Strategic Plan
2025

ICTP

The Abdus Salam
**International Centre
for Theoretical Physics**

IAEA
International Atomic Energy Agency

unesco
United Nations
Educational, Scientific
and Cultural Organization
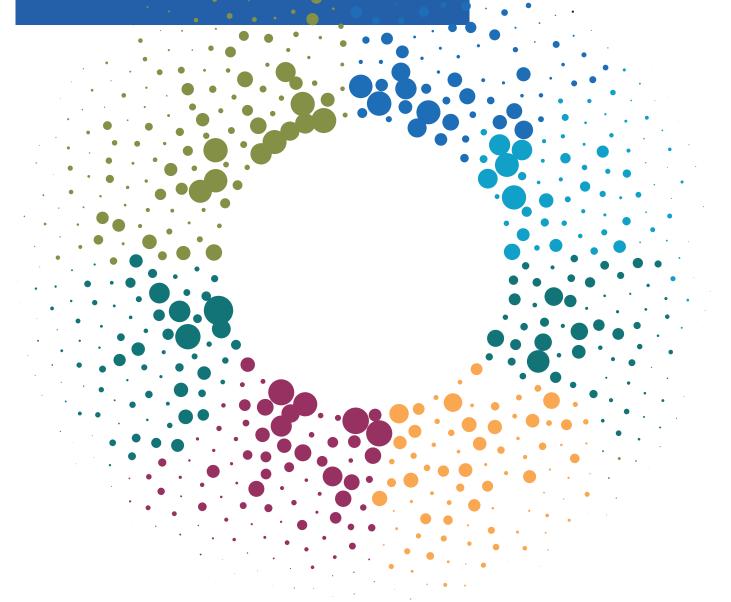
Introduction

The Strategic Plan 2025 is a natural progression of the historic role of ICTP with its core inspiration that "science is common heritage and creation of all humankind". At the same time, it has the ambition to achieve a step change in its impact, responding to the changing landscape. It aims to create a world where scientific excellence is allowed to flourish in all corners of the globe, equitably and for the common good. Through the implementation of this plan, ICTP will continue to serve as a unique and invaluable institution, dedicated to advancing theoretical sciences and building scientific capacity to pursue new opportunities and tackle planetary-scale challenges together.

Atish Dabholkar
अतीश दाभोलकर
ICTP Director

Mission

ICTP was conceived as an international science hub for free scientific exchange, overcoming the barriers of geography, ethnicity, gender and economics.

Since its inception, the mission of ICTP has been guided by three foundational principles:

1. Scientific excellence
Conduct world-class, pioneering research in frontier areas of science.

2. Global Inclusion
Make advanced science globally available to bridge the knowledge divide.

3. International Cooperation
Build international partnerships for and through science.

This mission, with a commitment to the Sustainable Development Goals, makes ICTP unique among the finest scientific institutions. Given its mandate as a UN organization and its impressive track record of the past six decades, ICTP continues to be an invaluable resource for the scientific community around the world as a "lighthouse for science".

Vision

The frontiers of science and the geopolitics today are radically different compared to when ICTP was founded. The vision for "ICTP 2.0" incorporates these new realities and re-imagines ICTP's role while remaining true to its founding mission.

It is even more true today that without a strong scientific base, developing countries risk being only consumers and not creators of science and its technological fruits. There is an even greater need for a culture of science and fact-based enquiry as a precondition to meet the Sustainable Development Goals with informed development policies. Science is a shared language which makes dialogue possible, transcending geographic and political boundaries. For these reasons, ICTP is even more relevant today in a world confronting serious global challenges and unparalleled opportunities which require a collective science-based trans-national response.

1. Many developing countries are now at a very different stage of their economic and scientific development with major investments in science and strong national scientific communities. Nevertheless, the role of ICTP for the "internationalization of science" remains critically important.
ICTP 2.0 must engage more in equal collaborative partnerships in recognition of this changing landscape. It will actively seek public-private partnerships for a more effective delivery of its mission.

