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A window open on the world

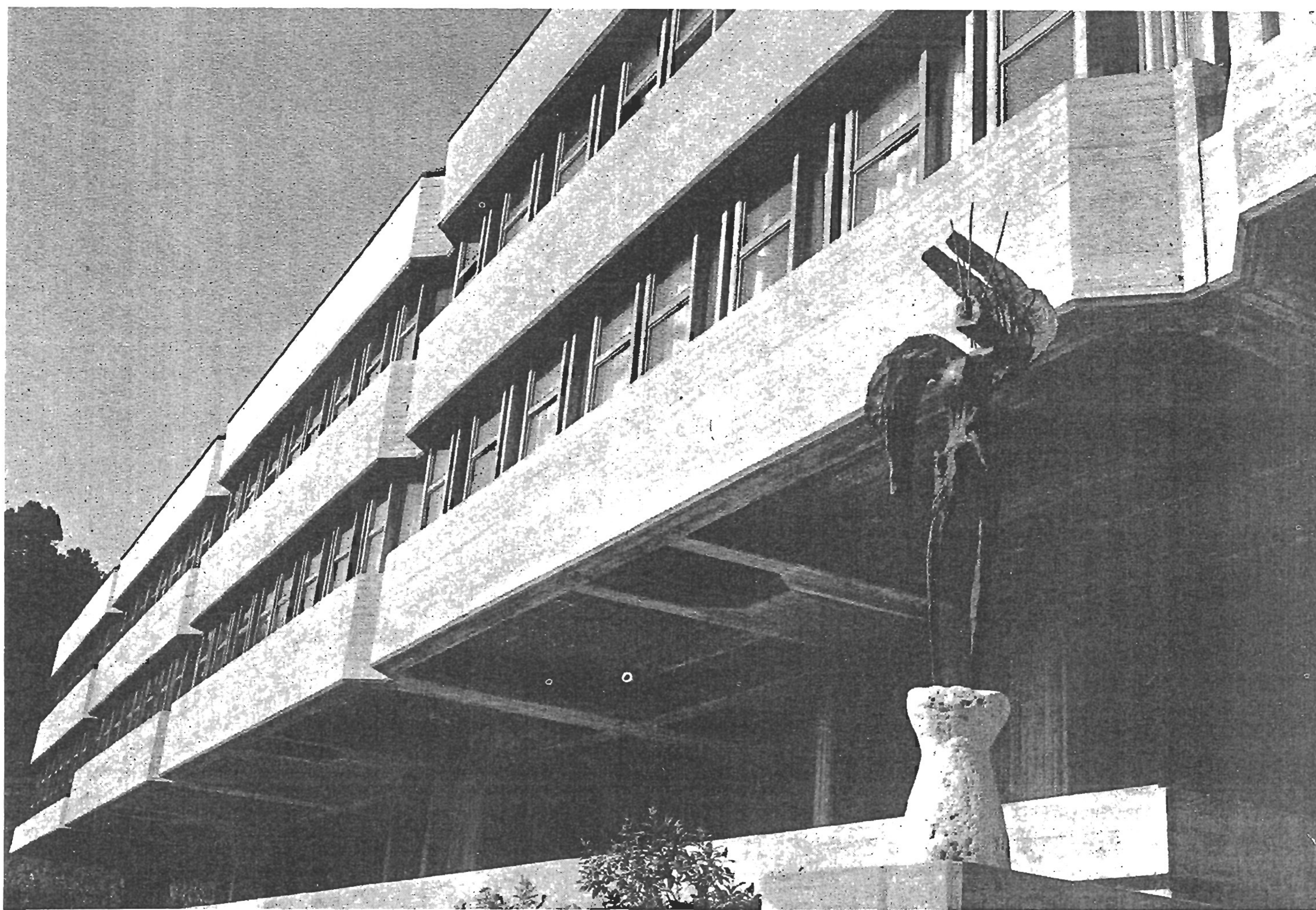
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Where the Dead Sea
Scrolls left off

