protein structures and functions. These opportunities at the frontier of science must be available to the developing world through open science and access to technology; if they are not, the knowledge gap and wealth disparity between the Global North and South will only increase.

ICOMP's primary objective is to form **strategic partnerships that provide world-class computational resources to scientists in developing countries**. This includes access to cloud-based computing for both research and training. ICOMP will integrate all essential components—education, infrastructure, technical skills and scientific insight—required for contemporary research. Its ultimate goal is to establish structured research initiatives and lay the groundwork for world-class scientific projects that will develop over time. This effort will create the foundation for advanced scientific computing ecosystems in developing countries, fostering generations of scientists capable of conducting interdisciplinary research and producing high-level technical experts to lead economic transitions. The impact of ICOMP's initiatives will extend beyond the scientific realm, influencing industry and strategic sectors. In its initial phase, ICOMP will focus on (i) climate modelling, (ii) functional materials research, (iii) computational life sciences, and (iv) applied mathematics and AI.

A.1 International Consortium for Scientific Computing (ICOMP)

Current progress and future development

Officially launched in mid-2024, **ICOMP operates as an incubator for scientific collaborations**, welcoming scientists from around the world. It already has an active events programme and partnerships now exist with Brazilian scientific institutions to foster research collaboration there (endorsed by Italy's and Brazil's presidents), and South Africa's National Institute for Theoretical and Computational Sciences (NITheCS) to support computational science there. Further, an ICTP-IBM partnership will sponsor AI schools and workshops over five years, together with an annual €10,000 prize for outstanding AI contributions. An agreement has been secured with CECAM, an international supercomputing collaboration based in Switzerland, to grant African scientists access to European HPC resources, with an initial allocation of 10 million core-hours in 2025.

Within ICOMP, ICTP will be the central facilitating node because of its strong domain expertise in many computationally intensive fields. The consortium will harness and amplify capacities, **but can only realise its potential with significant investment**. Without it, critical scientific capacity in developing countries will continue to struggle and compromise downstream applications of, for example, sophisticated climate modelling conducted in the Global North but requiring local ownership, expertise and application to mitigate or adapt locally. Both the International Science Alliance and ICOMP can play a role in building both connections and trust across the global science community.

A.1 International Consortium for Scientific Computing (ICOMP)

ICOMP will also **help grow other ICTP resources** like the computing facility with the "Argo super-cluster" which is important for its programmes on high-performance computing for training and development and cloud computing, with partnerships like CINECA; and ICTP's Science, Technology, and Innovation (STI) unit, which collaborates with CERN and IAEA on low-cost measuring devices for temperature and humidity to support the predictive capabilities of climate modelling.

ICOMP's long-term goal is to **establish computational science ecosystems in developing countries**, driven by demand for high-performance computing. New funding will be sought for personnel, in-house infrastructure, and software development; together with cultivating local communities of trained scientists, software developers, and administrators to sustain these ecosystems long-term. By integrating scientific research, education, and cutting-edge computing infrastructure, ICOMP will revolutionise computational science in developing countries, fostering a new generation of scientists and innovators.

A.2
International Science Complex

One of the major priorities of the Strategic Plan 2025 is to create a Science Complex with modern facilities to cater to the needs of the 6000 scientists who visit ICTP annually from around the world to attend a variety of scientific programmes.

A natural destination for such a complex would be the Adriatico Guesthouse. Currently the Adriatico offers 9600 square metres of space over 10 floors with 101 guest-rooms or equivalently 208 beds and 400 square metres for offices, 5 lecture-hall facilities, a computer lab, a canteen and meetings spaces. It houses 68% of the total of over 6000 scientific visitors coming to ICTP annually and 47% of the space for lectures during the ICTP programmes. While the Adriatico is indispensable to ICTP's mission, it is an unaffordable drain on our resources costing nearly €1M annually.

ICTP has been successful recently in obtaining a very generous grant of $15M from Simons Foundation International. This grant, together with additional fundraising, will enable ICTP to acquire and fully renovate the Adriatico. It will imply very substantial annual savings which will effectively add to the core budget. It will also allow a very significant redesign for a much more optimal use of space that is better aligned with the organizational needs. Implementation of this project will be one of the highlights of the Strategic Plan.

Such a Science Complex will be truly transformative for ICTP. Together with the existing facilities on main campus it will offer world-class infrastructure to the ICTP community commensurate with the global standing of the Centre.

A.3
Library Modernisation

Status

As part of the Research Division, the ICTP Library serves its user community by providing high-quality research information. During the previous reporting period, the library focused on three key objectives: making its collection accessible to the ICTP community on campus and abroad, updating its technical infrastructure and providing its users with a state-of-the-art library space.

The high mobility and dynamic way of working of ICTP researchers has raised the demand for online resources which guarantee site-independent access. In response, the library has adapted its collection management policy, transitioning its originally print-only book collection into a predominantly digital collection of scientific literature. At present, the ICTP Library offers 24/7 remote access to 55,000 eBooks. Through its “download and keep” policy the library allows users to build personal eBook collections, thereby fostering sustained learning and research, and advancing equitable access to scientific knowledge across the ICTP community. In 2024 the eBook collection recorded 133,000 downloads, reflecting a high level of user engagement.

This “transition to digital” also required the implementation of a technical infrastructure capable of managing and displaying the newly acquired electronic resources, enabling users to download and request scientific literature, and facilitating remote access to the “virtual library”. To support these needs, the library replaced its outdated library management system, ALEPH, with its successor, ALMA. The new system offers users an intuitive interface for searching scientific literature, requesting printed materials, and managing loans and search results. To ensure seamless access to electronic resources regardless of geographic location, the library implemented Federated Access and the web proxy server, EZProxy.

A.3
Library Modernisation

Engagement with, and the production of, scientific output in its various forms and formats involve multiple stages and a wide array of work activities. Acknowledging that an inspiring work environment can positively influence these processes, the library initiated the development of a dynamic and stimulating library space tailored to the needs of the multifaceted ICTP research community. As a result, the traditional library model, characterised solely by "quiet zones", has been re-imagined as a multifaceted ecosystem offering a range of work settings designed to support the diverse activities of both researchers and students. The project is currently in progress and is scheduled for completion in 2026.

Future Outlook

In the next five years, the ICTP Library will build upon its existing services developed for the ICTP community and extend them to support both the global scientific community and the general public with an interest in physics and mathematics. To this end, the library will focus on three key objectives:

- promoting the open dissemination of scientific outputs
- broadening its portfolio of research support services, and
- actively participating in the sharing, discussion and exchange of best practice within an international network of research librarians.

A.3
Library Modernisation

A significant portion of physics and mathematics research is still published in subscription-based journals, limiting access for institutions and researchers without sufficient funding and excluding them from scholarly discourse. In alignment with the UNESCO Recommendation on Open Science, the ICTP Library is committed to supporting ICTP researchers in ensuring that their scholarly output is openly accessible to the global academic community. To this end, the library will facilitate immediate Open Access by promoting publication in both Gold and Diamond Open Access venues, with particular emphasis on fostering Diamond Open Access models. Additionally, the library will advance Green Open Access by developing and maintaining an institutional repository, where all scholarly publications by ICTP researchers will be archived and made freely available to the international research community.

Furthermore, the library will place a strong emphasis on developing research support services tailored to the specific needs of the ICTP community. The planned portfolio of services will range from publication support offerings for students and early-career researchers to quantitative research analysis services aimed at senior scientists. Particular focus will be given to the establishment of an Office of Research Analysis within the library, which will support activities such as institutional reporting, scientific impact evaluation and collaboration analysis. In doing so, the library aims to contribute effectively to the informed decision-making processes of both the scientific sections and individual researchers of the ICTP.

The ICTP plays a pivotal role in advancing scientific capacity building in developing countries and fostering international cooperation through science by serving as a global forum for scientific exchange among researchers from all nations. In alignment with this mission, the ICTP Library aims to strengthen collaboration between research librarians from the Global South and their counterparts in the Global North. To this end, the library aims to establish a platform that facilitates the active participation of research librarians and research support professionals worldwide, enabling them to share and discuss best practices in scholarly communication and research facilitation.

