THE MINERVA FOUNDATION 40 YEARS ON

Overcoming an Immense Tragedy

What began as a cautious attempt at "testing the waters" has since developed into a "fine-meshed network." Hence the celebration held at the Harnack-Haus in Berlin-Dahlem in early March, during which Israeli and German scientists commemorated 40 years of cooperation. It was in 1964 that the Weizmann Institute of Science in Rehovot and the Minerva Foundation, a subsidiary of the Max Planck Society, signed the first agreement to promote joint research programs. Peter Gruss, President of the Max Planck Society, Ilan Chet, President of the Weizmann Institute of Science, and Edelgard Bulmahn, German Federal Minister of Science, all addressed the gathering.

The longest tradition in past 40 years of scientific cooperation with Israel belongs to the Minerva foundation. Its programs – financed by the Federal Ministry of Education and Research, with funding thus far totaling some 200 million euros – offer the broadest sponsorship spectrum. There are several aspects to the Foundation's work, including the promotion of Minerva-Weizmann projects. Some 80 research projects at the Weizmann Institute of Science are now benefiting from the 3.6 million euros made available each year by the Minerva Foundation. Those first in line for support are primarily young, outstandingly well-qualified scientists working at an international level on individual projects of the highest quality, including cooperation with German research institutions. As part of this program, the first "Minerva Lecture Award" was presented in 2003 to Daniel Zajfman, an astrophysicist at the Weizmann Institute. He was thus able to present to the public in Heidelberg the results of his pioneering work on interstellar matter, undertaken jointly with the Max Planck Institute for Nuclear Physics.

By 2003, the German Federal Ministry of Education and Research and its predecessors had funded the Minerva-Weizmann projects to the tune of around 123.5 million euros – with extraordinary success: more than 10 percent of all Weizmann Institute publications in the past 10 years have resulted from these research projects.

In 1973, the Minerva Exchange Program was set up to include scientists from all Israeli and German research institutions (the "Minerva Fellowship Program"). Under this heading, the Foundation currently provides 1.2 million euros each year in support of some fifty Israeli and German scientists, who receive grants lasting up to three years. Increasing importance is being attached to targeted support for junior scientists in order to encourage a new generation to participate in Israeli-German cooperation programs.

In addition to grant funding for short-term residencies of around three months ("Minerva Seed Grants" and "Short-Term Research Grants"), Minerva Schools and "Gentner Symposia" – named after one of the founding fathers – are organized in each country on an alternating basis. These events provide an opportunity for larger groups from both countries to engage in the exchange of scientific ideas and make contacts that will stand them in good stead in future collaboration. By 2003, a total of 31 million euros had been procured for these activities, allowing nearly 700 Israeli and more than 800 German scientists to benefit from extended research residencies in each other's countries.

PHOTO: NORBERT MICHALKE

Presidents in congress: Peter Gruss (left) and his Israeli counterpart Ilan Chet.

The Minerva Research Centers, first established in 1975, represent yet another means of promoting joint research. To provide a financial foundation for these centers, the German Federal Ministry of Research has endowed the scheme with a fund totaling 65 million euros. The income from the fund – which is matched by grants from Israel – is used to finance the annual budgets of the Minerva Centers. An Advisory Council, on which Israeli and German scientists are represented in equal numbers, appraises the scientific work and makes decisions on new research projects and the allocation of funding.

There are currently 41 Minerva Research Centers located at seven research institutions in Israel, where they act as centers of excellence to promote cutting-edge science in close cooperation with German institutions. The work of these Centers covers an extensive range of subject areas, from German history, human rights and the history of German-Jewish literature and art to the application of genetics and biotechnology in agriculture, the conversion of light energy, marine biogeochemistry and computer sciences.

A gap in the Israeli-German research sponsorship program was filled by the Minerva Foundation in 2001 with the establishment of thus far five Minerva Junior Research Groups at several universities and institutions in Israel. Each year, the Foundation provides around 100,000 euros in funding. Following the pattern set by the Max Planck Society, the work of these Junior Research Groups in Israel is limited to five years. During this time, outstanding young scientists have the opportunity to qualify for future management positions and reinforce Israeli-German cooperation at an early stage in their career. Selection procedures are currently under way to identify researchers to join two new Minerva Junior Research Groups at the Weizmann Institute of Science, in addition to the existing Group, which has already started work.

Independently of the individual Minerva programs, the Max Planck Institutes have also been systematically extending their cooperation with Israeli partners. There are currently 85 joint research projects under way, with around 70 Israeli scientists working each year as guests at the various Institutes.

