Report of the Director

The success of the International Foundation High Altitude Research Stations Jungfraujoch and Gornergrat (HFSJG) is measured by the quality of the scientific results and by the extent to which its research stations are used. According to these criteria the year 2003 has again been a successful one. This new issue in our series of annual reports summarizes the major events within the Foundation HFSJG as well as operational aspects and research activity at Jungfraujoch and Gornergrat. As in previous years, the scientific reports have been prepared by the respective research groups.

The Foundation HFSJG

On October 24, 2003, the Board of the Foundation HFSJG met at the Victoria-Jungfrau Grand Hotel in Interlaken for its regular meeting held every odd numbered year. The president, Prof. Gustav Andreas Tammann, had the honor to welcome the members of the board, the 'Jungfraujoch Commission' of the Swiss Academy of Sciences SAS, the 'Astronomic Commission HFSJG', and a number of distinguished guests. The annual activity reports 2001 and 2002 as well as the statement of accounts for both years were approved unanimously and with no abstentions. The extensive and excellent scientific output that resulted from the research at Jungfraujoch and Gornergrat was recognized with great pleasure and satisfaction. The president also informed that the finances for 2004 are guaranteed and that there are promising signals from the Swiss National Science Foundation for a consolidation concerning the future financing of the Swiss contribution to the operational and maintenance costs of the research stations. Prof. Tammann then explained the reasons for his wish to resign as president of the Foundation. Prof. Hans Balsiger, space physicist and former director of the Physikalisches Institut of the University of Bern had agreed to accept the office and was elected president of the Foundation HFSJG by the senate of the Swiss Academy of Sciences on May 9, 2003. He will assume his duties as of January 1, 2004. The board HFSJG elected Prof. Paul Wild as Corresponding Member of the Foundation, honoring thus his meritorious service to the Foundation and to the Astronomic Commission. As usual, a number of interesting scientific reports concluded the meeting. On Saturday, October 25, 2003, the members and guests were invited to an excursion to the High Altitude Research Station Jungfraujoch, where representatives of the research teams presented on-going scientific projects on site.

The Astronomic Commission, which has changed its function to that of a users' and science advisory committee to strengthen the Foundation's internal and external communication, had its regular spring and autumn meetings.

In order to promote dissemination of the scientific results obtained at Jungfraujoch and Gornergrat, and in particular to emphasize the astrophysical work being done by the research groups using the Foundation's infrastructure, the International Foundation HFSJG co-sponsored the 4th Cologne-Bonn-Zermatt Symposium, organized by the University of Cologne and held in Zermatt in September 2003. The very successful conference was attended by more than 200 participants from all over the world.

The report period was also marked by endeavors being made toward closer connections among high altitude research stations in Europe. Upon the initiative of a

number of research groups working at Jungfraujoch and/or abroad, the Foundation was involved in several research proposals for Networks of Excellence within FP6, the European Commission's Sixth Framework Programme 2002-2006. The director HFSJG had the honor to represent the Foundation at two meetings in Italy for the proposal ATPROMO (Atmospheric Parameters and Radiation On Mountain Observatories; Rome, May 7-8, 2003; and Torino, September 19-20, 2003), headed by Dr. Alba Zanini, Istituto Nazionale di Fisica Nucleare - Sezione Torino, Torino, Italy. He was also invited to participate from June 28 - July 3, 2003, in the workshop "High Mountain Observatories and the Challenges of the 21st Century", at Borovetz, Bulgaria, organized by Prof. Jordan Stamenov, Director of the Institute for Nuclear Research and Nuclear Energy, INRNE, Bulgarian Academy of Sciences, and head of the scientific station at Mt. Moussala. This workshop resulted in a memorandum of understanding emphasizing the significance of High Mountain Observatories. All the meetings were extremely successful in providing an overview of the scientific activity at high altitude locations as well as in establishing very useful contacts to the station managers of other high alpine scientific stations in Europe. (Please see corresponding documents at the end of the activity report.)