A.4
ICTP Global Science Portal

Status

The ICTP Global Science Portal will be a key development over the next five years. The Portal will primarily be a community hub where former and current ICTP scientists across the world can form connections and collaborations, develop meaningful international and local networks and support each other's professional development. The Portal will provide users a place to easily connect with others in their field or geographic region, promote their work, discover and post opportunities such as studentships, grants, jobs and courses, discover events and ICTP news, search for collaborators, message other users, and engage in forum discussions.

Career development is a key advantage of the Portal for many early/mid-career scientists in the Global South. The Portal can be used to find and support other researchers, access career advice videos, search for mentors, find opportunities and promote themselves. ICTP will additionally provide exclusive career development services such as seminars, Q&As, and meetings. In time, it is anticipated that the alumni network created within the Portal will become an effective fundraising tool.

Staffing for the Portal is currently one full-time, externally funded employee, with assistance from the Public Information Unit. As the Portal grows, an additional full-time staff member focusing on community engagement tasks and moderation will be required.

A.4
ICTP Global Science Portal

Future Outlook

The timeline and metrics for developing the Portal is tabulated below.

January-June 2025

Development of:

i. A global media centre to store lectures, lecture notes, exclusive seminars and videos, and talks of interest to the community. Groups will be offered dedicated media centres to store and organise their content.

ii. Portfolios (a Hivebrite module) for personal profile pages to improve look and user experience. Users will be able to upload videos, documents, and links, (e.g. to ORCID pages and personal websites).

iii. Associates meetings, which started in 2024 to continue online.

iv. Onboard String Theory Mentoring organisers and participants, who will use it to organise and promote their mentoring community. This provides a test ground for future mentoring activities on the platform.

v. Community growth:

- Onboard established SMR groups (e.g., Hands-on Schools), providing each with a dedicated group and access to the rest of the Portal, via email campaigns and direct onboarding.
- Identify countries of interest for expansion and target potential users within these regions, starting with India and Brazil, where there are high concentrations of ICTP researchers.
- Highlight and approach possible ambassadors for the portal, both regional and in each field, to build a network of ambassadors in each region.

A.4
ICTP Global Science Portal

July-December 2025

- Automatically offer membership to all SMR participants, from the time of their acceptance.
- Create more video content to target SMR users, such as helpful tips for visitors.
- Hold first full Alumni Board meeting in July, online.
- Beta-test and launch the dedicated Portal app in summer 2025.
- Portal check-up: (i) evaluate SMR participation, (ii) assess use and functionality of each Portal functionality (module); (iii) survey user base.
- Launch more local groups to connect users within countries of interest.
- Create special interest groups to help bring people together with similar interest to share their experiences.
- Activate external recruiters' page.

Metric

- Reach 2000 users.
- 10% user engagement.
- Track pieces of organic content created.

A.4
ICTP Global Science Portal

2026

- Identify countries of interest for expansion, such as Nigeria and Vietnam, and target potential users and scientific communities there.
- Develop a strategy for creating in-person events in regions of interest, to promote networking both on and off the Portal and strengthen international and regional bonds.
- Set up a working group to discuss community-driven mentoring with both remote users and ICTP faculty. String Theory Mentoring will act as a test case for mentoring on the platform.
- Roll out gamification in the form of badges that are earned through engagement as a way of maintaining platform engagement.
- Open up the Portal for invited members, using a "friend of a friend" referral approach, to allow for broader engagement, particularly in regions where there are few ICTP scientists.

Metric

- Reach 5000 users by Dec 2026.
- Retain 10% user engagement.
- Track instances of organic content created.

2027-2030

- Further develop the Portal using the results of bi-yearly Advisory Board meetings and surveys to guide future strategy.
- Evaluate Portal membership for researchers from similar and linked networks such as CERN and ESA, and form collaborations with other platforms.

Metric

- Retain 10% user engagement
- Reach 10,000 users within 5 years.

Appendix B
Research

B.1 High Energy, Cosmology, and Astroparticle Physics (HECAP)

The High Energy, Cosmology and Astroparticle Physics (HECAP) section investigates nature at its most fundamental level.

Status

Research streams represent different approaches to understanding the universe's basic principles and building blocks. The section operates through four interconnected areas:

- **Theory:** Research focuses on mathematical aspects of quantum field theory, string theory and the holographic duality, investigating both their fundamental principles and potential phenomenological applications.
- **Particle Phenomenology:** Research focuses on the studies of fundamental interactions of elementary particles, in particular the origin of electroweak symmetry breaking, strong CP problem, dark matter, neutrino and flavour physics.
- **Cosmology:** Research focuses on the aspects of cosmology which are close to fundamental physics. Central topics are inflation, dark matter, gravitational waves and the present acceleration.
- **Experimental High Energy:** this group has been part of the ATLAS experiment at the CERN Large Hadron Collider since 2008 and works on searches for new particles and properties of Standard Model Particles such as Higgs bosons and top quarks.

The section currently consists of 7 full-time scientists, 5 Emeritus scientists, 1 Distinguished Staff associate, 11 post-docs (5.5 of them covered by external funds) and 14 PhD students (3 enrolled in the Joint SISSA PhD programme and 2 in STEP). In addition, the section collaborates with approximately 40 Associates.

B.1 High Energy, Cosmology, and Astroparticle Physics (HECAP)

This period saw incoming funding from (i) a European Research Council (ERC) starting grant which increased the number of post-docs in the section, further enhancing the Centre's ability to attract top-tier scholars; (ii) National Institute of Nuclear Physics (INFN) funding for the ICTP ATLAS group; and (iii) funding from the Simons Collaboration on Special Holonomy in Geometry, Analysis and Physics to fund two ICTP post-docs and two PhD students with significant travel funds.

The section works in collaboration with several local institutes:

- University of Udine, INFN Trieste and CERN: Collaboration with the ATLAS group.
- IFPU (Institute for Fundamental Physics of the Universe): Joint initiative with SISSA, Trieste Observatory and INFN to strengthen research collaborations in cosmology within the different institutions.
- IGAP (Institute for Geometry and Physics): Joint initiative together with SISSA to promote interdisciplinary research between mathematics and physics.
- INFN (Istituto Nazionale Fisica Nucleare): Financial support for activities, post-docs and visits.
- SISSA (International School for Advanced Studies): Local PhD institution. Collaboration for research and PhD students.
- University of Trieste: research collaboration with theoretical physics department.
- Intra-sectional collaboration: new geometry and physics seminar.

B.1
High Energy, Cosmology, and Astroparticle Physics (HECAP)

The HECAP section delivers eight courses annually on advanced topics in high energy theoretical physics in the Diploma programme. In addition, in the last five years, HECAP hosted approximately 35 activities (schools, conferences, and workshops), almost half of them outside Trieste.

In particular, HECAP's three Schools — the *Spring School on Superstring Theory and Related Topics*, the *Summer School on Particle Physics*, and the *Summer School on Cosmology* — are considered hallmark activities of ICTP. These schools have been central in forging connections with partners in developed and developing countries, including the Brazilian partner institute ICTP-SAIFR, where the particle physics and the cosmology schools take place biennially, alternating between Trieste and Sao Paulo. The African School of Fundamental Physics and Applications is a major summer school which takes place in a different African country every two years. The section also coordinates the impactful Physics Without Frontiers Programme which organises more than 20 activities in developing countries annually.

B.1 High Energy, Cosmology, and Astroparticle Physics (HECAP)

Future Outlook

In descending priority, HECAP anticipates:

- At least 10 post-docs operating at all times to ensure a critical mass in each research area. Post-docs play a vital role in the ICTP mission by serving as teaching assistants in the Diploma Programme, organizing of activities (schools, workshops, seminars), and mentoring PhDs and Diploma students. Excellence remains the primary selection criterion, with priority given to candidates from developing countries. One post-doc is assigned to the ATLAS group as the ICTP commitment to the experiment. This group has had a major impact on both the ICTP mission and its scientific profile, particularly through the Higgs boson discovery and its role in training young physicists from developing countries. HECAP has played a leading role in the creation development of the Postgraduate Diploma Programme (extended through the ICTP-SISSA joint PhD programme) and of the flagship Schools on string theory, particle physics, and cosmology all of which have achieved great success; future efforts will build upon them.