Another successful research instrument is specifically geared to mutual support: in November 2000, Erez Raz became the first Israeli scientist to head an Independent Junior Research Group at the Max Planck Institute for Biophysical Chemistry in Göttingen. A comparable group with a young German researcher at its head is scheduled to be set up before the end of this year at the Weizmann Institute in Rehovot.

In his celebratory speech in Berlin, Max Planck President Peter Gruss reminded his audience that it was scientists who "took the initial steps toward overcoming an immense tragedy that seemed likely to irrevocably separate the Israeli and German peoples." At the invitation of Joseph Cohn, Gerhardt Schmidt and Amos de Shalit of the Weizmann Institute, a delegation from the Max Planck Society embarked on the first official visit to Israel in early December 1959. Those making the journey were the President, Otto Hahn, and the two scientists Wolfgang Gentner and Feodor Lynen.

What began as a cautious attempt at "testing the waters" (so Otto Hahn) attracted the support of then-heads of government David Ben-Gurion and Konrad Adenauer and led in 1964 – a year before the opening of diplomatic relations – to the first Minerva agreement for scientific cooperation between Israel and Germany. Gruss went on: "From these beginnings, which helped release the scientific community in post-war Germany from its international isolation, there has developed over the past 40 years a constantly growing and increasingly sophisticated network which is now addressing the challenges posed by progressive globalization and the creation of a European Research Area." In this process, the Weizmann Institute and the Max Planck Society are pursuing the common aim of "safeguarding the excellence and competitiveness of our institutes, departments and researchers at an international level." ●

www
The Minerva Foundation on the Internet: http://minerva.mpg.de

GARCHING TECHNOLOGY FOR NASA SATELLITE

The Dark Side of the Universe

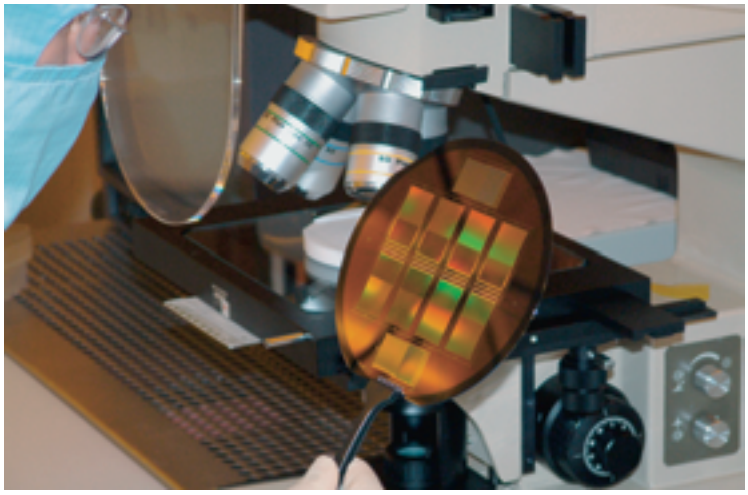
The National Aeronautics and Space Administration (NASA) in the U.S. is drawing up plans for a satellite to explore the "dark energy" that is assumed to be the cause of the recently detected accelerated expansion of the universe. The essential equipment carried by the satellite will comprise a new X-ray camera developed by the Max Planck Institute for Extraterrestrial Physics in Garching, near Munich, in combination with seven X-ray telescopes produced by the Carl Zeiss company. NASA has decided to take up the DUO mission, proposed jointly with U.S. research institutes under the leadership of Richard Griffiths of Carnegie Mellon University, as well as four other proposals for satellite missions.

There now follows a five-month study phase to investigate how to put *DUO* into Earth orbit in 2007. Once aloft, the satellite, which is designed to operate for a period of two years, will collect data on tens of thousands of galactic clusters. One of the researchers' objectives is to test new cosmological models, and it is hoped that the vast structure of the galactic clusters will provide a key to the "dark side of the universe."

The dark energy that is pushing the universe apart is proving to be quite a puzzle for astronomers. Finding a solution to the problem might necessitate a fundamental rethinking of the physics involved. Future experiments will therefore be directed at ascertaining the proportion of the universe made up of dark energy and finding clues to its cosmic evolution. In view of the fundamental significance of this work, cosmologists must employ a variety of independent methods to enable reciprocal verification of results, reduce systematic errors and increase overall accuracy. The recently published findings garnered by the *WMAP* (Wilkinson Microwave Anisotropy Probe) satellite already begin to demarcate the volume of dark energy. Similar results were previously achieved through an analysis of galactic clusters by the X-ray satellite *ROSAT*.