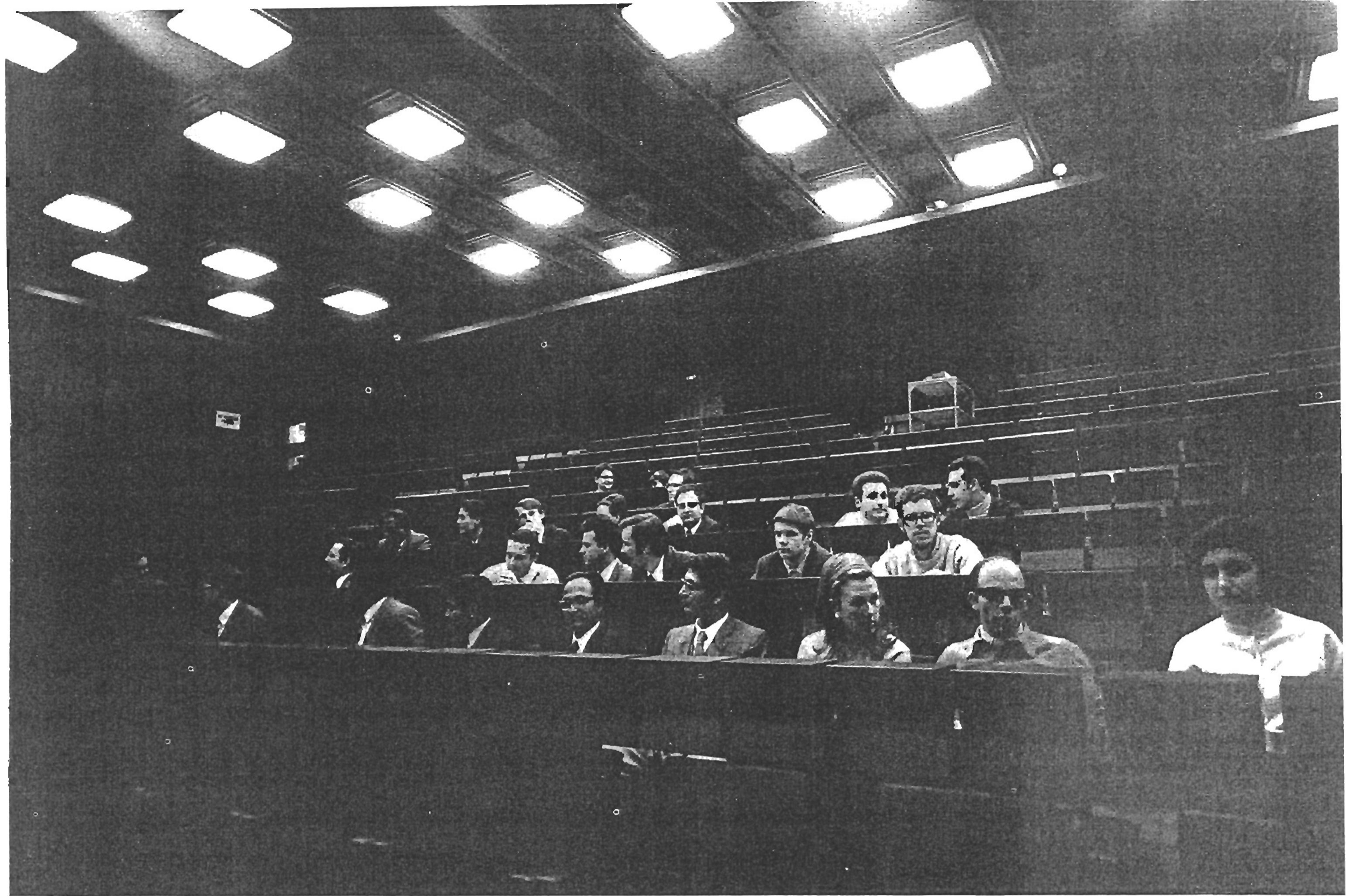
Early
Christian
manuscripts
from the sands
of the Nile



The International Centre for Theoretical Physics, operated jointly by the International Atomic Energy Agency and Unesco, is housed on the Adriatic coast outside Trieste in this \$2 million building (above) donated by the Italian government. The Trieste centre, a meeting place for minds, has neither cyclotrons nor other impressive-looking machines. Each year, over 500 scientists, mostly from the developing countries, make use of its facilities which include lectures in the amphitheatre (opposite) by some of the "greats" of modern physics.

TRIESTE— WORLD RENDEZVOUS FOR PHYSICISTS

by Dan Behrman



Photos Dominique Roger - Unesco

EVERY year, some five hundred of the world's brightest young minds in science are exposed to the International Centre for Theoretical Physics, a rather unusual United Nations institution on the Adriatic coast of Italy just outside Trieste. Most of these scientists come from developing countries and, under ordinary circumstances, they would be likely candidates for the brain drain.

This is precisely why the Trieste centre is in operation with the joint support of two U.N. agencies, the International Atomic Energy Agency and Unesco, and the Italian government. As a way out of the intellectual isolation that drives young scientists to emigrate, it offers them training, an opportunity to do research at regular intervals and, most of all, a place to think, talk and work.

From this scientific centre where chalk, blackboards and desks are the

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only visible apparatus, come more than 130 papers every year in the basic fields of elementary particles, high-energy physics, field theory, nuclear physics, solid state physics and plasma physics.