- Currently the section hosts 10 Diploma students each year. Increasing funding for the programme to accommodate at least 40% more students and extending its duration to two years will enhance its impact and competitiveness. Furthermore, the practice of granting one or two joint SISSA-ICTP PhD positions for Diploma students is likely to continue. To ensure the best Diploma graduates can advance, at least four joint PhD positions will be maintained at all times. The future will build on the success of this programme, where several graduates have returned to their home countries and served as key contacts for future student and post-doc selections from their regions.

- The HECAP schools remain a unique event in ICTP's scientific community: a yearly event of the highest scientific standard, and with a focus on students from developing countries.

B.1 High Energy, Cosmology, and Astroparticle Physics (HECAP)

In the current era of geopolitical tension, HECAP's three traditional schools on string theory, particle physics, and cosmology can serve as a crucial hub where young scientists from developing countries interact with one another and with high-profile lecturers. Given the enormous demand from the developing world (with up to 600 applications for a single event), these schools are recognised as flagship programmes of ICTP, and should support the participation of at least 50 students and extend the schools to minimum two-week events. With additional funding, these programmes could be expanded, to help build connections with the developing world, identify new venues for hosting schools, and engage with local scientists.

Section members are committed to, and actively applying for, external funding from agencies such as the ERC. ERC applications are highly competitive and time-consuming: ICTP's planned research grants office will help and ICTP could also consider incentives to acknowledge researchers who achieve ERC high rankings but do not secure funding.

Expanding the section to cover additional research areas is essential for the ICTP mission, enabling it to serve scientific communities that are not currently represented. Appointing new faculty in directions closer to observation (e.g. cosmology, astroparticle physics, particle physics) and/or with expertise in numerical methods and large-scale computation (e.g. numerical GR, large-scale structures, lattice QCD and collider physics) will complement existing areas of research, strengthen ongoing collaboration, address the needs of the developing world, and align with ICTP's ICOMP.

Historically, ICTP has hosted numerous impactful workshops, fostering collaboration and scientific advancement. Securing funding to expand these workshops will significantly enhance the section by attracting top-tier scientists, and providing valuable training opportunities for researchers, particularly from developing countries. Expanding the scope and frequency of these workshops would further solidify ICTP's role as a global hub for cutting-edge scientific discussions and capacity building.

B.2 Condensed Matter and Statistical Physics (CMSP)

Research in the CMSP group explores some of the most cutting edge areas of theoretical condensed matter and statistical physics.

Status

Its scope ranges from the study of interacting quantum many-body systems to the atomistic and electronic structure simulations of fluids and solids. It also encompasses quantum information processing, the physics of nanostructures, and the design of novel materials for renewable energy applications, as well as research related to synchrotron radiation. This highly interdisciplinary and broad spectrum of topics has emerged as prominent research areas at the ICTP, historically driven by the CMSP section's role as an incubator for new research directions. The research activities within CMSP are driven by two core pillars:

» Pillar 1: **The study of quantum many-body systems which connect different aspects of condensed matter, statistical mechanics and quantum information.** This includes topics ranging from cold-atoms in optical lattices, disordered systems, quantum transport through nanostructures, many-body physics with light and quantum simulators to name a few. Within this research pillar, the study of the physics of nano-systems offers the fascinating possibility of exploiting quantum phenomena in giant fabricated systems. In this context, research directions include charge/heat transport, topological systems and quantum coherent electronics and spintronics.

» Pillar 2: **Atomistic simulations used to model and probe molecular and electronic systems at the atomistic scale.** This includes a broad spectrum of interdisciplinary applications ranging from condensed matter to soft-matter physics and computational chemistry. Specifically, this covers the physics of materials under pressure, multiferroic materials, surface physics and biomolecular systems in liquids. Under this domain, the study of the properties of materials for renewable energy applications forms a key component of the research activity.

B.2 Condensed Matter and Statistical Physics (CMSP)

The CMSP group consists of 9 permanent staff members equally balanced between the two research pillars. This research expertise has been supplemented by typically 5 consultants who cover scientific topics beyond those covered within the section and who also ensure that the group maintains strong collaboration and ties with local Italian institutions. Historically, the research group has also benefited from having senior post-docs, as a mechanism for recruiting permanent in-house faculty and identifying directions that can strengthen the two research pillars. The research life of the group is further bolstered by the presence of a strong cohort of PhD students through the ICTP-SISSA, SISSA and University of Trieste PhD programmes and postdoctoral researchers. Regular seminars involving a steady flow of high-level scientists covering topics in both research pillars ensure a vibrant life in the section.

Collectively, this critical mass of group members populated by both senior and young researchers provides a strong environment for interactions with the Programmes division including Associates, STEP students and visitors from conferences and schools at the ICTP. In addition, senior PhD students and postdoctoral researchers are essential to provide continuous mentoring to the Diploma students who form an important part of the life of the section.

At the level of research, the group publishes approximately 100 papers a year, 10-20% of which are in high quality journals such as Science, PNAS, PRL, PRX, JACS and Nature journals. Over the last 5 years, the group has been very active and successful in attracting external funds; for example, through ERC (4), EU grants (2) and Italian PRIN/PNNR (2). Approximately 50% of the post-docs in the section have been funded through these external grants and are typically focused on thematic aspects of specific projects over a timescale of ~3 years. Several of the PhD students and post-docs who are trained within the section have been successfully placed in leading academic and industrial positions.

B.2 Condensed Matter and Statistical Physics (CMSP)

The CMSP section also helps build scientific communities in the Global South by running schools and workshops. In the last five years, a total of 42 schools and workshops have been run at the ICTP and beyond. Members of the CMSP section have pioneered the development and implementation of schools and networks geared towards training African scientists in electronic structure methods and applications (ASESMA), as well as in computational and experimental methods for biological systems.

Future Outlook

The CMSP section seeks to further strengthen the existing two research pillars. Staff changes in this next strategic planning period will create opportunities for exploring new and emerging directions within condensed matter that could strengthen and complement existing expertise. These include artificial intelligence and machine learning (AI/ML) methods, which will fill an important gap in the section and contribute to institutional initiatives such as ICOMP. Any recruitment will focus on both scientific excellence and international, cultural and gender diversity.

Faculty in the CMSP section will continue to seek new research grants through EU and wider international partnership, supported by the new ICTP research grants office/funding facility. In the meantime, maintaining strong ties with local and national Italian universities and supporting ICOMP's agenda (through its Renewable Energies and possibly Theoretical Quantum Technologies initiatives) will provide continuity.

B.2
Condensed Matter and Statistical Physics (CMSP)

In terms of capacity building, mission and training, CMSP will continue to respond to new challenges in the Global South and ensure the development of active scientific communities in the frontiers of CMSP, through its workshops and schools in Trieste and in partner countries/regions. For example, biennial school initiatives - ASESMA (electronic structure) and BISECS (computational biophysics) – both run in Africa and will form an important part of ICOMP's activities. Other opportunities include annual thematic workshops and schools that bring together a smaller number of researchers from the Global South as "research huddles".

The CMSP Diploma course will also be updated to include topics that complement other sections, such as in Mathematics (Topology), Mathematics/QLS (Machine Learning/AI), QLS (Mathematical Techniques and Statistical Physics), HECAP (Quantum Mechanics and Quantum Information) and ESP (Energy/Atmospheric Chemistry). Coordinating these efforts at an institutional level through the Programmes Division may also offer opportunities for exploring funding within the ICOMP/Future Earth initiatives.

B.3 **Mathematics** (MATH)

Status

The Mathematics Section conducts research in differential and algebraic geometry, geometric analysis, harmonic analysis and analytic number theory, dynamical systems and ergodic theory, mathematical aspects of quantum field theory and string theory, high-dimensional statistics, probability, and statistical machine learning. The section collaborates closely with the HECAP section on various aspects of geometry and mathematical physics, and with the QLS section on mathematical aspects of information processing systems. It contributes significantly to the main programmes of ICTP such as the Diploma and Associates programmes and regularly organises well-attended workshops and conferences.

The section is composed of seven faculty members. Two faculty members also share their activity with the HECAP and the QLS sections respectively.

The section collaborates with the most important mathematical organizations in the world. These include the International Mathematical Union (IMU), European Mathematical Society, Istituto Nazionale di Alta Matematica (INDAM, Italy), US National Science Foundation, Simons Collaborations and Clay Institute.