2. Computation has now emerged as an equally important third pillar of science together with theory and experiment. It is essential to ensure equitable opportunities in the ongoing scientific revolution in high performance computing, machine learning, and quantum computing.
ICTP 2.0 recognises the need to include Open Computing as a completely novel dimension of Open Science. ICTP must dedicate its efforts towards ensuring open access to computational resources to facilitate truly global participation, essential for shared challenges like global climate response.

Vision

3. There is a greater need to emphasise the importance of science and the essential unity of pure and applied science to both the public and policy-makers.
ICTP 2.0 recognises its role as a powerful advocate both for the intrinsic value of science and for its implications for social development. It has been a living example of impactful international cooperation in science. To continue to be globally credible and effective in this role, ICTP must strive to strengthen its core while responding to changing frontiers.

Further validation for this vision is provided by a 2024 evaluation of ICTP commissioned by UNESCO. 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 publications, citations, and success with prestigious grants are testament to its research excellence, and its educational programmes to its contribution to education, career development and capacity building. These observations, together with the recommendations for strengthening monitoring and evaluation and partnerships for advocacy, have helped inform this strategic plan.

Strategy

This vision for ICTP 2.0 informs three strategic priorities, designed to enhance ICTP's role as an international focal point for basic science research, education, cooperation, and outreach with active engagement in science advocacy.

A. International Science Alliance

Build collaborations with national agencies, foundations and private donors to engage with the ICTP global community in equal partnership for more effective delivery.

B. International Consortium for Scientific Computing (ICOMP)

Leverage the progress and accomplishments of ICOMP launched in 2024 with ICTP as the central node for making computational sciences accessible to the broader scientific community.

C. ICTP Core

Reinforce existing scientific competencies of ICTP in the core areas of research and programmes, modernise both scientific and physical infrastructure, and build upon these core strengths to attract the best talent to ICTP.

Successful implementation of Strategic Plan 2020 has already accomplished important milestones towards these objectives and has laid solid foundations upon which to build.

Strategy
A. International Science Alliance

The International Science Alliance is a natural evolution of the historical role of ICTP but embodies a fundamental philosophical shift in its approach.

The Alliance acknowledges the growth of strong scientific communities in many developing regions and seeks to harness it for collective advancement. It is therefore envisioned as **a network of equals for transforming the way ICTP engages with the world and for multiplying ICTP's impact**.

Key initiatives for the Alliance are described below and its main components are summarised in Table 1.

1. New Collaborations

Over the past five years, ICTP has successfully forged collaboration agreements with ministries and agencies in several countries (for example, Brazil and South Africa) as well as major foundations (for example, Kuwait Fund for Advancement of Science, Simons Foundation, Arab Fund, WE Heraeus). The Alliance will seek to expand this model to other countries like China, India, Thailand, Indonesia, Vietnam, as well as other foundations and private donors, where discussions are underway. By formalizing and strengthening ICTP's network of partners worldwide, the Alliance – already part-funded - will provide a coordinated framework for collaborative activities, distributed programmes, shared resources, and mutual support. Critically, this arrangement will serve to improve accessibility and reduce the necessity for travel (and the concomitant carbon footprint).

2. ICTP Global Science Portal

Envisioned as an online community, the Portal will enable current and former ICTP staff, associates, students, and affiliates to remain connected, and search for collaborators, mentors, regional and disciplinary opportunities. The first phase of the initiative has been successfully completed, based on the Hivebrite platform, with an online community of 1000+ members that is growing rapidly. The portal will greatly facilitate access to ICTP programmes and has huge potential to increase world-wide participation in ICTP research and programmes.

Strategy
A. International Science Alliance

3. Physics Without Frontiers

ICTP will engage in high-impact outreach by strengthening the Physics Without Frontiers (PWF) programme, integrating it more closely with ICTP scientific programmes and drawing on the network of over 60,000 ICTP affiliates in developing countries for greater effectiveness.

4. Synergy with IAEA and UNESCO

Implementation of the Alliance will take into account the IAEA and UNESCO medium-term strategies to strengthen programmatic and educational collaboration and science advocacy. Together, ICTP will help nurture new international institutional initiatives similar to the SESAME Synchrotron Facility, such as the African Light Source, the SEEIIST hadron facility for cancer therapy and biomedical research in Eastern Europe, or the LAAAMP Project.