The centre serves to link east and west as well as the developed and the developing worlds. Research workshops have brought together the top people in the United States and the U.S.S.R. on many topics and particularly plasma physics where problems related to the domestication of the thermonuclear energy of the hydrogen bomb are being studied. If they can be solved, the world will be presented with a new source of power, pollution-free and well-nigh inexhaustible.

Yet the pursuit of theoretical physics cannot be justified in terms of its immediate applications. It is the most philosophical of sciences for it is concerned with the study of the very nature of matter. As such, it attracts the most talented brains of the developing world, the Einsteins, the Fermis, the Niels Bohrs of tomorrow and the day after. They will not devise ways to build better mousetraps but they

learn to think in terms of original solutions. If they are not given the chance to work in contact with others at their own level, they languish... and they leave.

Such was the experience of the founder and director of the Trieste centre, Prof. Abdus Salam. It might even be said that it sprang from his own life, from the isolation that he himself suffered when, after taking his doctorate at Cambridge and conducting research in Princeton, he returned home to Pakistan to teach in 1951.

"I was the only theoretical physicist in the country at that time", he told me as I sat in his office sharing his lunch of sesame seeds. "The nearest one was in Bombay. You have no idea of what that can be like. A theoretical physicist has got to be able to talk, to discuss, to shout if need be.

"I remember, I received a cable one day from Wolfgang Pauli, the Nobel laureate from Zurich, who was in Bombay. He said he was alone and he wanted me to come to talk to him. So I took a plane to Bombay and a taxi to his hotel. I went up to his room, I knocked on the door.

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The micro-macro world under one roof

"He told me to come in and then, without a word of greeting, he said to me:

"The problem is, if we have derivative terms in Schwinger's action principle..."

Prof. Salam was called into an adjoining office for a moment and I had a chance to take in his surroundings. On one wall hung a framed 16th century prayer in Persian which, he had told me, invoked the name of Allah to ask for a miracle. A typewritten notice had been slipped under the glass top of his desk:

"Reminder: Mornings to be spent on physics: No visitors—No phone calls—No mail (except personal) before noon—Administrative matters and visitors during the period after lunch until 4 p.m. only. Remaining time to be spent on physics."

Also under glass on a wall to the right of the desk was a quotation: "We have all of us to preserve our competence in our own professions, to preserve what we know intimately, to preserve our mastery. This is, in fact, our only anchor in honesty."

Prof. Salam might have written that himself, but it was signed by the late Robert Oppenheimer, one of the earliest supporters of the Trieste centre. "The day that a director of a research centre like this one stops being a scientist, he's useless," Prof. Salam remarked. "Any fool can administer. People forget that they were made heads of centres because they

were doing good science. So they lose their competence, they become manipulators of men just to keep themselves in power."

The entire full-time professional staff of the centre could fit into a small Fiat or a short sentence: Prof. Salam, the director; Prof. Paolo Budini from Italy, deputy director; and Dr. André Hamende, a Belgian, who is everything else. At Trieste, Parkinson's Law has been repealed. The administrative staff has actually dwindled from five to three since the centre opened in 1964 but the number of scientists it reaches every year has more than quintupled.

THE International Centre for Theoretical Physics does all this on a budget of no more than \$600,000 a year. Of this figure, the biggest chunk is a generous \$250,000 grant from the Italian government which also financed the construction of its \$2 million building. Then the International Atomic Energy Agency and Unesco each give \$150,000. The remainder is made up mainly of contributions from the Swedish International Development Authority and the Ford Foundation.