Future Outlook

The section plans to consolidate current research fields and expand into closely related areas (for example, PDEs, representation theory and low-dimensional topology), through Marie Curie Fellowships, ERC grants, and other promising sources, assisted by ICTP's planned research grants office.

B.3 **Mathematics** (MATH)

Further, the section plans to develop longer-term thematic programmes to explore important current topics in-depth, through intense workshop weeks, regular seminar and lecture activities. This model of working benefits both research partners in the Global South and the local research community of scientists, post-docs and PhD students, as well as facilitating collaboration with the Italian mathematics community.

Collaborations will be strengthened and expanded with top research groups and institutions globally to:

- organise cutting-edge mathematics conferences at ICTP, with external funding support: specific examples include convening the SLMath graduate schools series in 2026, with INdAM, and the VBAC (Vector Bundles on Algebraic Curves) conference series in 2027.
- organise schools and conferences in developing countries, co-funded by external institutions (such as the EAUMP for EAST Africa, CIMPA, BIRS, and BIMSA and Beijing University for China).
- fund visiting fellowships, which are now already largely co-funded by INdAM and CIMPA through joint Research in Pairs Programmes, and extending such schemes using governmental support from countries like China (partly already in place), Vietnam and Brazil.

The Mathematics faculty is actively working on institutional agreements with various institutions to increase their co-funding of ICTP activities, also including the Diploma and the Associate Programmes.

B.4
Earth System Physics (ESP)

Status

ESP research activities tackle fundamental and applied front-line topics in climate and the solid earth; its main lines of research can be broadly divided into:

» **Climate physics and modelling:** This includes studies on (i) atmospheric tropical-extratropical and tropical-tropical teleconnections and the resulting predictability in monsoon and other regions, (ii) large-scale ocean circulation physics, its variability, stability and interactions with the atmosphere and sea-ice at decadal and longer time scales, (iii) Tropical dynamics and cloud/convection dynamics and climate feedbacks (iv) the interaction between large-scale and local scale processes in a changing climate, from decadal to centennial time scales, relevant for assessing the impact on multiple types of hazards and extreme events. Within the scope of this research line, the section develops and maintains a number of open source climate models, from a hierarchy of atmosphere, ocean and coupled models, to high resolution regional Earth system models.

» **Physics of the solid earth:** This research line investigates the way earthquake faults develop in time and how the Earth Interior deforms. It relies on geophysical methods blending space geodesy, seismology and tectonics, tied through realistic numerical modelling. This contributes to the physical understanding of the length and time scales of active deformation processes and to a more realistic assessment of the earthquake hazard. Specifically, the following topics are studied: mechanics of earthquakes and faulting, structure and rheology of the lithosphere in active earthquake and volcanic regions, physics of transient deformation, active tectonics and earthquake hazard.

» **Impact studies:** Climate change impacts, meteoclimatic extreme events and associated hazards and risks, which makes use of modelling tools, especially the RegCM4 run at high resolutions and the CHyM hydrological model, the VECTRI malaria model, as well as analyses of observation records.

B.4
Earth System Physics (ESP)

In all these areas, both basic curiosity-driven research aimed at process understanding and applied research for use by stakeholders and policymakers are carried out. ESP faculty continue to contribute to numerous international programmes and community efforts, most prominently the Intergovernmental Panel on Climate Change (IPCC), various panels and working groups of the World Climate Research Programme (WCRP), Climate and Ocean Variability Predictability and Change (CLIVAR), West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL).

The ESP section is composed of six scientific staff. On average, the section is complemented annually by 8-10 post-docs and long-term visitors, staff associates and consultants, allowing for a vibrant, multidisciplinary and innovative environment. Additionally, the ESP section benefits from many PhD students, mostly from the Global South, thanks to its participation to the ESFM PhD programme at the University of Trieste. The ESP group has co-authored around 70 peer-reviewed publications per year.

ESP research relies heavily on massive computational resources, which have to be secured either from external sources (e.g. the CINECA supercomputing centre in Bologna) or now aging local infrastructure (the ICTP ARGO HPC). The section has been successful in attracting and securing external funding, in particular from the EU Research and Innovation programme, but also Italian programmes (PNRR, MIUR), private stakeholders (e.g. Allianz, Generali, ENEL) for research fellowships, and international organizations and foundations (e.g. UNITAID, Wellcome Trust, GATES Foundation).

B.4
Earth System Physics (ESP)

In its capacity building and training function, ESP draws on ICTP's broad range of programmes (Diploma, Associates, Scientific Activities, STEP students, EAU Affiliated Centres, EAU Networks, Scientific Activities, Physics Without Frontiers). The section has a long tradition of capacity building by involving scientists from the Global South in networks in seismology, regional climate, global atmospheric and ocean, as well as malaria and fire modelling. The section organises about 10 activities per year both abroad and on the Trieste campus. In addition, members of the ESP group also participate in a PhD programme at the University of Trieste, while some also teach at the Laurea Magistrale in physics there, and in the master programme in solid-earth geophysics at EAIFR in Rwanda.

Future Outlook

Under new sectional leadership, the Section will strengthen its activities in four priority areas:

» **Applications of Artificial Intelligence and Machine Learning** (AI/ML) in climate science, improving representation of atmospheric teleconnections in climate models and the extended range (from a few weeks to years) forecast skill of such models. Additionally, AI emulators for very high resolution climate projections will be a valid supplement to already existing high resolution regional Earth System climate models.

B.4
Earth System Physics (ESP)

- **The study of tipping points and tipping elements,** and general non-linearities in the climate system, to support theoretical, observational and modelling perspectives, with impacts that go beyond physical science and cascade into the biosphere, economy and society. Individual research in the physical climate system within the section could be complemented and intersected through the establishment of an institute-wide initiative on earth system tipping points with an interdisciplinary approach on (i) physical climate science (ocean-atmosphere circulation, cryosphere, extreme events), (ii) impacts (biodiversity, ecology), and (iii) society and technology, with a focus on the Global South as a stakeholder. The effort could leverage on multiple existing research activities at ICTP (ESP, QLS, MATH, STI, ICOMP) and promote new scientific research lines and programmes with Global South Institutions.

- **Integrated climate-impacts tools.** Traditionally climate impacts are modelled as a down-stream, off-line, individual components that focus on one aspect of the climate-drivers, such as how changes in winds, temperature or rainfall might impact e.g. energy generation, health or agriculture. In future the aim will be to move towards more integrated, synergistic models that incorporate multiple impacts and their interactions, including the societal impacts and influences such as circular and long-term migration.

- **Integrated fluid and solid-Earth geophysics:** 1- investigate the response of the Earth system to changes in ice and ocean loading in the present day through numerical models that reflect ice dynamics, spatially variable sea-level change, deformation of the heterogeneous Earth and validated through space geodesy, cryoseismology and glaciology 2- investigate climate and chemical perturbations caused by large explosive volcanic eruptions integrating computational fluid mechanics, physics of volcanoes, atmospheric chemistry and geochemistry.

B.4
Earth System Physics (ESP)

All these advancements will rely heavily on massive HPC resources and support, specifically for the dynamical model transition on GPU platforms. ICOMP can help provide a strong software engineering support unit, with new research staff and/or post-doctoral fellowships. ICTP's planned research grants office will be invaluable here.

In terms of capacity building and teaching, the ESP section and its networks will continue to support the Intergovernmental Panel on Climate Change (IPCC) process, which has seen increasing involvement of scientists from Least Developed Countries (LDC). The steep rise of applications of AI/ML in climate science poses further challenges for developing country scientists where computational resources are limited and access to these resources is imperative. ICTP will endeavour to streamline its programmes to these fast-emerging areas to help plug this gap. It will seek longer-term research collaboration that engages Associates, STEP and Affiliated Centre students as well as scientists in ICTP's External Activities Unit's networks. A first step and pilot event is the ICTP activity '6th Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics: Artificial Intelligence and Climate Modelling' planned for May 2025, which could potentially pave the way for long-lasting collaboration with Global South research groups. Strengthening the interdisciplinarity and duration of the Diploma programme would also be helpful, allowing students to enrol in courses from other Diploma programmes and build their own curriculum.