5. Affiliate Centres and Partner Institutes

The Alliance will identify affiliate centres and regional nodes for furthering the mission of ICTP. ICTP will leverage the strengths of the Trieste Science System through local partner institutes like the Trieste Institute for Quantum Technologies (TQT) or the Institute for Fundamental Physics of the Universe (IFPU) for collaborations with partners like SISSA or Elettra. ICTP programmes like TRIL (Training and Research in Italian Laboratories) can provide a suitable framework. ICTP will evaluate the performance of its four partner institutes of ICTP (in Brazil, Rwanda, China, Mexico) to design the most effective implementation.

6. International Masters course

To date, the ICTP Postgraduate Diploma Programme has graduated over 1000 students from 85 countries. More than 80% go on to do a Master's or PhD programme (many at highly selective and prestigious universities like Harvard, MIT, Cambridge and the Max Planck Institutes); and many return to their home country. To help elevate this programme further, ICTP is seeking to award an internationally recognised Master degree, in collaboration with Imperial College and the United Nations University.

Strategy
A. International Science Alliance

Component	Action
Regional nodes and partner institutions	Establish formal relationships with key institutions in strategic regions to serve as coordinating centres for ICTP-affiliated activities.
Long-term collaborative research teams	Create sustained research collaborations that bring together Associates, STEP students, and researchers from partner institutions.
Co-funded initiatives	Develop joint programmes with matching contributions from partner institutions and countries.
Mobility programmes	Enhance scientific exchange through expanded sabbatical opportunities, visiting professorships, and student exchanges between Alliance members.
Shared infrastructure access	Facilitate access to specialised research infrastructure across the Alliance network, with particular emphasis on computational resources through ICOMP.

Table 1. Main components of the International Science Alliance

Strategy
B. International Consortium for Scientific Computing

The primary objective of the International Consortium for Scientific Computing (ICOMP) is to enable Open Computing as an essential element of Open Science.

ICTP will be the central node and a facilitator to form strategic partnerships that make world-class computing available to scientists in developing countries, including access to computational resources, modern algorithms and theoretical developments.

Key initiatives under ICOMP include:

1. Open Computing

ICOMP will integrate all essential components—education, infrastructure, technical skills and scientific insight—required for contemporary research. It will include access to cloud-based computing for both research and training. Beyond Open Access to resources, ICOMP will aim for Open Codes and Open Weights. It will invest in the theory-driven development of machine-learning algorithms and quantum computing as well as in capacity building for the use of modern technology. Its ultimate goal is to establish structured research initiatives and lay the groundwork for world-class scientific projects that will develop over time.

2. Computing Core

ICOMP is envisaged to cut across all ICTP sections as a common resource for the ICTP community. ICTP's High-Performance Computing infrastructure will be strengthened, both in terms of human and computational resources, with the aim to develop a strong computing core. New sources of funding through partnerships will be sought to achieve this ambition.

3. Scientific Focus

In its initial phase, ICOMP will focus on climate modelling, functional materials research, quantum simulations and computing, computational life sciences, and applied mathematics for AI where ICTP already has strong domain expertise. It will facilitate multi-disciplinary integration, breaking down traditional section boundaries to address complex scientific questions together (Table 2).

4. New Partnerships

ICOMP is already getting good traction through partnership agreements with foundations like the Arab Fund, corporations like IBM, and national computational agencies like NITheCS in South Africa, CINECA in Italy, and CECAM in Switzerland. Other strategic partnerships will follow and ICTP will actively seek core funding over the next five years. ICOMP will consider the formation of a science advisory board for active engagement of partners.

»	AI and Climate Science	ESP
»	Quantum Many-Body Physics and Molecular Simulation	CMSP
»	Computational Neuroscience and Neuro-AI	QLS
»	Numerical Methods in High-Energy Physics	HECAP
»	Mathematical Foundations of Data Science	MATH & QLS
»	TinyML, IoT and Applied AI	STI
»	Quantum Information and Computing	CMSP

Table 2. Scientific domains of ICOMP across sections

In summary, ICOMP is envisioned as a framework led by ICTP to establish the foundation for advanced scientific computing ecosystems in developing countries with main components listed in Table 3. ICOMP will help foster a new generation 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.