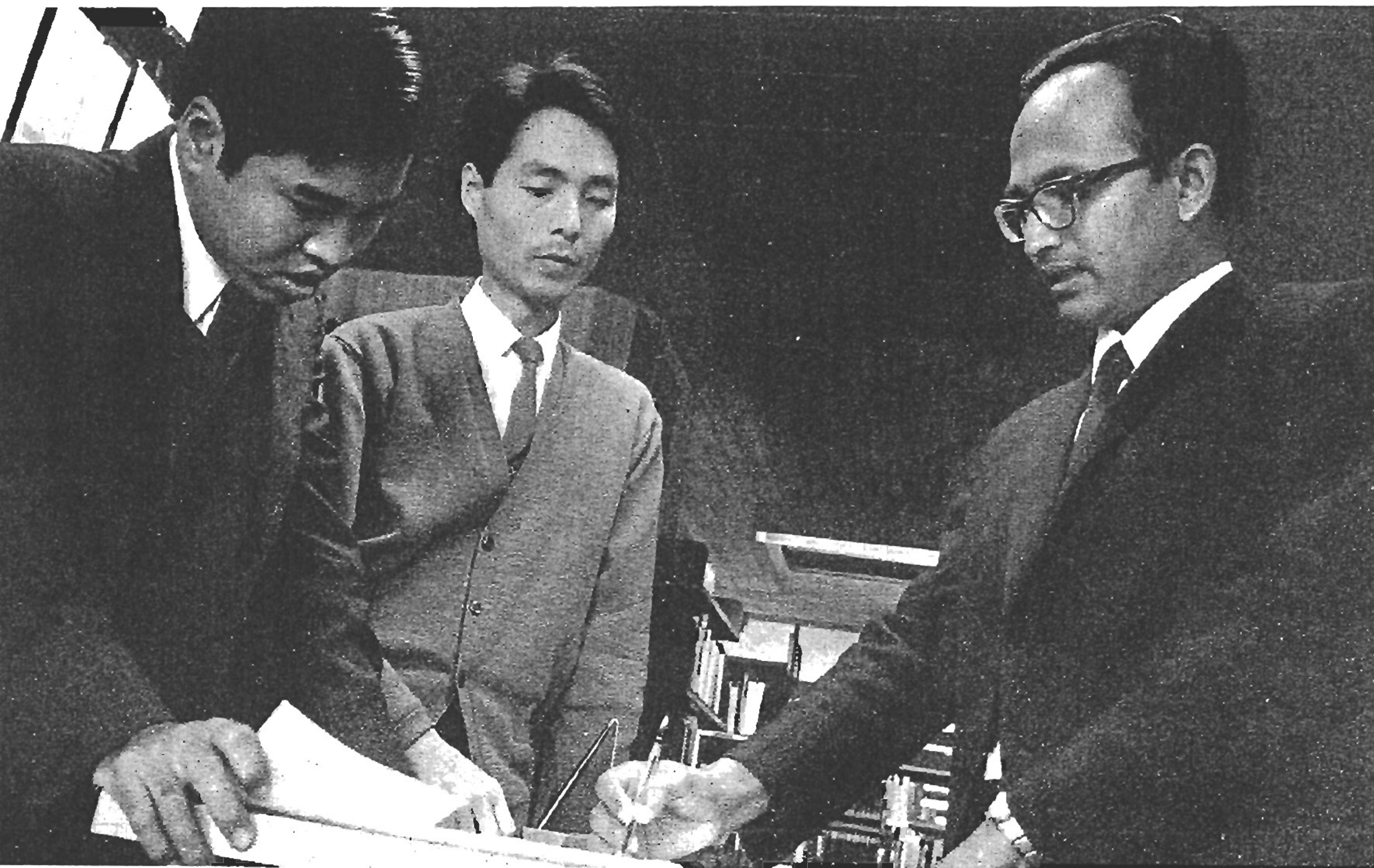
This sum covers virtually all expenses from fellowships and publications to heating and administration: Included is the operation of the centre's library with 6,000 volumes and an up-to-date reference section of journals.

The output in physics is so great today that one American journal alone runs to eighteen volumes in a single year.

This all began in 1960 when Prof. Salam was a member of the Pakistani delegation to the General Conference of the International Atomic Energy Agency in Vienna. He has always had a great gift for doing a number of things all at once: even today, he is still science adviser to the President of Pakistan and professor of theoretical physics at the Imperial College of Science and Technology in London along with his tasks in Trieste. Commuting between such jobs would numb an ordinary man, but Prof. Salam claims it enhances his productivity.

As a delegate in Vienna, he put forth the idea of an international centre for theoretical physics. "I was naive then, I wouldn't dare do it today. People took it half-jokingly and many delegations abstained on the vote when it was approved for a preliminary study. I found out that the idea interested the poor countries. What I wanted to do was to give the poor a place of their own where they would not have to beg anybody. Why shouldn't a bright youngster in Pakistan have the right to receive the same stimulating atmosphere as an Englishman or an American, provided he deserves it?"