In terms of infrastructure and HPC, the need for rapid and continuous upgrade of computing infrastructures, together with their high cost, requires ICTP to be ready to adapt to the influx of new HPC platforms and new hardware. Shifting to large European HPC platform and service providers, built on and extending existing agreements as a framework for national and international programmes with LDC countries, will help here, as will the ICTP local New Hardware Evaluation Platform (NHEP) which will reduce the time required for porting and optimization of ICTP codes.

B.5 Quantitative Life Sciences (QLS)

Status

The Quantitative Life Sciences (QLS) research section at ICTP studies fundamental problems at the interface between physics and life sciences, in seven areas:

» **Ecology and Evolution.** Research explores the organization of ecological communities, focusing on species coexistence, abundance, and variation. It employs stochastic processes, random matrix theory, and non-linear dynamics to analyse microbial sequencing data and uncover the ecological mechanisms shaping community structures.

» **High-Dimensional Statistics and Machine Learning.** Research explores the theoretical foundations of modern inference and learning algorithms. It investigates the interplay between data structure, computational efficiency, and statistical requirements, connecting these questions to phase transitions using statistical physics and information theory.

» **Stochastic Thermodynamics:** research focuses on non-equilibrium fluctuations in microscopic systems, combining theory, simulations, and experiments. It has pioneered the martingale theory of stochastic thermodynamics, quantifying entropy production, time irreversibility, and energy harvesting in biological and physical systems.

» **Emergent Collective Behaviour:** research explores collective phenomena in physics, economics, and finance through the lens of statistical mechanics. By integrating techniques from game theory and thermodynamics, it examines inequality, technological innovation, and financial transformations using models that account for agent heterogeneity and interactions.

B.5 Quantitative Life Sciences (QLS)

- **Featureless Statistical Inference and Learning:** research focuses on challenges in analysing high-dimensional datasets with limited system knowledge. It introduces a notion of relevance in featureless inference, linking maximal relevance to criticality and thermodynamic efficiency in statistical inference and machine learning.
- **Efficiency of Neural Computation:** research explores how biological constraints shape neural computation and dynamics. Using information-theoretic and energetic perspectives, it builds data-driven models from large-scale neural recordings to study the role of heterogeneity in neural function and control.
- **Physics of Behaviour and Sensing:** research focuses on how organisms make decisions based on environmental cues, from chemical gradients to social signals. By combining physics, information theory, and reinforcement learning, it seeks to understand sensory-guided behaviours in diverse biological systems, from bacteria to birds.

The QLS Diploma Programme involves 8-10 students every year and is unique in exposing students to multiple disciplines at the interface between physics, life sciences, and complex adaptive systems. At the end of the QLS Diploma, the students have a solid background in statistical mechanics, probability theory, stochastic processes, non-linear dynamics and machine learning; useful for modelling and to answer fundamental questions in a vast range of context, from biophysics to ecology, and artificial intelligence to economics. The Associates visiting QLS section span a broad range of disciplines and career stages.

B.5 Quantitative Life Sciences (QLS)

Other core QLS activities include the annual Spring College in the Physics of Complex Systems – a one-month school exposing students to advanced topics in statistical physics and its application to complex systems; the conference Youth in High-Dimensions, already in its 6th edition in 2025, as a flagship activity of ICTP in the field of theoretical machine learning and its interdisciplinary connections and now linked to the ICTP-IBM Prize for early career researchers in AI; and the Hands-on school in Quantitative Biology, aimed at removing the barrier in interdisciplinary collaborations.

The section is composed of 2 P4 staff scientists, 2 P3 staff scientists and 1 P3 with half appointment in math and half in QLS. As of January 2025, there are 4 post-docs on section budget and 8 post-docs on external funds (4 ERC, 2 FIS, 1 PRIN and one funded by TLQS). The 4 post-docs on the section budget teach and supervise students in the Diploma programme, and 3 have contracts expiring before September 2025. As of January 2025, there are 5 PhD students, 4 of which are former QLS diploma students. The QLS section has a direct connection with the MATH and CMSP sections.

The Section has successfully secured funding from the ERC and an application to the ERC consolidator grant scheme is expected in 2026. Applications are in train with other ERC grants, in partnership with CNR-IOM. Other grant partners include Fondo Italiano della Scienza, Trieste Laboratory of Quantitative Sustainability, National Quantum Science Technology Institute (NQTSI), Quantinuum, and the Horizon programme. QLS is actively collaborating with the International Centre for Genetic Engineering and Biotechnology (ICGEB) in organizing and co-funding schools and activities. There is also a strong connection with IBM and the new joint ICTP-IBM Prize in AI for early career researchers. Efforts will be made to consolidate these multiple funding sources in future.

B.5 Quantitative Life Sciences (QLS)

Future Outlook

QLS research is at the interface of multiple disciplines, with a barycentre in physics, but with collaborations in biology, ecology, math, computer science, social sciences and economics. As science becomes more interconnected, QLS will become a hub for interdisciplinary research so that it can be responsive to new research areas and expertise.

Over the next five years, the section will invest in in-house expertise in theoretical neuroscience, not least with the advent of Large Language Models, whose scale in terms of number of parameters is now similar to the human brain's number of synapses. Recent studies point towards emergent reasoning capabilities, whose understanding requires the joint expertise of neuroscientists, physicists and mathematicians. ICOMP will assist QLS in addressing the emerging field of Neuro-AI to help revolutionise AI by uncovering the fundamental principles of intelligence. QLS can foster a community of researchers proficient in both fields. Understanding biological intelligence will inform principles for application in advanced computer and robotic systems, driving the next wave of AI innovation. QLS's research focus on the intersection of ML, AI and life sciences will become ever more important.

As interdisciplinary research becomes more prominent, QLS will contribute to breaking down barriers to this research and building skills and incentives in many developing countries presently lacking them. With the shift towards more data-driven research, this role is vital in efforts to reduce the gap between Global North and Global South as a result of the lack of advanced computational resources, together with the reduced ability to access and collect high quality data in developing countries.

B.6 Science, Technology, and Innovation (STI)

Status

The STI Unit (STI) encompasses:

- Advanced Scientific Instrumentation: research focuses on developing advanced scientific instrumentation and methods for particle physics experiments, nuclear applications, reconfigurable computing, and multidisciplinary experimental research, including cultural heritage and optics.
- Ionospheric Physics, Ionospheric Modelling, Space Weather: research on the near-Earth plasma environment, ionospheric physics, and ionospheric modelling. Particular attention is given to space weather phenomena, which can influence the performance of technological systems like the Global Navigation Satellite Systems.
- Wireless ICT and Internet of Things: research on reliable, affordable, and sustainable wireless solutions to help foster science in developing countries; leveraging unlicensed frequencies to provide broadband solutions such as TVWS and other novel data communications technologies to connect academic institutions, as well as narrowband alternatives to connect scientific devices based on Internet of Things technology.

The unit is composed of 3 fixed-term scientific staff (1xP3 and 2xP2), 2 PA scientific staff (2xP1), 1 fixed-term G5 staff (group secretary), 1 fixed-term G6 staff (technical assistant), 5 post-docs (3 externally funded), 2 emeritus scientists.

B.6 Science, Technology, and Innovation (STI)

STI hosts a number of Associates (27), STEP (5), and TRIL fellows. STI labs are very attractive for these three categories, as fellows benefit from access to advanced equipment for their experimental research. Through STI, they also participate in cutting-edge scientific experiments in collaboration with institutions such as CERN, IAEA, and INFN. The number of papers published by visiting fellows is a clear indicator of such success over the years. Co-funded PhD students work full-time at the STI Labs on topics proposed by STI. Since 2020, the Unit has fully supported four out of six PhD students from developing countries, all completing their PhD studies with outstanding scores or with distinction. SMR activities focus on participants from developing countries, with more than 95% of funded participants in our activities coming from DC or LDC. This special focus makes the unit attractive for external funding.

The unit collaborates with ESP on low-cost weather stations, in the framework of the "ACCLIMATISE: Attribution of a Changing CLIMate in the AssessmenT of malaria Intervention Strategy Efficiency" project. The unit has been successful in fundraising with UN and international organizations to support scientific research. ICTP's mission, role, and network are recognised as unique, valuable and fundable.