Strategy
B. International Consortium for Scientific Computing

Component	Action
Higher education and career programmes	Implement modern and interdisciplinary computational science programmes to train the next generation of researchers.
International research collaboration	Build a global community of scientists from developing countries who utilise modern computational tools at scientific frontiers including in areas crucial to sustainable development.
Access to High-Performance Computing facilities	Establish an international network of key players in HPC to ensure access to world-class computational resources for cutting-edge scientific research.
A multi-stakeholder science advisory board	Ensure financial sustainability of ICOMP in medium-to-long term.

Table 3. Main components of ICOMP

Strategy
C. ICTP Core

ICTP's research and programmes supported by its staff and infrastructure form the foundational core of its activities and reputation as a global lighthouse for science.

In the next five years, ICTP will continue to strengthen these core competencies by updating its staffing and renewing its physical and scientific infrastructure, so that it can continue to attract the best talent in new, emerging, and fast-moving frontier sciences.

1. Research

ICTP will maintain its commitment to fundamental science. Pure science feeds long-term (and sometimes serendipitous) scientific progress, knowledge infrastructure (fuelling applied science), scientific autonomy (building capacity and inclusive contribution to the global scientific enterprise), and intellectual heritage (building on ICTP's reputation and legacy).

The sections at ICTP have made important contributions to major breakthroughs in science and continue to flourish. Areas of research cover a broad portfolio (Table 4). **ICTP will continue to strengthen these core competencies to pursue world class research at the frontiers and seek to grow in new directions**.

2. Programmes

Educational and training programmes are the primary mechanisms through which ICTP extends its impact beyond its campus, across all core elements. In alignment with ICTP 2.0, **ICTP will strengthen and adapt its programmes portfolio to better serve the evolving needs of the global scientific community** (see Table 5).

Strategy
C. ICTP Core

Section	Research Areas
High Energy, Cosmology & Astroparticle Physics (HECAP)	String Theory and Quantum Gravity
	Phenomenology of Particle Physics
	Cosmology
	Experimental Particle Physics
Condensed Matter & Statistical Physics (CMSP)	Equilibrium and Non-equilibrium Many-body Quantum Systems
	Atomistic, Molecular, and Electronic Structure Simulations
	Materials for Renewable Energy Applications
	Physics of Nanostructures
Mathematics (MATH)	Harmonic Analysis and Analytic Number Theory
	Differential Geometry, Geometric Analysis, and Mathematical Physics
	Dynamical Systems and Ergodic Theory
	Algebraic Geometry
	High-dimensional Statistics, Inference and Theory of Machine Learning
Earth System Physics (ESP)	Solid Earth Geophysics
	Climate Applications
	Earth System Modelling
Quantitative Life Sciences (QLS)	Quantitative Ecology and Evolution
	High-dimensional Statistics, Inference and Theory of Machine Learning
	Stochastic Thermodynamics
	Emergent Collective Behaviour in Interacting Agent Systems
	Physics of Behaviour and Sensing
Science, Technology & Innovation (STI)	Advanced Scientific Instrumentation
	Ionospheric Physics, Ionospheric Modelling, Space Weather
	Digital Fabrication and Science Dissemination
	Wireless ICT and Internet of Things