The High Altitude Research Station Jungfraujoch

As documented by the individual reports and the lists and statistics, the High Altitude Research Station Jungfraujoch continued to be a place of exceptionally lively and exciting research. In 2003, 32 teams from 23 institutions were active at Jungfraujoch. Among the 32 research projects, 20 were primarily based on automatic measurements around the clock. With the exception of Italy (whose researchers work exclusively at the Astronomical Observatory Gornergrat North), all member countries of the Foundation benefited from the excellent research conditions (Figure 1). By number of projects, Germany was the second largest user after Switzerland. As in previous years, researchers from The Netherlands, a former member country of the Foundation, were also present. Scientists spent a total of 686 person-working days at Jungfraujoch. As shown in Figure 2, this number is lower than the numbers of the past years and reflects the trend to automatic and remote-controlled measurements. Also, for several field campaigns, the scientific station Jungfraujoch was just used as a base. Figure 3 illustrates the relative number of person-working days for 2003 by country. Leading in presence at Jungfraujoch were the Institut d'Astrophysique et Géophysique de l'Université de Liège, the LIDAR group from the Laboratoire de Pollution Atmosphérique et Sol de l'Ecole Polytechnique Fédérale de Lausanne (EPFL), and the University of York, Department of Chemistry together with the University of Leeds, School of Environment / Department of Chemistry (Free Tropospheric Experiment 2003, FREETEX 03). Researchers from the Institut für Medizinische Physik, Universität Innsbruck, Austria, pursued their long-term annual measurement campaigns on solar UV irradiance. Complementing the automatic meteorological measurements, our custodians continued the daily weather observations for the Federal Office of Meteorology and Climatology (MeteoSwiss). The custodians also provide the updates for a new internet weather report of the Jungfraubahn.

The extensive research conducted at Jungfraujoch during 2003 resulted in 112 scientific publications, conference contributions, and data reports. It is noteworthy that young and in particular young women scientists are playing an increasingly active role. In 2003, six Ph.D. theses were based on work conducted at Jungfraujoch.

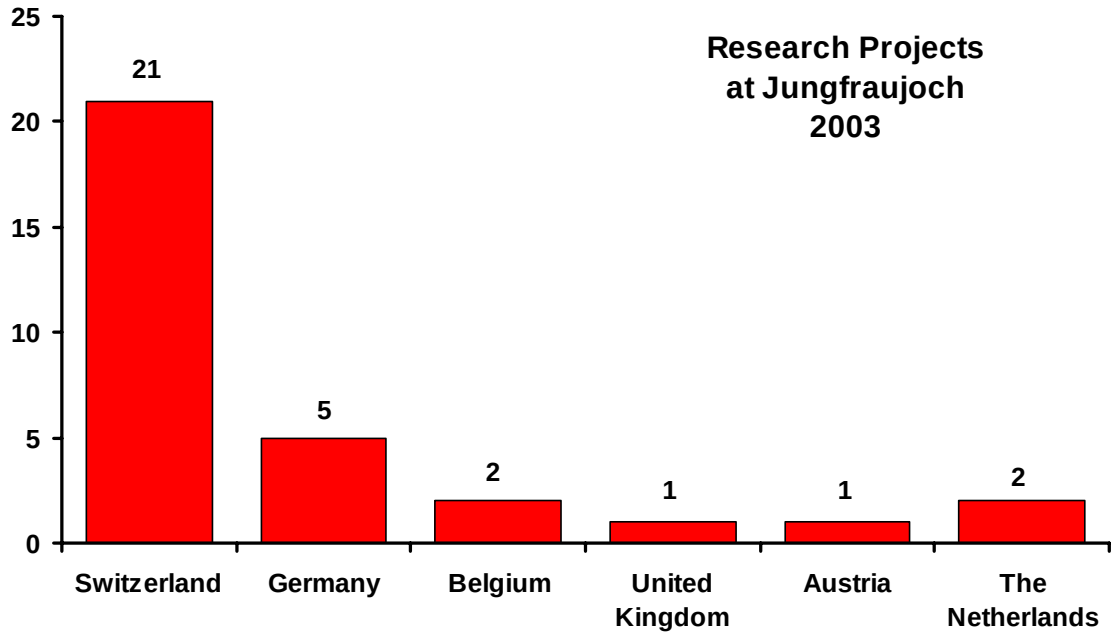

Figure 1: *Number of research projects at the High Altitude Research Station Jungfraujoch by country.*