Future Outlook

AI will impact many scientific fields significantly. In the field of ionospheric research, improved models will be implemented to better describe the temporal evolution of the 3-D ionospheric electron density, particularly in relation to the dynamics associated with space weather phenomena. Significant efforts are underway, and will continue, to develop more advanced physics-based, assimilative and AI-driven models. Similarly, in the fields of scientific instrumentation and IoT, embedded devices running ML models will be more and more powerful, evolving from TinyML to EdgeAI. This will enable the development of complex, sustainable real-time solutions for environmental monitoring, particle detection and discrimination, radiation monitoring, dosimetry, BCI, and more.

B.6
Science, Technology, and Innovation (STI)

The unit will endeavour to participate in the development of the new ePIC (electron-Proton-Ion Collider) detector at the EIC (Electron-Ion Collider), and provide remote access to a reconfigurable supercomputing cluster, based on heterogeneous devices, currently under development at the STI Labs.

The unit will consider expanding research in the field of satellite technologies. Satellites offer valuable capabilities for ionospheric and space research, requiring advanced electronic instruments and methods. Additionally, they can facilitate interplanetary communications. Satellites also provide critical real-time data for climate research, presenting opportunities for collaboration with ESP. Complementing Ionospheric research, the unit could increase efforts to study the lower atmosphere and, in the field of wireless, expand research in the field of interplanetary communications; a new promising technical field that can help connect the unconnected on Earth. Brain-Computer Interface (BCI) is a further interesting topic that could be developed in collaboration with QLS.

Stronger computing capabilities will be required to adapt to these new areas, that are both affordable and sustainable. While the academic level of scientists in developing countries has improved, they still have limited access to advanced instrumentation, devices, and computing infrastructure. As a result, their research often relies on simulations or publicly available datasets. The availability of affordable devices and scientific instruments would enable them to conduct their own experiments, advancing their scientific capabilities and benefiting their educational activities. The unit would hope to attract more scientific fellows from developing countries to provide access to the latest, most advanced, yet affordable technologies. Concomitantly, establishing local labs for in-situ activities will allow scientists in their own institutes to increase the impact and multiply ICTP's training efforts with their own students and colleagues.

Appendix C
Infrastructure and Operations

C.1
Operations

Status

ICTP Operations comprises:

- Facilities – covering a campus on two sites with five buildings (27,000m^2) and responsible for space and grounds management and maintenance; accommodation (two on campus with 300 beds and three off campus sites); catering and hospitality; and safety and security.
- Budget and Finance - preparing, monitoring, reporting and auditing an annual budget of €30 million, developing around 100 donor agreements and processing payments for 5000 plus visitors and 350 plus personnel.
- Procurement – searching, negotiating and issuing around 600 orders annually for €7 million.

The nature of ICTP programmes requires 24/7 services and high volumes of low value transactions for visitors. Over the next five years, facilities and processes will continue to be upgraded to improve automation, integration and efficiency. While there are no major structural defects, even the newest building is over 30 years old, and insufficient and reactive investment in maintenance over the years has led to obsolete infrastructure, energy and cost inefficiencies as well as operational risks. A €10 million grant from the Italian government in 2023 will partly cover energy efficiency and safety compliance measures.

ICTP Operations will meet two primary objectives:

- Providing reliable and timely data for decision-making, thereby strengthening accountability.
- Providing cost efficient support.

One third of ICTP staff are in Operations services.

C.1
Operations

Principle	Action
» Focus on programme priorities » Resource optimization » Sustainability » Accountability	**Financial management** 1. Plan for sustainable financial models, cost recovery, procurement, cash-flow 2. Report resource allocation and use, linked to priorities and results using consistent and accurate data 3. Support evidence-based decision-making 4. Develop risk-based policies and controls 5. Optimise and standardise processes **Accountability** 1. Build awareness 2. Strengthen compliance with ICTP, donor, UNESCO and audit requirements 3. Reduce risks through automated work-flows and monitoring high risk transactions

Table 6. Reliable and timely data for decision-making, thereby strengthening accountability

C.1 Operations

Facilities	Operations
1. Transform the facility into a modern usable energy efficient and low maintenance space by investing in modern technology: » 30-40% reduction in energy consumption » Cut maintenance costs by 25-35% 2. Consolidate space, reduce rented premises » Integrate offices into ICTP buildings » Maximise use of ICTP guesthouses and reduce external accommodation 3. Ensure maintenance capacity » establish fund and replacement plans 4. Strengthen security and safety awareness and practices.	1. Manage capacity in operations teams through standardised, automated, simplified processes and more cross-unit support 2. Ensure auxiliary services are self-funding 3. Contain catering, accommodation and gift shop costs through fair pricing models 4. Rethink transport model approach and fleet to reduce costs and emissions 5. Reduce waste in paper, printing and recycling 6. Improve participant experience and reduce bank charges and processing

Table 7. Objective: Cost efficient support

C.2 Information & Communication Technology Section (ICTS)

Status

The Information and Communication Technology Section (ICTS) supports the Trieste campus and faces a number of challenges over the next strategic planning period, as the ICT landscape continues to evolve at pace. This includes structural reorganization to reflect a more modern, flexible and customer focused approach, updating visitor management, and a significant number of upcoming staff retirements. Outdated legacy applications are being migrated onto the main system (Sigma), supported by cloud services, so that they can continue to be supported, and more modern bespoke applications will require more efficient integration.

The historic emphasis on in-house or locally developed and typically open-source solutions has saved software licensing costs but comes with its own overheads and risks. Outdated operating system versions are increasingly difficult to support and secure, exacerbated by the lack of development and programming resources. An ongoing business process review will assess what systems should be prioritised for replacement as well as minimise duplication.

Aging personal computing will be updated through a streamlined procurement process based on business need. Open access computing facilities may require a virtualised solution to provide better economies, manageability and flexibility. High performance computing will be served by a local cluster (Argo) and a contract with CINECA for access to HPC resources. Local clusters are useful resources in relation to ICTP's academic mission, specifically in supporting institutions in developing countries.

C.2
Information & Communication Technology Section (ICTS)

ICTS also supports audio visual and multimedia services, necessary for recording, live-streaming and uploading events. These services will be refined through improved post production and search ranking optimization, as well as simple interface technology allowing individual lecturers to have more recording control. Resource efficiencies will be used to create promotional materials for the PIO, support the IAU, and facilitate wider remote attendance at ICTP events. A technical architecture master plan will integrate these elements.

Finally, the ICTP network – while in reasonable condition – comprises cabling of variable age and quality, and is sub-optimally designed. Ongoing construction projects in LB, and those proposed for AGH, will look at network design and tackle issues like poor environmental conditions, noise and H&S concerns.

The current ICTS structure is heavily weighted towards G staff. Additional P posts to replace some G current and forthcoming G vacancies will allow access to a broader talent pool and facilitate a structure more aligned to the organisation's objectives.

C.3
Public Information Unit

Status

ICTP's Public Information Unit (PIU) is responsible for designing and implementing ICTP's communications strategy. It directly supports ICTP's objectives by promoting the Centre's research and training activities and achievements to scientists, collaborating institutes, funders, and the general public. The PIU prepares and distributes non-scientific material including e-newsletters, brochures, web news stories and social media posts. It also serves as the primary link to the news media, maintains visitor statistics, and coordinates photographic/video services and group visits by schools.

ICTP's objectives are threefold: research, training and outreach. The PIU's communication goals support these by ICTP communications are evaluated periodically using web statistics, social media analytics and feedback from the Scientific Council and other scientists in the ICTP community; surveys and unsolicited feedback; and monitoring of media coverage (quantity, quality and reach).