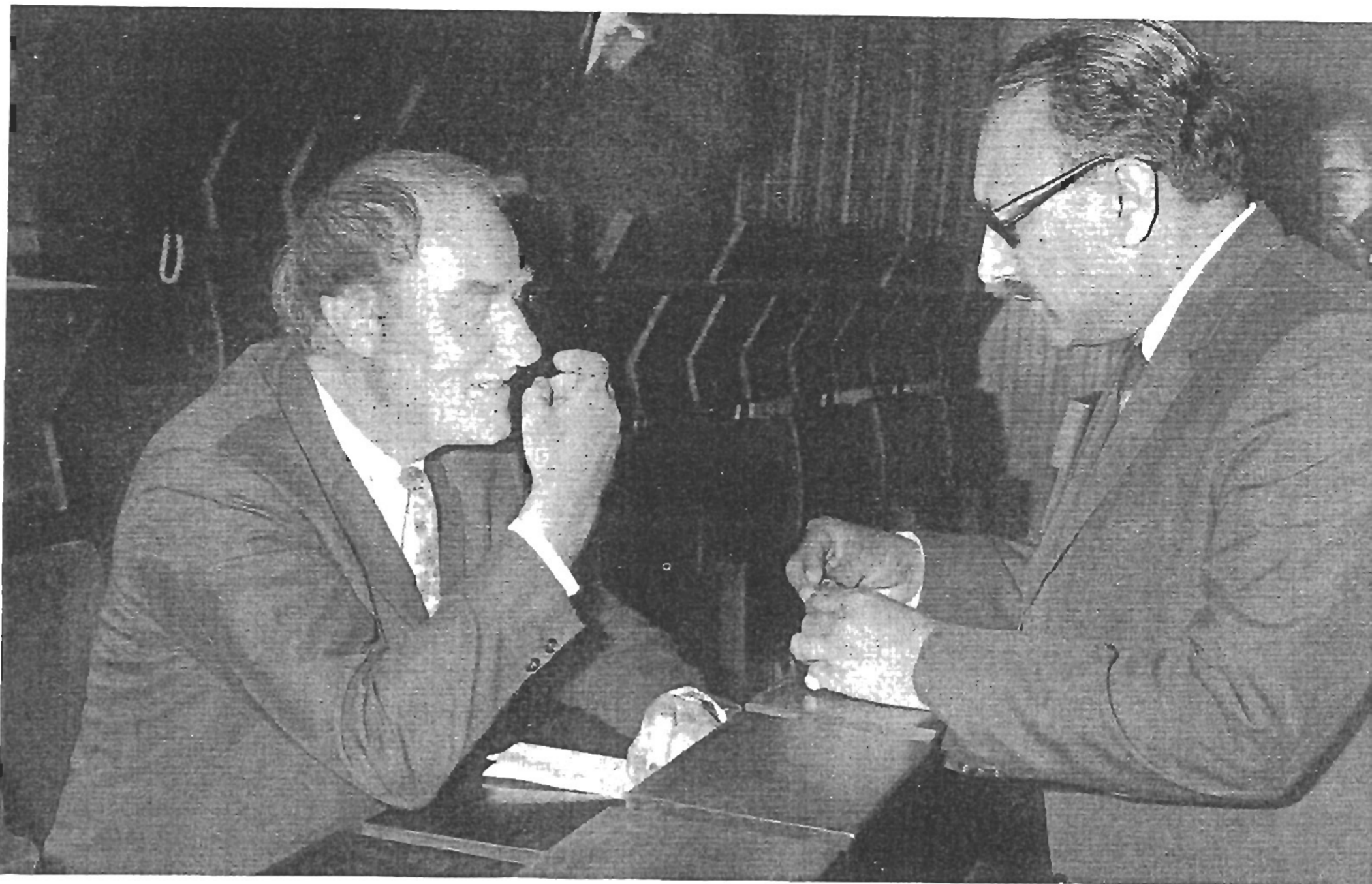
His proposal got over the first hurdle in 1960. It was helped over the succeeding ones by Prof. Salam's fortuitous meeting with Prof. Budini at a



Pencils, paper and conversation are the working tools of the theoretical physicist. Left, three Asian scientists studying a problem are (left to right) M. Tint from Burma, I.T. Cheon from the Republic of Korea and M. Rahman from Pakistan. Right, Dr. V.K. Samaranyake of Ceylon (on right) and Dr. Ottaviani of Italy compare journals in the Trieste Centre library.

Many Nobel Prizewinners lecture and attend meetings at the Trieste Centre. No less than eight came to the International Symposium on Contemporary Physics in 1968. Among them was Sir Francis Crick, co-discoverer with James Watson of the molecular structure of DNA, the "messenger" that carries nature's genetic code. Sir Francis is seen here (seated) talking to Prof. Abdus Salam, Director of the Centre.

Photo Francesco Riccardi © Rice, Trieste



symposium in Trieste on elementary particle interactions.

Prof. Budini was also seeking a way out of isolation, in this case the geographic predicament of Trieste in a cul-de-sac at the far corner of Italy. Nationalism did not make much sense to this physics professor at the University of Trieste whose birthplace, an island that once belonged to Venice, has changed flags three times in his own lifetime. He dreamt of a Trieste lying instead in the centre of Europe, a pole of attraction to fellow physicists from the world over. He and Prof. Salam had no trouble putting their dreams together.

Money was put up by a local bank, the Cassa di Risparmio di Trieste. An offer of land, later converted to money, came from Prince Raimondo di Torre e Tasso whose nearby castle at Duino has played host to Liszt, Mark Twain, Rilke and, most recently, to the 1970 Pugwash Conference. The prince said: "Trieste is my daughter and this is my dowry."