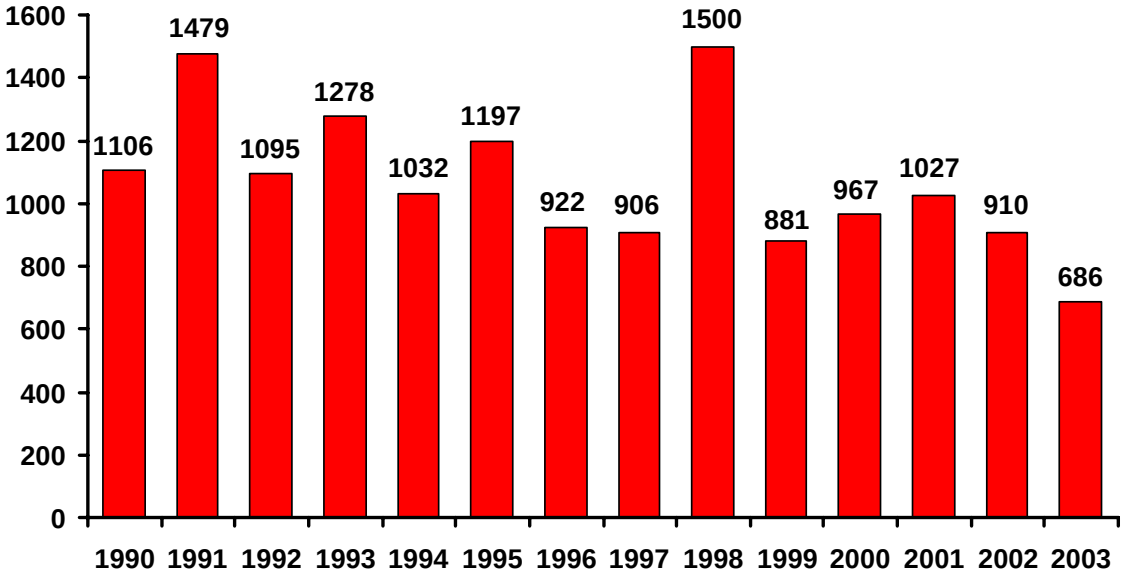

Figure 2: *Number of working days spent by scientists at the High Altitude Research Station Jungfraujoch during the past years.*

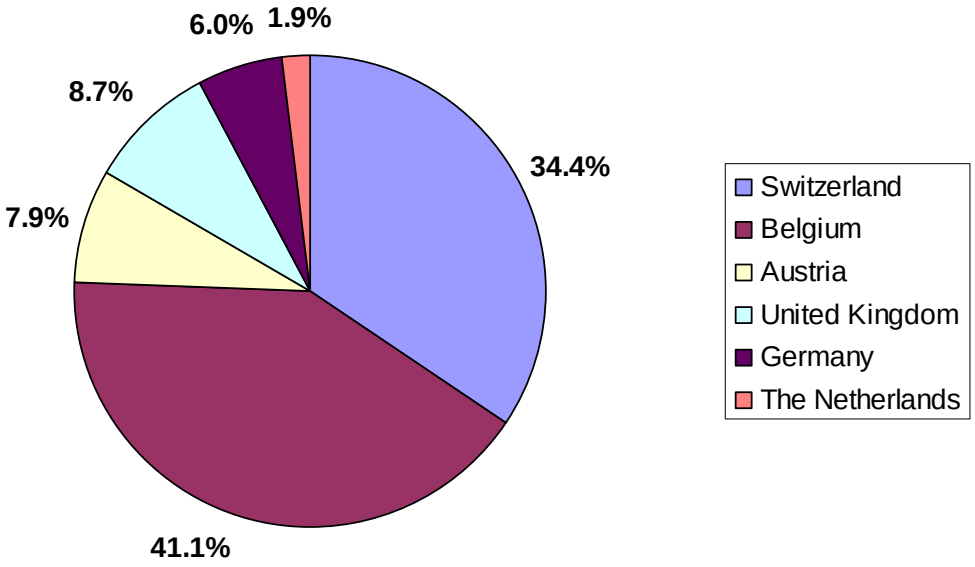

Figure 3: *Relative number of person-working days at the High Altitude Research Station Jungfraujoch by country.*

Due to the unique location and the unspoiled environment as well as the quality of the scientific work, Jungfraujoch has maintained its role as a center for environmental research. The site plays a significant role in a number of nationally and internationally coordinated research programs. Jungfraujoch is a key station in the following major networks:

NDSC	Network for the Detection of Stratospheric Change Primary Site
GAW	Global Atmosphere Watch
GAW-DACH	European Baseline Station, together with Zugspitze/Hohenpeissenberg (2962 m, Germany) and Sonnblick (3106 m, Austria)
SOGE	System for Observation of Halogenated Greenhouse Gases in Europe
AEROCARB	Airborne European Regional Observations of the Carbon Balance
EARLINET	European Aerosol Research Lidar Network
CHARM	Swiss Atmospheric Radiation Monitoring Program
ANETZ	Automatic Measuring Network of MeteoSwiss
RADAIR	Swiss Automatic Network for Air Radioactivity Monitoring
NADAM	Netz für automatische Dosis-Alarmierung und -Meldung
NABEL	Nationales Beobachtungsnetz für Luftfremdstoffe (National Air Pollution Monitoring Network)
ASRB	Alpine Surface Radiation Budget Network
AGNES	Automated GPS Network for Switzerland

The significance of the environmental research at Jungfraujoch is threefold:

1) the large number of chemical and physical atmospheric parameters measured simultaneously at the same site by a variety of state-of-the-art experimental techniques,
2) the existence of long-term datasets which are unique in the world, and
3) the extensive interaction of scientists across disciplines on all scales: locally, in national, European, and global networks, including ground-based measurements as well as observations from space, and combining experiment and theory.

Jungfraujoch, however, is not only a center for atmospheric and environmental research. The high alpine surroundings are of equal importance, as demonstrated e.g. by the research projects conducted by the University of Zürich, Department of Geography, Glaciology and Geomorphodynamics Group (rock-face temperature monitoring), by the Swiss Federal Institute of Technology, Laboratory of Hydraulics, Hydrology and Glaciology, Zürich (permafrost temperature monitoring in alpine rock walls). These long-term temperature measurements will be of importance for the evaluation of the consequences of heat waves such as the one in summer 2003 to the high alpine environment in general but in particular for the region of the UNESCO World Heritage Jungfrau-Aletsch-Bietschhorn (JAB). Glacier parameters as key indicators for climatic changes were also measured remotely by means of SAR (synthetic aperture radar) within the Swiss Alpine Airborne SAR Experiment SASARE (University of Zurich, Department of Geography, Remote Sensing Laboratories). It was the first time that such an SAR experiment was flown in a high alpine environment. The extraction of climate information from archives within the JAB was also the goal of ice drilling campaigns in the Fiescherhorn/Jungfraujoch area conducted by a joint team of the University of Bern, Laboratory for Radio- and Environmental Chemistry, and the Paul Scherrer Institute within the NCCR Climate project VITA (NCCR Climate: National Centre of Competence in Research on Climate; VITA: Varves, Ice cores, and Tree rings - Archives with annual resolution).

On November 7, 2003, the highest grid connected photovoltaic power plant in the world, installed and operated by the Berner Fachhochschule, Hochschule für Technik und Informatik (HTI), Burgdorf, celebrated its 10th anniversary. Throughout the years the experimental plant operated successfully with 100% availability in energy production and data monitoring, and it provided a wealth of results on technological and environmental aspects. The HTI celebrated this event on site with one of its traditional Face-to-Face meetings, bringing about 60 representatives from science, industry, politics, and media to Jungfraujoch.

The Research Station, the scientific activity, and the unique environment of the new UNESCO World Heritage Jungfrau-Aletsch-Bietschhorn attracted a number of visitors throughout the year. Several organizations initiated meetings of national and international scientific committees in the Jungfrau region and combined these meetings with an excursion to Jungfraujoch, e.g.

- HYDRAM group of the Ecole Polytechnique Fédérale de Lausanne EPFL (Prof. André Musy, February 20, 2003)
- Swiss Aral Sea Mission, Uzbekistan (March 7, 2003)
- AGAGE Meeting of EMPA (June 18, 2003)
- Deutscher Geographentag (September 27, 2003)

- Wengen Workshop 2003 (Prof. Martin Beniston, October 4, 2003)
- COST-723 Workshop (October 5, 2003)

The administration HFSJG also received a number of requests for visits to the Research Station from representatives of news media and non-scientific groups. Thanks to the help of the researchers and the custodians most of them could be realized, and all were extremely well received. Life in the mountains, the high alpine environment, and the research activity were reflected in more than 20 contributions in the news.

The extreme solar events of October and November 2003 attracted the attention of scientists, engineers, and the public worldwide. Intense northern lights (aurora) were visible on the entire globe even at low geographic latitudes. Eye-witness reports in Switzerland included locations such as Jungfraujoch and the region of Lake Constance and were extensively discussed in the media.