Objective	Action
1. To enhance the status and recognition of ICTP as an institute that conducts research in physics and mathematics at the highest international standards.	» Highlight ICTP research activities and achievements via various communication tools » Publicise ICTP prizes and awards (esp. Dirac Medal)
2. To present ICTP as a dynamic organization that has a real impact on physics and maths education in the developing world.	» Highlight ICTP training activities via various communication tools » Highlight success stories about participants of ICTP training and education programmes
3. To build support amongst donors for ICTP as a cost-effective partner in the challenge to improve physics and maths training in the developing world.	» Improve outreach to Italian government by anticipating their information needs and providing more info in Italian » Improve communications with UNESCO, IAEA » Develop communications targeting other funders/ sponsors, working closely with the Institute Advancement Unit

C.3
Public Information Unit

Objective	Action
4. To build and maintain good community relations with the city of Trieste and with the other science institutes based there	» Develop relations with local media, other science institutes and institutes of higher learning » Continue to support public outreach activities, esp. with other area science institutes, such as TriesteNext and the Maker Faire » When possible, organise public outreach events featuring a debate or panel discussion about current topics of interest
5. To provide accurate communications about visitor and activity statistics	» Contribute statistics to annual report » Highlight interesting statistics on homepage and via social media » Respond to ad hoc requests from Director's office and other sources in a coordinated, timely fashion » Highlight important statistics in yearly "ICTP in Numbers" poster
6. To encourage networking and community building amongst ICTP alumni.	» Maintain ICTP Global Science Portal according to a content and engagement strategy » Publicise the community via various publicity actions to grow number of users » Monitor community engagement to ensure content and actions remain relevant to the network » Liaise with Institute Advancement Unit in support of fundraising initiatives

Current staffing includes a public information officer, a science writer, a social media expert, and a statistics expert. The recent hiring of an additional staff member dedicated to ICTP's new Global Science Portal was covered financially by external funding.

C.4
Institute Advancement Unit

Status

The goal of the Institute Advancement Unit (IAU) is to significantly increase and diversify contributed revenue in order to provide increased sustainability to ICTP as it continues to expand and fulfil its mission.

Over the course of the next five years, the IAU will run a comprehensive fundraising campaign to raise $15 - $55 million, not only matching the grant from Simons Foundation International for the International Science Complex, but raising funds for an endowment ($1 - $5 million over 5 years) and for ICTP's international consortium's and alliances (including International Science Alliances, the International Consortium for Scientific Computing, and the International Consortium for Future Earth). The Unit will also build an engaged alumni community and an annual giving programme through the Global Science Portal that will keep constituents engaged, priming them to be the major donors of the future.

ICTP's first comprehensive fundraising campaign will align to the three pillars of its mission:

- Excellence at the Frontiers of Science aligns with the International Science Complex and Campus Improvements;
- Global Inclusion for Scientific Resources aligns with the International Science Heritage Endowment Fund; and
- International Cooperation through Science aligns with the International Consortium's and Alliances.

C.4
Institute Advancement Unit

The IAU will develop a comprehensive case for support that will increase donor and prospect pools, expand foundation and corporate giving, and increase public/private partnerships. It will continue to raise the visibility of ICTP and its need for private contributions though constant and consistent communications, regular global events for the alumni community and current and prospective donors, donor stewardship and reporting, and at least two annual fund appeals per year. The IAU will work with existing contacts to broaden its network; actively work with colleagues in the Public Information Unit to get ICTP, its scientists and their research in the news; highlight public private partnerships and endowment efforts, including named chairs, associateships, fellowships, and scholarships; and launch a formal planned giving programme.

Outcomes will include securing funds for the state-of-the-art International Science Complex and other campus updates, providing the ICTP community with the infrastructure, tools, and services needed to excel at the frontiers of science and additionally, save up to 1 million Euros each year to invest in programmes, research and reserves; an endowment that will provide a steady and stable stream of income to support scientists, students, and infrastructure; and a solid, committed global community of smaller donors who are invested in ICTP and its future.

The IAU anticipates meeting its campaign goal at the end of the strategic planning period, and maintaining and increasing annual contributions for programmes and operations from private donors, foundations and corporations, and government entities.

Appendix D
Highlights of UNESCO Review of ICTP 2024

In evaluating ICTP's activities since 2012, UNESCO concluded that ICTP's mission has never been more important, as the North-South capacity gap persists and as new technological challenges surface. ICTP's prestigious grants, publications and citations are testament to its research excellence, and its educational programmes to its contribution to education, career development and capacity building (Figure 1).

In the past decade, ICTP has reached over 53,000 scientists worldwide with its conferences, workshops, and research visits (Figure 2). Its STEP and Associates programme has exposed over 360 scientists across the developing world to its high scientific standards and training (Figure 3). ICTP's positive impact on scientists' careers is demonstrated by the fact that over 60% of former ICTP students have regular employment, with 64% of them returning to their home country; 30% of them pursue further education, 78% of them finding opportunities abroad (Figure 4).

UNESCO's 2024 review of ICTP recommended that

- ICTP enhance its strategic planning and monitoring by systematically measuring the impact of its educational and career development programmes in developing countries and identify gaps where it could further invest.
- ICTP, working with UNESCO Natural Sciences Sector, refine ICTP's third pillar on international cooperation and advocacy, including clarifying the respective roles and collaborative potential of ICTP, UNESCO, and Field Offices.
- ICTP develop a localization plan to increase number of activities in the Global South, with a focus on under-represented regions, following an assessment of its current networks (including: Partner Institutes, Affiliated Centres, research networks, and the Senior Associates Programme).

These recommendations have informed some elements of this new Strategic Plan.

