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# PROFILE

## International Centre for Theoretical Physics

### Introduction

The International Centre for Theoretical Physics (ICTP) is a multi-disciplinary institution for research and training-for-research in physics and mathematics. Its purpose is to stimulate and foster fundamental research in physics and mathematics, especially in developing countries. To this end, the ICTP, which is run by scientists for scientists, provides its visitors, Associate Members and fellows with schemes and facilities to conduct original research.

The ICTP is located in Trieste, in the North-East of Italy -- an ideal location for a meeting point of scientists from all over the world. The institution is under the aegis of the United Nations -- it is jointly managed by the International Atomic Energy Agency (IAEA), Vienna, and the UN Educational, Scientific and Cultural Organization (UNESCO), Paris. About 75 percent of its budget comes from the Italian Government which allocates 20 billion Italian Lire a year through an appropriation bill, while the rest comes from IAEA, UNESCO and many other donors. Its founder and Director (until 1993) is Professor Abdus Salam from Pakistan, Nobel Laureate for Physics in 1979. Since January 1994, Professor Abdus Salam has been President of the institution, while a new director is being appointed.

### Activities

The activities of the ICTP are carried out through several modalities:

#### *Basic research in physics and mathematics*

Long-term stays are organized for scientists to work throughout the year at the ICTP in the framework of permanent research groups. The main groups work in High Energy Physics, Condensed Matter Physics (including Superconductivity, Lasers and Fibre Optics) and Mathematics, while small teams carry out research in Plasma Physics, Computer Science, Atmospheric Physics and Radiopropagation, Structure of the Solid Earth, and Earthquake Prediction. Continuity of the research programs of each group is ensured by the presence of senior members of the ICTP scientific staff, and by distinguished consultants from the Department of Theoretical Physics and International School for Advanced Studies (SISSA) of the University of Trieste. The permanent research groups involve an average of about 200 scientists who are recipients of long-term contracts (six months to several years).

#### *High level training courses, conferences & workshops*

These activities are limited in time (from 1 to 10 weeks) and there may be 50 to 100 participants. The

ICTP organizes about 45 of these activities every year in a wide variety of topics in physics and mathematics, covering subjects in all the fields of the research groups and in many other areas where the ICTP is not in a position to carry out research. The choice of subject matter is also based on suggestions by the ICTP advisory committees and scientists at large, especially scientists from developing countries who express the changing needs of the Third World.

A new part of the training program is the Diploma Course which started in High Energy Physics and Condensed Matter Physics in 1991, and in Mathematics as well in 1992. It is designed to give young scientists from developing countries an intensive training program, with the aim of bringing them to an advanced level of training suitable for continuing their research. The ICTP Diploma Course is thus a basis for Ph.D.-level instruction for students from the Third World, who would not find a similar course at their own universities. It is hoped that more and more ICTP Diploma students will study for their Ph.D.s in universities in developing countries. In so doing, they minimize the risk of immigrating to advanced countries.

### *Laboratories*

The scientific programs at the ICTP have always been in the process of expansion toward all possible branches of physics, and thus, also to applied physics. Of course, this type of activity must be complemented by practical activities, demonstrations and advanced experimental research. In a first phase, about 10 years ago, temporary experimental activities and demonstrations were added to the program of lectures of some activities. This was the case for the Workshops on Cloud Physics, for the Colleges on Lasers and Fibre Optics, Solar Energy, or Microprocessors. In recent years, experimental activities have become more and more consistent and permanent research groups have been established, while laboratories have been set up offering opportunities for training and advanced research on:

- Microprocessors (established in 1985)
- Superconductivity (established in 1989)
- Lasers and Optical Fibres (established in 1991)
- Atmospheric Physics and Radiopropagation (established in 1992).