In order to provide the researchers with optimal working conditions, continuous effort is needed to keep the environment clean and the infrastructure in good condition. As in previous years, several coordination discussions took place with the management of the Jungfraubahnen. Prime topics were measures to avoid or minimize disturbances of the scientific measurements by emissions in connection with ongoing and planned construction work or by apparatus defects. A few disturbing emissions due to technical malfunctions were eliminated promptly. The continuous support by Mr. Andreas Wyss, chief of technical services and maintenance division of the Jungfraubahnen at Jungfraujoch, and his team is gratefully acknowledged.

Maintenance work on the infrastructure of the Research Station included repainting the laboratories on the ground floor in the Research Station, and the repair of small water leaks in the flat roofs of the Sphinx building and the Research Station.

At the end of July, reaching age 65, Mrs. and Mr. Susanne and Kurt Jenni resigned as our substitute custodians after three years of devoted service to the benefit of the researchers and the Foundation. They were succeeded by Mrs. and Mr. Gertrud and Kurt Hemund.

The High Altitude Research Station Gornergrat

Due to its unique location, its clean environment, and the good infrastructure, the High Altitude Research Station Gornergrat, which includes the two astronomical observatories Gornergrat South and Gornergrat North as well as a container laboratory, continued to serve as an excellent basis for astrophysical research.

The Astronomical Observatory Gornergrat North is subleased to the Italian Consiglio Nazionale delle Ricerche (CNR). It is equipped with a 1.5m Cassegrain-Infrared (IR) Telescope (TIRGO). The telescope and related instrumentation are run by the Istituto di Radioastronomia (IRA-CNR), sezione di Firenze (former CAISMI), with the assistance of the Osservatorio Astrofisico di Arcetri and the Dipartimento di Astronomia e Scienza dello Spazio of the Università di Firenze. Observations were made during the winter months 2002/2003 and again after the summer season, which is not suited for IR observations. TIRGO activity was focused on observing galaxies in the local universe to address the issue of galaxy formation.

The Observatory Gornergrat South is subleased to the Universität zu Köln. Here, the I. Physikalisches Institut der Universität zu Köln has installed the 3m radio telescope

KOSMA (Kölner Observatorium für Submillimeter und Millimeter Astronomie). The central topic of the research with KOSMA is the spectrally resolved observation of the global distribution of interstellar matter in the Milky Way and nearby external galaxies, using the important mm-, submm-lines of CO, and atomic carbon. The most advanced technical equipment (two superconductor-insulator-superconductor SIS array receivers) combined with the excellent observing conditions at Gornergrat allow astronomical observations up to the highest frequencies accessible to ground-based instruments.

Both instruments at Gornergrat are accessible to guest investigators. In 2003, scientists from 18 European and non-European research institutions spent a total of 936 person-working days at the astronomical observatories at Gornergrat (Figures 4 and 5).

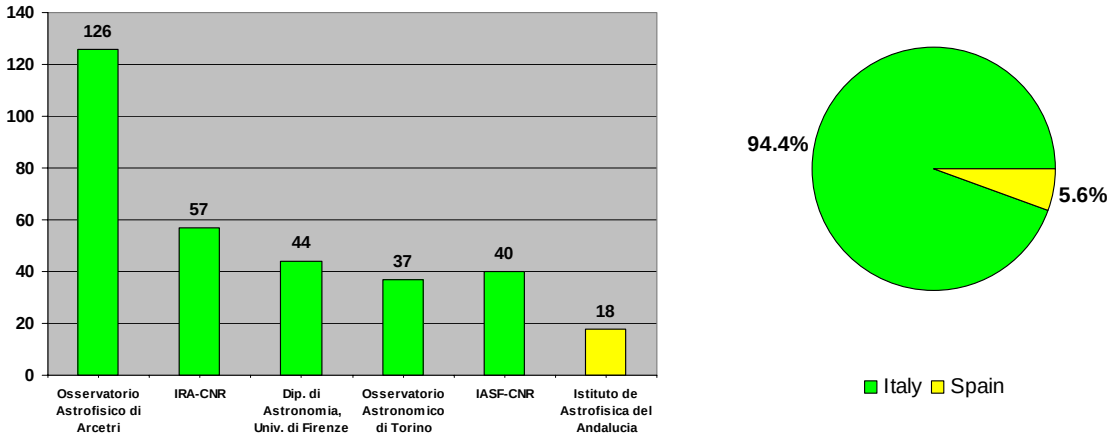

Figure 4: *Statistics of the person-working days at the Astronomical Observatory Gornergrat North.*