The systematic X-ray observation of tens of thousands of galactic clusters – roughly 20 times as many as were studied by *ROSAT* – should enable scientists to plot the chronological changes in dark energy with even greater accuracy. DUO will be relying on synergies offered by a new X-ray detector that is to be installed in the International Space Station ISS, and that was originally developed at the Max Planck Institute for Extraterrestrial Physics for *ROSITA*, the planned successor to the X-ray satellite *ABRIXAS*, which met with failure in 1999. The *DUO* mission provides an extremely cost-effective opportunity to make use of these technological innovations and deploy them in the search for the nature of dark energy.

In the course of the two-year mission, *DUO* is scheduled to undertake two scanning operations. The first will cover the same area of sky as the optical Sloan Digital Sky Survey (SDSS). This wide-area scan will take in 6,000 square degrees of sky and record some 8,000 galactic clusters at a distance of up to around 6 billion light-years. A second, deeper scan covering an area of 150 square degrees close to the galactic south pole is expected to detect around 1,800 galactic clusters at distances of up to 8 billion light-years. The region of sky has been selected so as to overlap with the planned deeper scans of the microwave background. The combination of X-ray and microwave data will thus provide better results in both frequency bands, as well as yielding synergies with other projects, principal among them the APEX experiment headed by the Max Planck Institute for Radio Astronomy.



DUO's "eyes": Scientists in the semiconductor laboratory at the Max Planck Institute for Extraterrestrial Physics are developing wafers with new types of CCD chips.

PHOTO: MPI FOR EXTRATERRESTRIAL PHYSICS/SEMICONDUCTOR LABORATORY

UNIVERSITY COOPERATION

Focus on Optics

The modernized Max Planck Research Group building on the Siemens research campus in Erlangen.

A new joint project, initially limited to a period of five years, has been launched by the Free State of Bavaria and the Max Planck Society under the title "Max Planck Research Group for Optics, Information and Photonics." The Group, comprising as many as 100 staff members, is being run as an Institute of the University of Erlangen-Nuremberg, where it covers the entire spectrum of modern optics. It is housed on the Siemens research campus in a building with some 2,600 square meters of floor space.

The Max Planck Research Group encompasses three departments: Department I is headed by Gerd Leuchs, whose chair at the University of Erlangen-Nuremberg has been integrated into the Research Group. The leadership of Department II is in the hands of Lijun Wang who, over the past 10 years, has worked at some of the major institutions in the U.S., most recently at the NEC Research Laboratory in Princeton. The procedure to appoint a head of Department III is expected to be completed sometime in 2004.

An experiment in nanophotonics: Characteristic interferogram for an overlay of radial and linear polarized light.

Scientists in Department I are using techniques such as interferometry and trigonometrical methods to develop new means by which to determine the three-dimensional form of bodies with optically smooth or rough surfaces. The objects being studied range from a statue from the Bamberg cathedral to aspherical lenses for lithography with extreme ultraviolet light. The department is also tasked with developing and constructing new micro-optical instruments. Research is also being conducted into the characteristics of wavelength- and sub-wavelength-scale optical fields and their interaction with small structures ("nanophotonics"). The study of nanophotonics is of great importance for microscopy, lithography, optical data carriers and quantum information.

Much of this work will also benefit applied research. Researchers engaged in one project are studying so-called solitons – solitary waves that spread out without changing their form. On the one hand, these are used in basic research to perform the Einstein-Podolsky-Rosen 'thought experiment' for continuous quantum variables. Building on this foundation, investigations are also under way into "quantum communication protocols" as used in the secure distribution of cryptographic cipher keys. And finally, the same experimental construct can be used to develop new types of telecommunications technology instruments with exclusively optical transmission components.

In Department II, which is currently under development, researchers are concentrating on laser science and technology. They are attempting to use a single trapped indium ion as a quantum oscillator to regulate the frequency of an ultra-stable laser, and in a second stage to design an atomic clock that works on an optical frequency standard. Such an "optical atomic clock" offers numerous advantages over conventional radio frequency atomic clocks.

What's more, an optical clock based on an indium ion is likely to achieve a degree of accuracy three orders of magnitude greater than that of the most precise atomic clocks currently in existence – equating to an error in accuracy of just 30 picoseconds (trillionths of a second) per year. In addition, the trapped ion offers a clean and controllable quantum mechanical system with which to verify new findings in the quantum world.

Using optics as a means of precision measurement, the scientists also intend to design a highly accurate gravity-measuring device with which to determine variations in the force of gravity in real time. This project is being conducted in close cooperation with the German Federal Office of Cartography and Geodesy. In the field of material processing, the scientists are planning experiments with an intensive ultra-short pulse laser that is capable of permanently altering the optical characteristics of transparent materials such as glass. This will make it possible to design and create a variety of optical structures for future telecommunications applications. Beyond this, it is also hoped that research can be carried out into potential new applications for lasers in biology and medicine.

