

SWISS – SPACE SCIENCE

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Swiss Academy of Sciences
Akademie der Naturwissenschaften
Accademia di scienze naturali
Académie des sciences naturelles

SWISS SPACE
RESEARCH COMMISSION

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SWISS SPACE SCIENCE IN 2004—2005

ALTERATION OF
CYTOSKELETON
IN MICROGRAVITY
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ZURICH & UNIVERSITY
SASSARI

INTRODUCTION

Every two years many states produce a report to communicate with others the status of their space science efforts. This is done in the frame of the Committee for Space Research COSPAR. Switzerland does contribute to this information effort through this report. This year, the detailed reports on all the projects that are going on in the institutes and industries are published on the web, on the site of the Space Research Commission of the Swiss Academy of Sciences, spacere-search.scnatweb.ch. We give here our appreciation of the on-going efforts and of the framework in which these efforts take place. Indeed, in a small country, the boundaries are large compared to the surface and the dependence on the surroundings more important than in large national communities.

THIERRY COURVOISIER
AND THE SWISS COMMITTEE
FOR SPACE RESEARCH

THE SWISS SPACE RESEARCH COMMUNITY

In Switzerland we have a number of research activities in areas such as astronomy, planetary studies in the solar system, solar physics, Earth observations, space biology and physiology. This research is led in the large majority of the cases by federal and cantonal academic institutes and, where important hardware developments take place, with the collaboration of industrial partners. The funding for these efforts is through ESA's PRODEX programme and some further tools of the Swiss confederation, through the academic institutes and the Swiss National Science Foundation. We thus have a large diversity in subjects, organisation and funding sources. This diversity gives us a certain level of flexibility and the possibility to adapt to new challenges; it is also the source of complexity and makes it difficult to have a broad and synthetic overview of the magnitude of the efforts. The positive side of the flexibility of our organisation is well illustrated by the creation in the last decade of two institutes, ISSI (International Space Science Institute) in Bern and the ISDC (INTEGRAL Science Data Centre) in Geneva. The first of these institutes provides a forum where scientists of all nations can gather in interdisciplinary panels to study a large variety of subjects, using many different observational tools, thus providing a real added value to the data analysis efforts based on single instruments. ISSI also provides a frame where different world leading space agencies can meet and therefore contributes to the coordination of the world space research efforts. The ISDC is centered around the data processing, archiving, distribution and analysis of ESA's gamma ray astronomy satellite INTEGRAL as a service for the world astronomical community. The ISDC is the link between the

complex data of the mission and the large world wide community of users. It can now use the knowledge and experience gained in the very successful INTEGRAL project for new space borne, but also ground based, observatory type projects. Both institutes were very new in their aims and structures when created and could be set in place thanks to the flexibility of the Swiss system and the responsiveness of funding authorities to new challenges clearly outside of the familiar frames.

Some large projects are conducted by Swiss space scientists, projects in which they take the responsibility at the principal investigator level for whole instruments to be flown on ESA or sometimes other agencies' missions. This represents significant financial resources in Switzerland, up to some 15 Meuros for a given project, large and highly competent workforce in both academic institutes and industry and a high skill in the management of complex projects. A prime example in this category is the ROSINA instrument on board Rosetta now flying towards a rendez-vous with the comet Schuryumov-Gerasimenko in 2014. Other important instrumental projects have been conducted for astrophysical missions like XMM-Newton or RHESSI in the last years. These were led in Switzerland by the Paul Scherrer Institute near Zurich. This institute is now closing its astrophysical laboratory, which will lead to an impoverishment of the Swiss capacity to contribute important parts of instruments in astrophysics missions. Keeping the knowledge and experience gained over the last decades in this very successful laboratory implies that this activity is relocated in another frame, possibly close to an active space astrophysics

group in Switzerland. The size spectrum of projects is much larger than these large endeavours. Smaller projects include instruments developed and flown on various microgravity platforms for life and physical sciences, significant contributions to experiments led elsewhere. There is also the analysis of large and small data sets on many subjects, like, among many others, the study of movements of the Earth surface. The Swiss community thus contributed much appreciated elements of many space science missions and could exploit successfully the resulting data.

The «importance» of a project should not be judged solely, if at all, on the magnitude of its funding, but on the progress in the knowledge acquired in the end. In most if not all the Swiss space research efforts the results that are obtained are at the world cutting edge, as testified by the publications that result. The Swiss space science effort certainly contributes to the positive reputation of the country in the world scientific community.