In 1962, the General Conference of the International Atomic Energy Agency approved the creation of a centre. "That was the most momentous day of my life," Prof. Salam told me. "I seldom smoke, but I must have smoked fifty cigarettes that day and I went

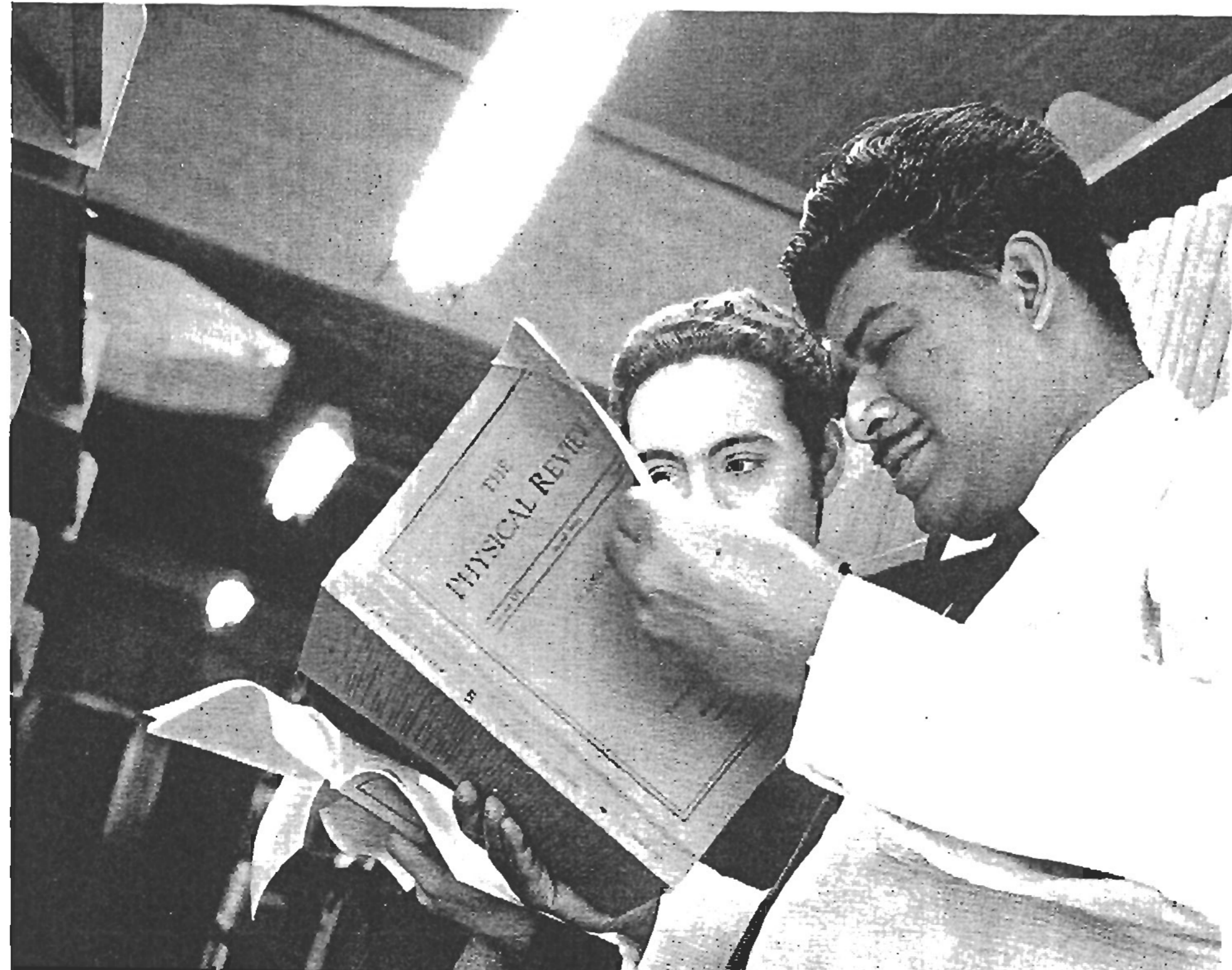
through a kilo of grapes. At the end of the debate, sixty hands went up in favour—and we had won."

The following year, the Italian government's offer of Trieste as a site was accepted and, in 1964, Prof. Salam and his staff moved into temporary quarters in the heart of the city. Four years later, they were in their present building at Miramare, a long double-decker sandwich in concrete with two rows of wood-framed windows as the filling.

On the grounds of the building, there is a small house where Prof. Salam lives while he is at the centre. It is only twenty yards or so from his office window but he can spend two weeks at a stretch seeing nothing more of the outside world than those twenty yards. He has one group working in Trieste, another at Imperial College in London. In the centre, he and his collaborator, John Strathdee, share an office decorated principally with blackboards and equations.