Finally, the future Department III will be dedicated primarily to researching new kinds of optical materials, looking into techniques for microstructuring such materials and into the physical characteristics of severely spatially restricted light.

PHOTOS: MAX PLANCK RESEARCH GROUP ERLANGEN

Pinboard

EVIDENCE OF THE FACT that Germany is not exclusively plagued by a one-way "brain drain" is at hand: the Max Planck Institute for Evolutionary Anthropology in Leipzig has shown that it is quite capable of attracting prominent scientists from abroad. At the beginning of the year, French paleoanthropologist Prof. Jean-Jacques Hublin (51), who was previously involved in research at the Laboratoire d'Anthropologie at the University of Bordeaux, began work at the Institute. There, he heads the new Department for Human Evolution – the Institute's fifth such department. His team's objective is to investigate the fossil remains of prehistoric humans, so-called hominids, for clues to their biological nature, behavior and culture. The scientists will be concentrating on fieldwork as a prerequisite for all further investigations. One project has already begun in Ethiopia, and further digs are planned in France and North Africa. The archaeological finds will then be analyzed by no fewer than three groups at the Max Planck Institute laboratory. The researchers will be using medical X-ray techniques and three-dimensional graphics programs to reconstruct fossil fragments, analyze anatomical structures and simulate particular biochemical features of hominids. The investigation of the chemical composition of bones and teeth will also provide clues to their eating habits and migrations, their ability to adapt to the seasons, and possibly even to their social coexistence and sexual behavior. With the aid of comparative morphological studies, the scientists working under Jean-Jacques Hublin also hope to find answers to the manner and speed with which the human brain developed in comparison with the rest of the body. Only in this way can we understand the unique abilities of modern man and how we came to acquire them.

A PRIZE WITH A TOP REPUTATION is the research prize that has been presented annually since 1983 by the Philip Morris Foundation. The 100,000 euro award was shared this year by three individual prize winners and one research team. Two shares in the prize went to Max Planck scientists. One of them is 61-year-old biophysicist Peter Fromherz, Director at the Max Planck Institute for Biochemistry, who received the award for his work in which he succeeded in exchanging electrical signals between a cell and a chip for the first time. Working as a team at the Max Planck Institute for Radio Astronomy, Karl Menten, Ernst Kreysa and Frank Bertoldi were singled out for the outstanding sharpness of their view into the universe. They developed bolometers and, using hundreds of these superconductive radiation-measuring devices, discovered stardust dating back to the early days of the universe. Their findings now cast doubt on conventional theories regarding the birth of galaxies and stars.

PREMIERE for the Max Planck Society: This year, the Society made its first appearance at the annual gathering of the American Association for the Advancement of Science (AAAS), the world's largest scientific congress, where it shared a stand with the Fraunhofer Gesellschaft and the Leibniz and Helmholtz Associations. With the striking slogan "Hi Potentials! International Careers made in Germany," the organizations presented their latest research findings at the meeting in Seattle and provided visitors with details of research and study opportunities. There were also American scientists on hand to report on what they experienced while living and working in Germany and encourage their colleagues to follow their example.

AS VALUABLE AS THE NOBEL PRIZE ... Dierk Raabe, Director at the Max Planck Institute for Iron Research, has been awarded the 2004 "Gottfried Wilhelm Leibniz Program Prize for German Scientists" (the Leibniz Prize, for short). Raabe's principal area of study is the computer simulation of materials. He was awarded the Leibniz Prize for "his outstanding fundamental work on the interdisciplinary frontiers of materials science, physics and mathematics, his simulation methods grounded in the physics of metals, his work on the mechanics of interfaces and surfaces, and his defining influence on modern materials science." Dierk Raabe has also come to the fore as an author of books for the layman with a scientific bent. His work entitled *Morde, Macht, Moneten* [*Murder, Might and Money*] brings together numerous stories revolving around metals – from the catastrophic sinking of the Titanic to chastity belts to tin cans. Since the Leibniz Prize is similar in value to the Nobel Prize – it's worth 1.55 million euros, or half as much for purely theoretical scientists – it ranks as the German equivalent to the latter. On the other hand, in contrast to the Nobel Prize, the funding is tied to specific purposes. The aim is to allow prize winners to broaden their research horizons, free themselves from the burden of administration and recruit qualified junior research staff. This year, the Deutsche Forschungsgemeinschaft (German Research Foundation) and the Federal Ministry of Research singled out a total of eleven scientists, including two women.

PHOTO: MPI FOR IRON RESEARCH

An outstanding researcher: Dierk Raabe was awarded the 2004 Leibniz Prize.