Appendix D
Highlights of UNESCO Review of ICTP 2024

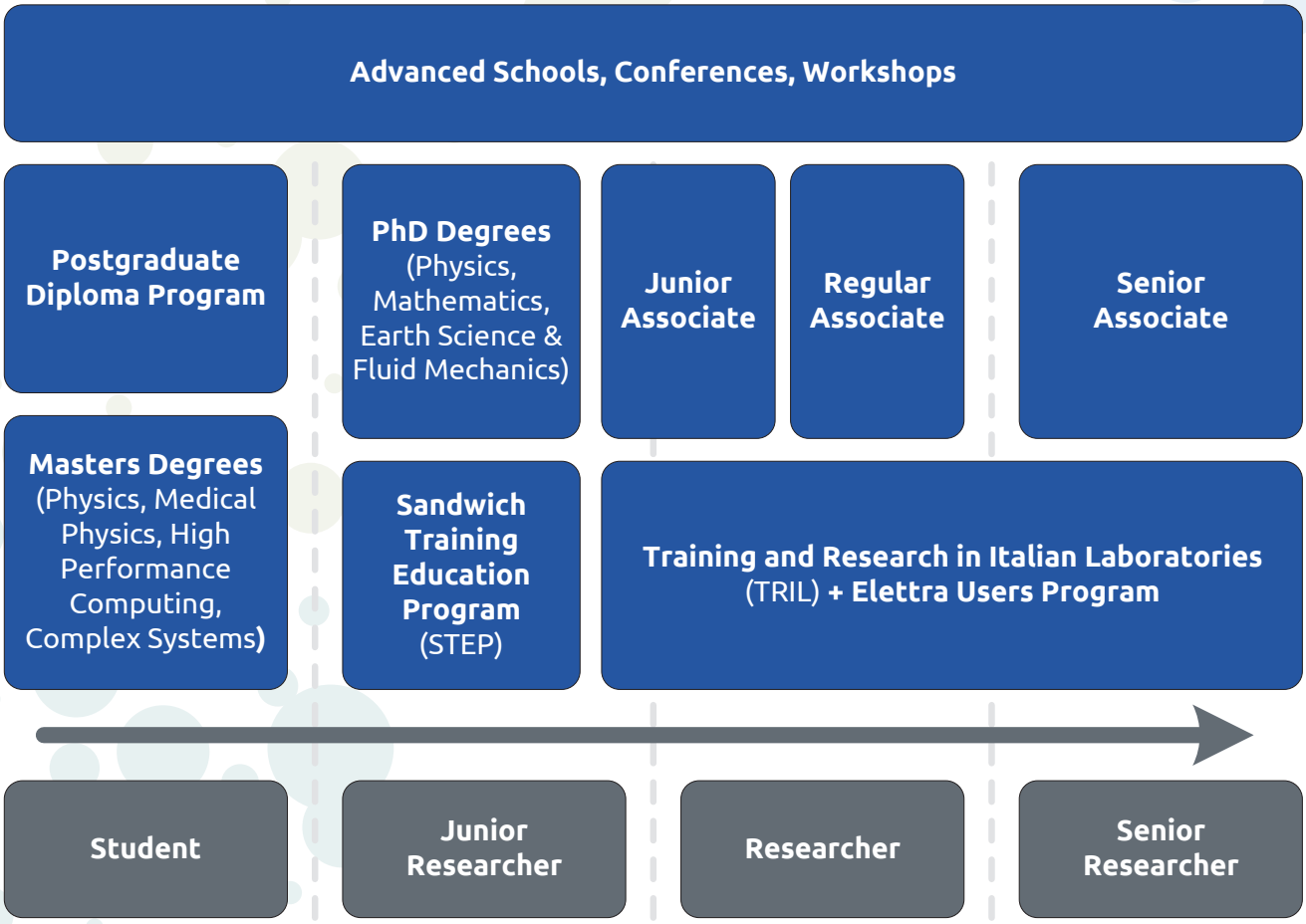


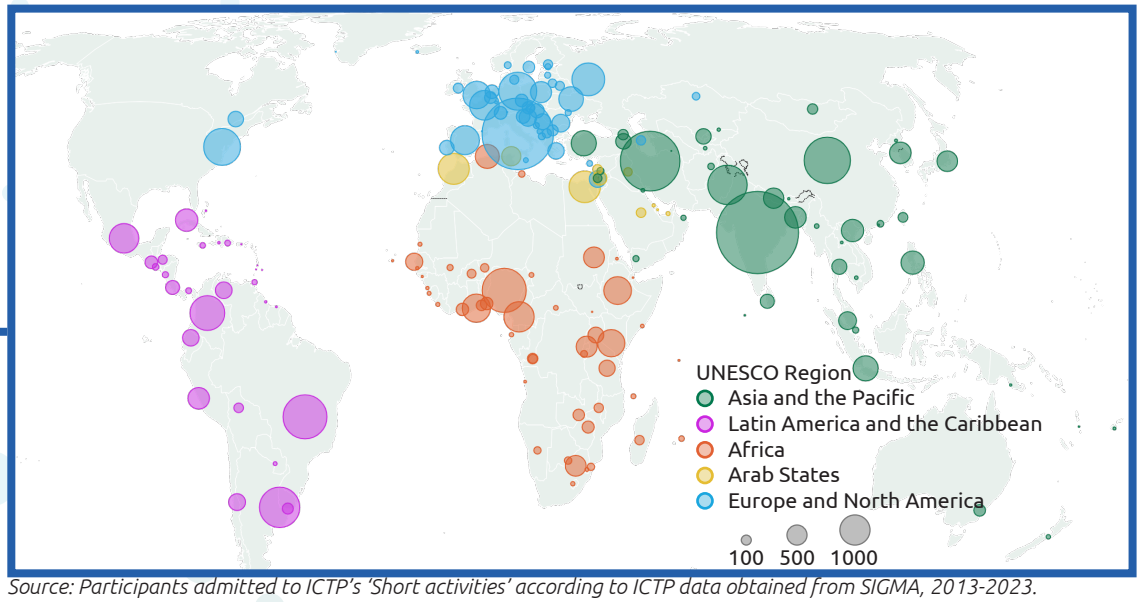
Figure 1. Overview of ICTP educational and career development programmes.
Source: Evaluation Terms of Reference (ToR)

Appendix D
Highlights of UNESCO Review of ICTP 2024

High quality visualisation available at Flourish.

Figure 2: ICTP conferences, workshops, and research visits reached over 53,000 scientists worldwide 2013-2023.

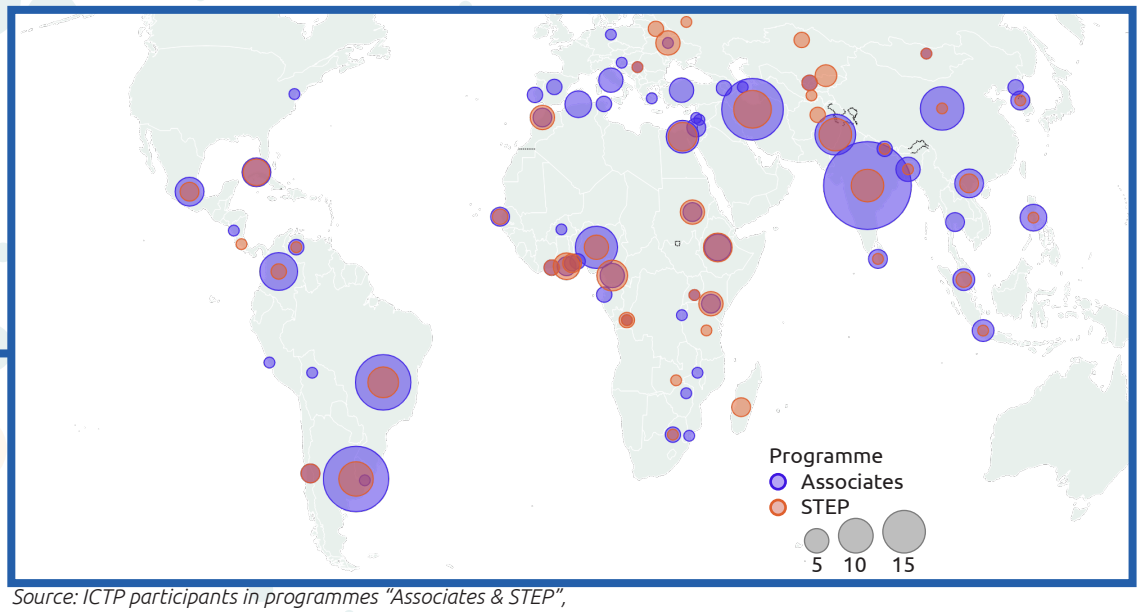
Top Ten Countries	
India	7,921
Italy	5,987
Iran	4,181
China	2,524
Nigeria	2,283
Brazil	2,274
Argentina	1,912
Pakistan	1,820
Germany	1,693
USA	1,589



Source: Participants admitted to ICTP's 'Short activities' according to ICTP data obtained from SIGMA, 2013-2023.

Figure 3: The STEP and Associates Programmes linked 366 scientists across the developing world with ICTP's high scientific standards

Top Ten Countries	
India	74
Argentina	46
Iran	44
Brazil	34
Pakistan	23
Nigeria	20
China	17
Egypt	16
Colombia	14
Cuba	13



Source: ICTP participants in programmes "Associates & STEP", according to ICTP data recorded in files: "Associates 2012-2023" and "STEP_2012-2023".

Appendix D
Highlights of UNESCO Review of ICTP 2024

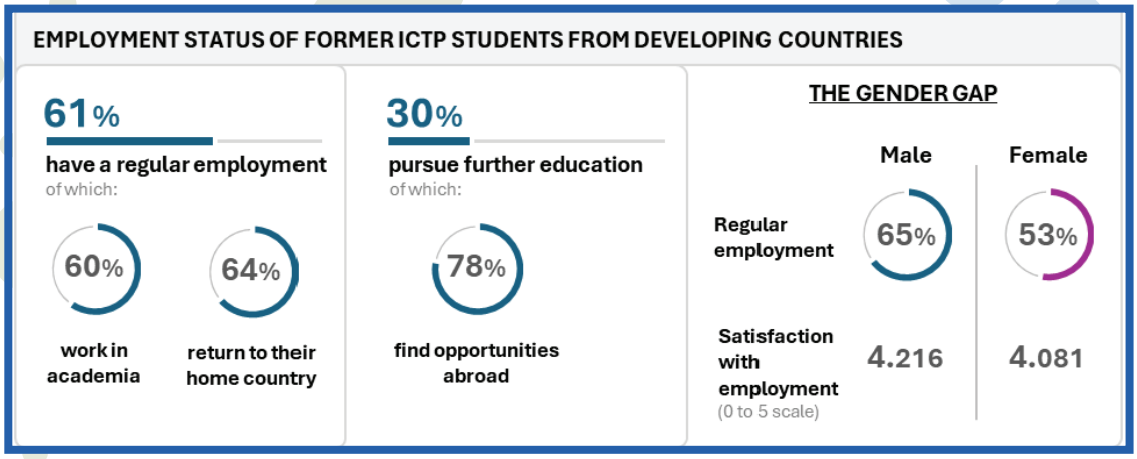


Figure 4: Survey data demonstrates ICTP's positive impact on scientists' careers.
Source: Tracer study (see Annex VL Question 24-n=430, Question 25-n=266, Question 26-n=250).

The Abdus Salam
International Centre
for Theoretical Physics