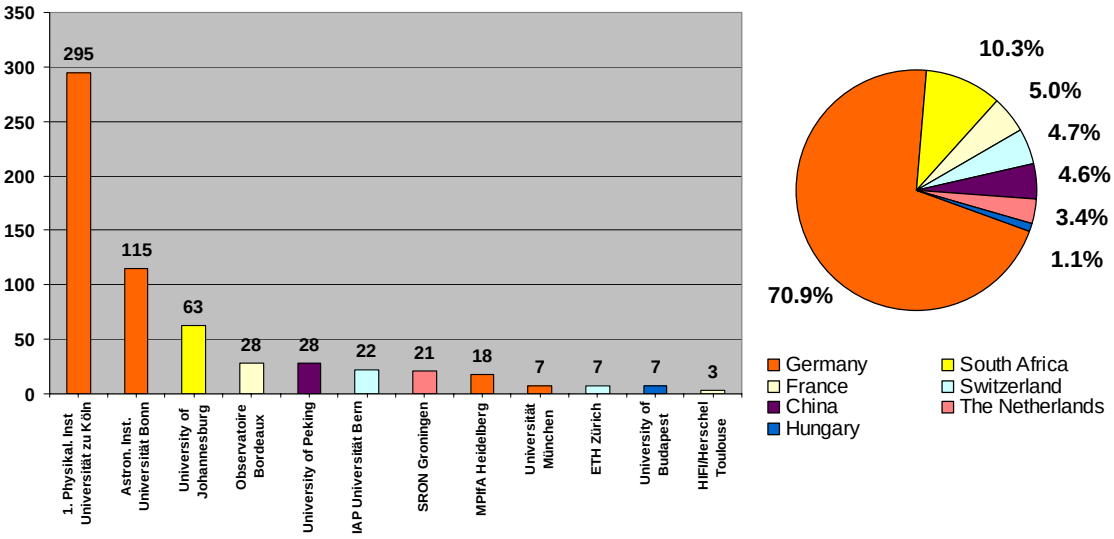

Figure 5: *Statistics of the person-working days at the Astronomical Observatory Gornergrat South.*

Within a collaboration with the KOSMA team the Institute of Applied Physics of the University of Bern investigates the spectral development of the radio emission and electron distribution during the acceleration and thermal phase of solar flares. Shortly after completion of a new receiver the exceptional flare on October 19, 2003, was observed. This observation gave fascinating results about the temporal evolution of the millimeter flux and a significant shift in the source position correlated with a dramatic change in source diameter. Some of these features were observed for the first time.

Since 1998, the Space Research and Planetary Sciences Division of the University of Bern has been operating a solar neutron telescope (SONTEL) on the Belvedere plateau. This detector is the European cornerstone of a worldwide network initiated by the Solar-Terrestrial Environment Laboratory of the Nagoya University for the study of high-energy neutrons produced in energetic processes at the Sun. Analysis of the recordings during the series of extremely energetic solar eruptions that occurred at the end of October and the beginning of November, however, shows no indication of the presence of solar neutrons near Earth. Nevertheless, even in the absence of solar neutrons the SONTEL data during the October/November 2003 time period are of special interest, in particular for the study of solar-terrestrial effects.

The scientific work at Gornergrat during the past year resulted in 20 publications. Details of the activity during 2003 can be found in the individual reports.

In 2003 the I. Physikalisches Institut of the Universität zu Köln was the main organizer of two conferences in Zermatt. From July 14-18, the 4th International Conference on Tunable Diode Laser Spectroscopy was held at the Grand Hotel Zermatterhof. The 4th Cologne-Bonn-Zermatt Symposium on “The dense Interstellar Medium in Galaxies” was held from September 22-26, at the same location. Both conferences were extremely successful, each attracting more than 200 participants from all over the world.

Many of the conference participants seized the opportunity to visit Gornergrat, as did a major group of technical staff of Swiss transport companies (June 14, 2003).

An extremely important help for the successful scientific work done at Gornergrat is the continued support provided by the Burgergemeinde Zermatt as the owner of the Gornergrat Kulm Hotel, by the Gornergratbahn, and locally by Mrs. Marianne Schwall and Mr. Uli Schwall as the director of the Kulm Hotel, and his crew.