Prof. Salam told me they were endeavouring to put under one unified scheme the micro and the macro universes inside the nucleus and outside in galactic space to cover the frontiers between the behaviour of elementary particles measuring 10^{-15} centimetres (that is, the number one preceded by fifteen zeroes and a decimal point) and the so-called quasars that lie 10^{27} centimetres (the number one followed by twenty-seven zeroes) away from the earth. Prof. Salam is fascinated by the "black holes of gravity" in space occupied by celestial bodies that have collapsed under the weak but relentless force of gravity.

Photos Dominique Roger - Unesco



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The loneliness of the long-distance scientist

Theoretical physicists, such as those found at Trieste, try to explain the behaviour of elementary particles. But though he may use a computer, the physicist's main tool is his mind, and he must have contact with other minds if he is to keep it honed.

This problem, a major one for many scientists from the developing world, was explained to me by Dr. Paul Vitta who got his Ph. D. in the United States and is now teaching at the physics department of the university of Dar-es-Salaam, in Tanzania.

He had come to the centre to attend a two-month nuclear theory course that was just ending. "In Tanzania," he said, "I am the only nuclear physicist. I am in perfect isolation. With our teaching load, one very soon gives up all hope of research. So you pick up a textbook. It gets out of date, but you're stuck with it. I simply need to come to a centre like this."

DR. Khaik Leang Lim, from the University of Malaysia at Kuala Lumpur, is the only Malaysian theoretical nuclear physicist. "There might be some outside, but not in the country. If you're on your own, you can only read scientific journals. It's hard to keep up. Your interest fluctuates when you get tired reading. And there is no one to talk to."

Dr. Lim is an associate at the centre which means that he has the right to three three-month stays there over a period of five years. Trieste now has sixty such associates from more than twenty countries. It hopes to expand the list until it covers all the estimated 200 theoretical nuclear physicists in the developing world. The centre's activities are now being extended into mathematics as well.

He thinks that basic science is necessary to a developing country if only because over-specialized scientists have trouble adapting to change, but he certainly does not believe that Malaysia needs the whole gamut of theoretical physics. His own speciality, nuclear physics, requires fast computers that are not available at home. "Here, I must think of something to do that requires less computation. One cannot change from one field to another, but one can change within a field. In that respect, the centre helps the individual. He can meet people in the same or related

fields, he can learn what's going on"

Dr. Lim would like to see a similar centre some day in Southeast Asia, perhaps in Bangkok. He had to come all the way to Trieste to meet Dr. I.T. Cheon from Korea with whom he is now collaborating by correspondence.

It was once fashionable to remark that no Einstein can come out of the jungle, but the reply heard at Trieste to that is simply: "Why not?" A physicist can come from almost anywhere. Paul Vitta grew up on a farm in a village 600 miles from Dar-es-Salaam, the capital of his native Tanzania, where he went to boarding school. For the educational revolution is paying off.

Omar El Amin, a research worker at the University of Khartoum's radiation and isotope centre in the Sudan, is one of five brothers whose father was a crewman on a Nile river steamer. He reminded me that education in the Sudan is free. It enabled him to reach the point where he was able to go to the University of London for his M. Sc. in radiation physics. Of his brothers, one is a textile technician, another is also studying science, one is in the army and the fourth is working in electronics engineering at Kiev. Mr. El Amin, an experimental physicist, wanted to come to the Trieste centre to "see what theoreticians do with their long equations and their mathematics."

Scientists often say that the best way to look at a phenomenon is to study an extreme case. In that respect, Dr. Toshur Gujadhur certainly qualifies as the most isolated of the theoretical physicists in Trieste. His home is on the island of Mauritius and he was returning there after an absence of ten years that began when he went to Imperial College to earn his doctorate in mathematical physics.

He was about to take a post in a new teacher training institute on Mauritius. "I want to go back, my roots are there, but it will mean complete paralysis of the mind if I cannot get to Trieste every three years or so. I'm working in relativity and quantum mechanics. Learning to me is like food, I need it. It's a challenge; you do it in spurts. I'm here at least twelve hours a day, six days a week. I arrive around eight or nine in the morning, sometimes I go home on the last bus at 10:30 at night. Some people prefer to work only at night so the place is open twenty-four hours a day."

To Dr. Gujadhur, the greatest ad-

vantage of the Trieste centre is its mere existence. "It is a meeting-ground, it offers post-doctoral training but, most of all, there is the fact that one can come back. I must be able to tell myself that I will always be able to come here for three months. Otherwise, one is just cut off."