THE CONTEXT

The Swiss space science effort is to be seen in its international context. This context is largely dominated by the programmes of the European Space Agency. The programmes that are relevant to our research are the space science programme, the Earth observation programme and the Human spaceflight, microgravity and exploration (HME) programme.

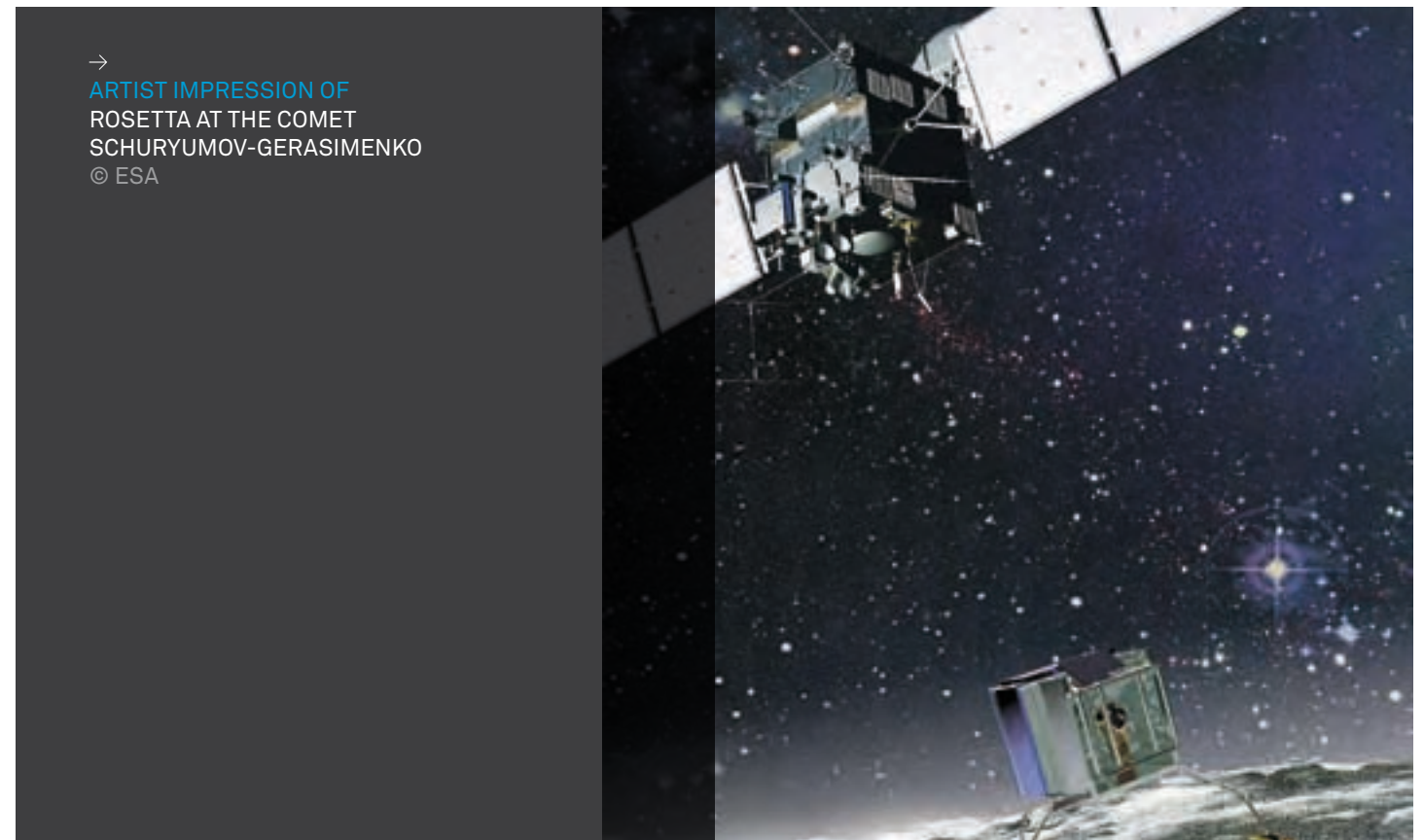
The space science programme of ESA covers the research activities related to astronomy, the study of the solar system and of the Sun. The space science programme missions in flight now, Cluster, SOHO, Ulysses, XMM-Newton, INTEGRAL to name some that were led or completely developed by ESA, provide world class and highly relevant data on many questions regarding the cosmos, the solar system and the interaction of the Earth with its immediate surrounding. This unparalleled success has been built by the efforts of a large, dynamical and competent community within ESA, the European industry and in the laboratories, sustained by adequate financial support until the middle of the 90's.