Summary and Acknowledgements

As documented by the individual activity reports, the large number of publications, and the feedback from meetings, scientific work at the High Altitude Research Stations Jungfraujoch and Gornergrat during the report period 2003 continued to be extensive and of high international standard. Due to the unique observational and measuring conditions, the Jungfraujoch station has maintained its position as a key station in a number of European and global measuring networks for climate and environmental studies. For the same reasons, Gornergrat continues to be a center for outstanding astronomical and astrophysical research. The Foundation HFSJG therefore confirmed its role as a provider of excellent research infrastructure. The hard work and the efforts of all who contributed to this success are highly appreciated and gratefully acknowledged. We also thank all members of the Foundation and their representatives for their support. In particular, we thank the Swiss National Science

Foundation for the most significant funding of the Swiss contribution, and in particular Prof. Albert Matter (President Division II), Dr. Paul Burkhard (Head secretariat Division II), and Dr. Jean-Bernard Weber (Head Coordination and Interdivisional Tasks), for the excellent and benevolent collaboration.

Operation of the High Altitude Research Stations Jungfraujoch and Gornergrat would not be possible without the help and support of many individuals and organizations.

For the Jungfraujoch station, our thanks go to our custodians, Mr. and Mrs. Fischer, Mr. and Mrs. Hemund, and the now retired Mr. and Mrs. Jenni. With their devotion to duty, their competence, and their ability to create a comfortable atmosphere in the station, they are providing the basis for all scientists to do good research work. A special thanks goes to the Jungfrau Railway Holding Ltd and to the Jungfrau Railways. Without their goodwill and their substantial help the Research Station at Jungfraujoch could hardly be operated. Both the Board of the Jungfrau Railway Holding Ltd under its president Mr. Riccardo Gullotti, as well as the management and personnel of the Jungfraubahnen under Chief Executive Officer Walter Steuri, are always open and positive toward our needs, which quite often conflict with touristic objectives. We gratefully acknowledge the generous direct and indirect support and appreciate the continued interest in the research activity and the scientific output. At Jungfraujoch we are particularly grateful to Mr. Andreas Wyss, chief of technical services and maintenance, and his team. Our thanks also include Mr. Urs Zumbrunn, and the personnel of the Restaurant Top of Europe.

The great efforts of all these individuals and institutions would, however, be worthless if the research facilities would not be used adequately. We therefore would like to express our sincere gratitude to all scientists for their dedicated work and good collaboration, demonstrating through the excellence of their research that the High Altitude Research Station Jungfraujoch continues to fulfill an undisputed need of the scientific community.

In this sense, for Gornergrat our thanks go first to all the scientists of the Istituto di Radioastronomia (IRA-CNR), sezione di Firenze, of the Osservatorio Astrofisico di Arcetri and the Dipartimento di Astronomia e Scienza dello Spazio of the Università di Firenze, the I. Physikalisches Institut der Universität zu Köln, and of the University of Bern, and of all collaborating institutions. We then thank the BVZ Holding AG and, in particular, the Gornergrat-Monte Rosa-Bahnen with its president of the Board, Mr. René Bayard. The substantial continuous support provided by the Gornergrat-Monte Rosa-Bahnen, by its Chief Executive Officer Hans-Rudolf Mooser as well as the entire crew, has been essential for the success of the scientific work. Finally, we are extremely grateful to the Burgergemeinde Zermatt under the presidency of Mr. Andreas Biner, the members of the Burgerrat, and to Mr. Fernando Clemenz, Director of the Matterhorn Group. Without their goodwill and support it would not be possible to operate a world-famous astrophysical observatory at Gornergrat.

At the administrative office in Bern I would like to thank Dr. Urs Jenzer, the technical assistant HFSJG for electronics and computers, for his proficient work. Continued assistance by the Informatikdienste of the University of Bern in networking and data transfer is also gratefully acknowledged. We have greatly appreciated the competent services of our treasurer, Mr. Karl Martin Wyss, and the knowledgeable support and auditing by Mr. Christian Gasser. Last, but not least, I would like to thank our secretary, Mrs. Louise Wilson. Her devotion to the Foundation HFSJG, her

competence and flexibility in running the administrative affairs, and her kindness in the daily contacts with staff and scientists are well recognized and highly appreciated.

Bern, February 20, 2004 Erwin O. Flückiger