That is a precarious situation for the physicist. Prof. Georges Ripka of the French Atomic Energy Commission at Saclay, who co-organized the nuclear theory course with Prof. Luciano Fonda of the University of Trieste, believes that the scientist in a developing country runs the risk of doing "perfectly good but irrelevant work." If he only reads scientific journals, he cannot keep up and there is the danger that he will do work already performed elsewhere. "In an hour's conversation with a physicist," said Prof. Ripka, "I learn more than in a day in the library."

The theoretician must also remain in touch with the experimentalist, as is the case at Trieste. "Research is not walking in a garden and waiting for a good idea," said Prof. Ripka. "Physics, unlike mathematics, is an approximate science. One must construct corrected theories when new experimental data come in. It's not that the old theories and experiments are bad, they are approximate. In physics, one is always guessing. Our guessing is never quite wrong, and never absolutely right."

A number of guest lecturers participated in the nuclear theory course as they do in all the training given at Trieste. The centre has become a sort of crossroads for physicists in Europe and it is not unusual for a man to come down from Germany or up from Yugoslavia to lecture for a day or two. The centre pays for his stay and his own institution pays his salary as a contribution by the scientific community to Trieste.

Participants in the course worked hard with three lectures a day followed by a seminar in which each one talked about what he was doing. Most of the lectures were in the forefront of the subject because, as Prof. Ripka remarked to me, it just as easy to teach new material as it is to teach the old, Prof. Ripka was particularly pleased that many participants had

TRIESTE—WORLD RENDEZVOUS FOR PHYSICISTS *(Continued from page 16)*

arranged to collaborate by post. Such arrangements are valid, he thinks, if they are preceded by personal contacts. "In nuclear theory, contacts are invaluable. That's how I got started myself. I was invited to go from France to a conference in New York and I talked to a lecturer there. He got me going and he put me in touch with a student of his in Belgium. After speaking to him, I had the drive and I'm sure my case is typical. That is why I feel responsibility to a fellow here. He must go home with all that he can."

Such courses are far from the centre's main function. In fact, every time one looks around, another function seems to appear. Besides courses, associateships, research workshops and occasional symposia, the centre has a system of federated institutions. They number twenty from sixteen countries and each has the right to send a scientist of its own choosing to Trieste for a period of up to 40 days a year. Such is the thirst for theoretical physics that some institutions send forty scientists for one day—and they stretch their subsistence allowance to cover nearly a week by staying in modest boarding houses or with friends.

EVEN a week is enough to become imbued with the atmosphere of the International Centre for Theoretical Physics. The long corridor that leads to Prof. Salam's office on the second floor is punctuated by portraits of the centre's spiritual fathers: Einstein, Niels Bohr, Oppenheimer, Werner Heisenberg, Wolfgang Pauli, Louis de Broglie, among others... and a humorous New Year's card from Lev Landau showing the fox who fished with his tail. The developing world flocks to Trieste and to what these names represent. To Prof. Salam, this is only the swing of history's pendulum.

He likes to tell how Michael the Scot left his native land in the 13th century to travel south to the Arab universities of Toledo and Cordova. Or how Mamun the Caliph of Baghdad in the 9th century, sent the Emperor of Byzantium a work concerning "a new path in mathematics called Algebra." Prof. Salam blames the Mongol invasions for the end of Islamic science.

"The Mongols systematically destroyed libraries. Before printing, the destruction of a library meant the end of a tradition. When the libraries at Baghdad, Bukhara and Samarkand went up in flames, Islamic science was lost with them."

With men like Prof. Salam we are witnessing an exciting resurgence of Islamic science. Already his work has received recognition by the award of the "Atoms for Peace" prize—a fitting recompense for a man whose name, Abdus Salam, means "Servant of Peace."

With such a name he was almost pre-destined to work for the United Nations. He now has another dream, a world university of which the Trieste centre would be but one campus.

SUCH a university could meet a number of needs. There is already a strong movement for an institution devoted to the study of peace and disarmament which are at the heart of the problems that the United Nations must solve.

Secondly, institutes could be set up at the postgraduate level to conduct research in the basic sciences. Like his own at Trieste, Prof. Salam thinks that they should use the same built-in plug against the brain drain by requiring their participants to spend most of their time in their own countries.

And thirdly, Prof. Salam foresees international campuses with truly international faculties for the applied sciences. "They could be anywhere: Kenya for health sciences, particularly tropical diseases, Iran for petroleum and petro-chemicals, Nigeria or Latin America or Pakistan for agriculture, and so forth." Gaps left in the network of U.N. centres would be filled by federated universities and research institutes. "I'm after fifty campuses, not five or six," said Prof. Salam. "This must be truly a world university. Don't worry, it will come, certainly not tomorrow but certainly within twenty years."

On that note, I left Abdus Salam. His prediction is just a dream, but this disconcerting man of faith and science must be one of the world's most realistic dreamers... ■

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