Table 4. Research at ICTP

Strategy
C. ICTP Core

Component	Action
Postgraduate Diploma programme ICTP's flagship educational initiative, providing intensive scientific training for talented young scientists from developing countries.	**Explore the possibility of extending programme duration** to two years to provide deeper training and research experience. **Increase programme capacity** to grow the number of students by ~40%. **Enhance interdisciplinarity** to allow students greater flexibility to customise coursework across disciplines. **Strengthen pathway to PhD** to maintain and expand joint PhD positions with partner institutions. **Modernise curriculum** as part of a regular revision of ~25% of course topics every five years to incorporate emerging scientific developments. **Integrate computing and AI** to enhance computational components across all Diploma subjects, particularly in machine learning and artificial intelligence.
Schools, workshops, conferences to maximise accessibility, training and capacity building.	Continue signature annual **flagship schools** in high-energy physics, condensed matter, mathematics, and other fields while extending their duration to allow for deeper engagement. Develop extended 2-3 month **thematic programmes** that bring together researchers for sustained collaboration. Co-organise **more distributed activities** with partner institutions in strategic locations to reduce travel burdens and reach more participants. Incorporate **digital (virtual) elements** into in-person activities to extend participation while maintaining essential human connections. Develop **interdisciplinary activities** at the intersection of traditional disciplines, such as the Advanced School on the Mathematics of AI (QLS and Mathematics) planned for 2026.

Table 5. Main components of ICTP's education portfolio

Strategy
C. ICTP Core

Component	Action
Global capacity-building programmes to strengthen ICTP's global network of scientists and institutions.	Continue **Associates Programme** to foster long-term links with scientists from developing countries while introducing longer "sabbatical" visits for sustained collaboration. Maintain **STEP Programme** as a pillar for supporting science in the developing world, while emphasizing enrolment at home universities to prevent brain drain. Support regional networks of scientific excellence with **affiliated centres and networks**, through targeted training and research activities. Develop **research huddles**, smaller, focused research groups on key topics, bringing together scientists across career stages and geographic regions. Maintain successful **regional training initiatives**.
Education for the Digital Age recognizing the growing importance of computational and data science skills as well as possibilities of remote participation.	Ensure access to computational resources and training for researchers in the Global South through **AI/ML Training**. Establish a **new hardware evaluation platform** to help scientists adapt to emerging computing architectures. Expand **online learning resources** while maintaining hands-on, collaborative learning. Provide **technical skills training** in scientific software development, data management, and computational methods across disciplines.

Table 5. (cont.) Main components of ICTP's education portfolio

Strategy
C. ICTP Core

3. Human Resources

The most important resource for any organization is its people. For the scientific staff, it is essential to have a stable structure with a sufficient number and a proper distribution of posts at all levels to ensure attractive career progression. To this effect, important steps have already been taken, with over 50 posts (a third of the total 150) being upgraded successfully, in collaboration with UNESCO HR and Administration, and with support from the Steering Committee and the Scientific Council. Recruitment of Heads of Research, Programmes, Administration, Library, Human Resources, ICTS, Advancement, and Medical Services were also accomplished. Significant progress has been made towards gender parity with a long-term commitment at all career stages. Incoming male and female students at ICTP are now almost equal in numbers. From 2020 to 2024, the gender ratio for professional staff improved from [1:5] to [1:3], doubling the number of women following recruitment.

ICTP is now an even more attractive and competitive place to work and can confidently attract and retain the very best talent. It is important to continue this successful recruitment policy at all levels, as required.

4. Infrastructure

ICTP infrastructure is 60 years old and requires major upgrading. Over the next five years, ICTP will seek additional resource to **modernise the main campus and create world-class facilities** commensurate with its global standing. The Italian government has injected €10 million for the "extraordinary maintenance" of the ICTP campus. The Euler-Lagrange lecture hall complex is already beautifully renovated, and works will soon start on the Leonardo and Fermi buildings for renovations in line with modern standards of energy efficiency and fire and security compliance.

ICTP has reached out successfully to private donors for additional support. The Simons Foundation International (SFI) has approved a grant of US$15 million to create an International Science Complex. The iconic Adriatico building is a natural destination for such a complex, beautifully located by the Adriatic and an integral part of the ICTP experience, but it also needs upgrading to become a world-class facility. A science complex will be truly transformative in securing the future of ICTP. Concomitantly, ICTP's ICT infrastructure will need to be upgraded in line with up-to-date technologies, including more sophisticated events management, and to reflect a more modern, flexible and customer-focused approach.

The ICTP Library is being renovated using public-private partnership monies, in keeping with the changing paradigm of a 21st century facility. In the first phase of digitalization, the library collection now contains over 50K digital and 50K physical books. All ICTP associates from anywhere in the world can legally download these digital books and keep them in perpetuity. This makes the ICTP library a resource for the entire ICTP community. In the second phase, a library space will be completely re-designed and reorganised as an inspiring space for creative thinking and collaboration.