### *External Activities Program*

The aim of this program is to strengthen and build scientific communities in Third World countries. The Office of External Activities (OEA) offers financial

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and scientific support toward the organization of conferences, courses and workshops in the Third World. Since 1986 (starting year of this program), more than 600 activities received financial and technical support from the ICTP. The most important programs of the OEA aim at supporting long-term activities. Special attention is given to the formation of scientific networks and, in particular, to the establishment of research centers with regional character. The OEA has already established, in collaboration with the local universities, 15 Affiliated Centers in as many Third World countries. Part of this program is jointly run by the ICTP and the Swedish Agency for Research Cooperation with Developing Countries (SAREC). This cooperation proves to be extremely fruitful. ICTP's joint programs with other organizations should be extended to other international and governmental agencies.

#### *Training and Research in Italian Laboratories*

Up to 100 fellowships are granted each year to experimental physicists from Third World and Eastern European countries for 10-12 month stays at university or industrial laboratories in Italy. This program represented the first step of the ICTP to also include experimental physics. More than 200 Italian laboratories are officially associated with the ICTP in this program. This program was implemented in Italy because funds are provided by the Italian Ministry for Foreign Affairs, but there is no reason why there could not be an ICTP program for visits to laboratories in other European countries, as soon as appropriate funds are made available.

#### **Associateship Scheme**

The Associateship Scheme is maybe one of the best anti-brain-drain devices: a distinguished scientist working in a Third World country is offered all the expenses for a 6-12 week stay at the ICTP, three times over six years. 527 physicists and mathematicians are presently ICTP Associates. It is remarkable that after 22,000 visits made over 30 years to the ICTP by scientists from the Third World, there has been no case of brain drain. There is a need for similar schemes for research workers from other disciplines besides physics and in other institutions.

#### **Federation Agreements**

Federated Institutes are entitled to send their junior scientists to the ICTP for a set number of person/days per year (from 40 to 120); the ICTP provides subsistence and may contribute toward travel expenses. This program was launched in 1970 with the purpose of strengthening links with universities in central Europe and the Third World. 294 departments, mainly in Eastern Europe and Third World countries, are now ICTP Federated Institutes. This scheme is a very effective tool of collaboration between the ICTP and other institutions.

#### **Book and Equipment Donation Program**

For several years, the ICTP has been running a Book and Equipment Donation Program whereby scientific books and collections of journals as well as unused surplus equipment received from libraries and research centers in industrialized countries are distributed to institutions in developing countries.

#### **Prizes**

To encourage high-level research and honor eminent scientists, the ICTP awards the ICTP Dirac Medals and ICTP Prize each year. In particular, the Prize aims at recognizing outstanding contributions to physics and mathematics by young scientists from, and working in, developing countries.

#### **Participation**

The ICTP maintains its activities at a high level, as is proved by the involvement of the highest ranking scientists in the world (34 Nobel Prizes lectured at ICTP). In 30 years of existence, about 30,000 scientists visited the ICTP for a total of more than 54,000 visits. Of these 54,000 visits, about 24,000 were from Third World countries, 6,000 from Eastern European countries and the rest from industrialized countries. The average number of visits per year is about 4,000. Normally, visitors from advanced countries spend two weeks at ICTP, while scientists from developing countries spend six.

#### **Publications**

Since 1964, the ICTP has produced 5,500 preprints of scientific works. ICTP preprints are regularly sent to 6,000 institutes and individuals. The majority of these preprints are then published in international journals.

#### **Library**

The library collection contains 46,000 books in all branches of physics and mathematics. The library subscribes to 1,100 scientific periodicals. About 1,200 preprints and reports are received every month from research institutes all over the world: this is one of the most appreciated services offered by the ICTP to its visitors. It is not unusual that scientists from universities in nearby regions or countries visit the ICTP regularly to consult the preprint display.

#### **Computer facilities**

The computing facilities available to ICTP visitors include a network of personal computers and workstations and a cluster of very powerful "superworkstations" used as computational servers. All the machines are equipped with a high-speed Internet link.

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