Execution of these major infrastructure projects will be important milestones of the Strategic Plan 2025.

Implementation

The implementation of this strategic plan requires significant additional funding from current and new partners, who share ICTP's steadfast commitment to nurture science capacity and collaboration in the Global South. This funding will essentially be matched by existing pledges so that ICTP can raise funds at pace and realise its strategic ambitions over the next five years.

In line with UNESCO's 2024 review recommendations, ICTP will establish clear metrics and regular review processes to monitor and evaluate progress. Regular surveys of programme alumni will provide valuable feedback for refining this approach. Additionally, ICTP will track scientific outcomes, capacity-building impacts, and financial sustainability indicators.

ICTP will also explore opportunities to strengthen its advocacy role, to help genuinely transformative science inform policy, in cooperation with UNESCO and others. As an international science hub, ICTP is an exemplar of science diplomacy in action and is willing to share its learning where there is interest.

Resources

ICTP enjoys high international recognition as a premier scientific institution with generous support from the government of Italy, IAEA, and UNESCO. ICTP will harness these existing strengths, and consolidate and refresh structures that require more attention.

An Institute Advancement Unit has been established to explore funding from major foundations, crowd funding, and to engage with ICTP-community and private donors. In a short time-span of 2-3 years the IAU has already accomplished important milestones. Several community-building events were organised around the world. A high-powered and very active Advisory Board has been established. Proper mechanisms for receiving contributions and reporting to the donors have been established. These efforts have resulted in substantial new resources from foundations, governments, corporations and private donors.

During the past two years, ICTP was celebrated at a number of high level events, for example, at the headquarters of UNESCO, of IAEA and of the United Nations as well as at other locations in Hanoi, São Paolo, Los Angeles, New York, and San Francisco. It is important to continue to build upon these successes to consolidate the ICTP global community. ICTP's communications strategy will be refreshed to support these advancement efforts as well as the Centre's evolving research and training activities, and to strengthen its relations with key stakeholders.

In addition, a Research Grants Office will be established to provide dedicated support for identifying funding opportunities, brokering new partnerships, and assisting in proposal writing, so that ICTP scientists can focus more on their research than on grant applications. This office will build on the successful track record of ICTP faculty in attracting funding from highly competitive Italian and EU research grant programmes.

Summary and Conclusion

The Strategic Plan 2025 is a natural progression of the historic role of ICTP with its core inspiration that "science is the common heritage and creation of all humankind".

This strategic plan builds on ICTP's impressive 60-year legacy while boldly re-imagining its role in a transformed global scientific landscape. ICTP came into existence in a particular historical context. It would be nearly impossible to recreate these conditions to create another ICTP. It would be far more sensible to enhance the existing framework into ICTP 2.0 with increased resources and a broader vision to deliver on this unique mission of great global significance on an expanded scale for the next century. ICTP 2.0 will endeavour to maximise its impact through genuine partnerships that acknowledge and respect the rapid development of scientific capacity worldwide.

To turn our ambitious strategic vision into a reality, substantial new resources will be needed. ICTP's core budget has been static for several decades. The inflationary pressure is now strongly felt, requiring ICTP to absorb these financial shortfalls through efficiency measures, programme reduction and deferred maintenance. This is not sustainable indefinitely.

ICTP has responded positively to these challenges. The advancement efforts have brought in very substantial resources for infrastructure upgrades as described above and very substantial resources for projects and programmes from competitive research grants. However, this new funding adds to the core budget only indirectly. It is essential that the successful fundraising of ICTP is matched by a corresponding increase in the core budget of ICTP by at least 25%. This can stimulate a public-private-international partnership which can have a multiplier effect. Both the International Science Alliance and ICOMP have huge potential. What were once visionary aspirations are now becoming a reality, thanks to encouraging support from diverse partners in strategically important countries and global institutions.

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More information is available in the "Strategic Plan 2025 - Appendices" and on the ICTP website.