These major successes notwithstanding, the science programme has seen its level of resources decrease over the last decade from some 500 MEuros/year to now some 400 MEuros/year. At the same time, the complexity and cost of missions has naturally increased, as the first simple discovery type missions have been followed by more ambitious ones, seeking to answer the important questions revealed by the progress of science. As a result, ESA's science programme is now resource starved and cannot anymore provide any reasonable launch rate in any given domain. A direct consequence of this large funding deficit is an extreme difficulty, if not impossibility, to keep in the community the expertise that is needed to develop new missions. Communities should not be kept alive once they have finished their task just for their own sake. However, when important questions must be tackled, the corresponding communities are the most important asset to successfully address them. Loosing the expertise is then jeopardising our future possibility to progress. Examples of this state of affairs are found in Solar and high

energy astrophysics research, where many areas exist in which fundamental knowledge must be acquired to understand where we come from or what the Sun has in store for us. In these domains the lack of perspective in ESA's science programme has become a major worry, also within the corresponding Swiss communities.

The whole European space science community has shown its capability to generate new ideas in the last 2 years and shaped an ambitious possible programme covering many aspects of research relevant to mankind's most fundamental questions. The result of this collective work is the Cosmic Vision brochure issued by ESA in 2005. In the current financial and political context, however, one if any of the projects outlined will be realised before 2020 or thereabout. A score that is bound to discourage most bright young collaborators and to prevent students to enter the field, leading to a considerable loss of expertise and potential and hardly a positive step in building the knowledge based society called for in Europe.

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ARTIST IMPRESSION OF
ROSETTA AT THE COMET
SCHURYUMOV-GERASIMENKO
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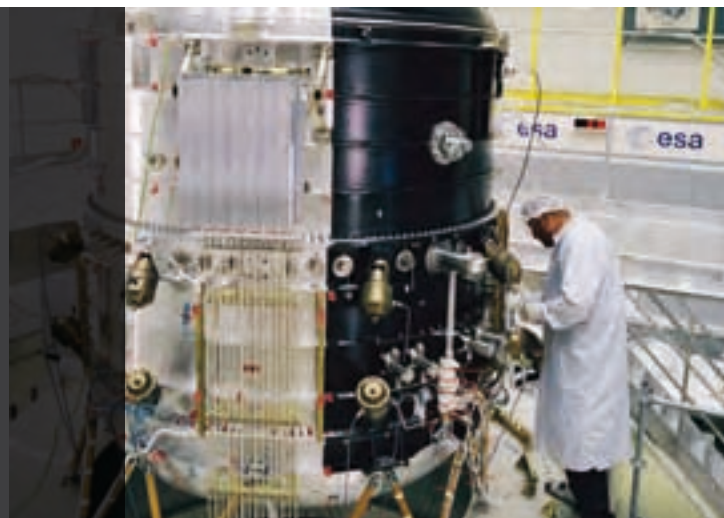
On a brighter note ESA's exploration programme is now well underway with a Mars mission, ExoMars, well funded. Switzerland decided to make a large use of this opportunity and to fund it at a higher level than the mandatory activities. If this programme is led according to scientific criteria, by opposition to industrial short term interests of the different contributing countries, then this will be a real addition to Europe's research effort.

Most microgravity research, as well as all the research done in orbiting laboratories (biology, physiology and solid state physics for example) rely on the existence of flight opportunities. These are either given by the international space station (ISS) or by shuttle flights. Here the problems related to the shuttle in the last years, the delays in assembly of the space station and the lack of resources for its scientific exploitation mean that the associated research efforts fall a very long way short of the expectations that our society could put in these research tools. Thus the immense investments made to date in this area remain largely fruitless in terms of scientific knowledge. Here also the research community has the intellectual potential of providing much more in terms of science than the present situation allows them to do. Improving this situation would allow the world community to not only gain the technological, industrial and managerial know how that is now acquired with the international space station, but also to use it as a true scientific laboratory.

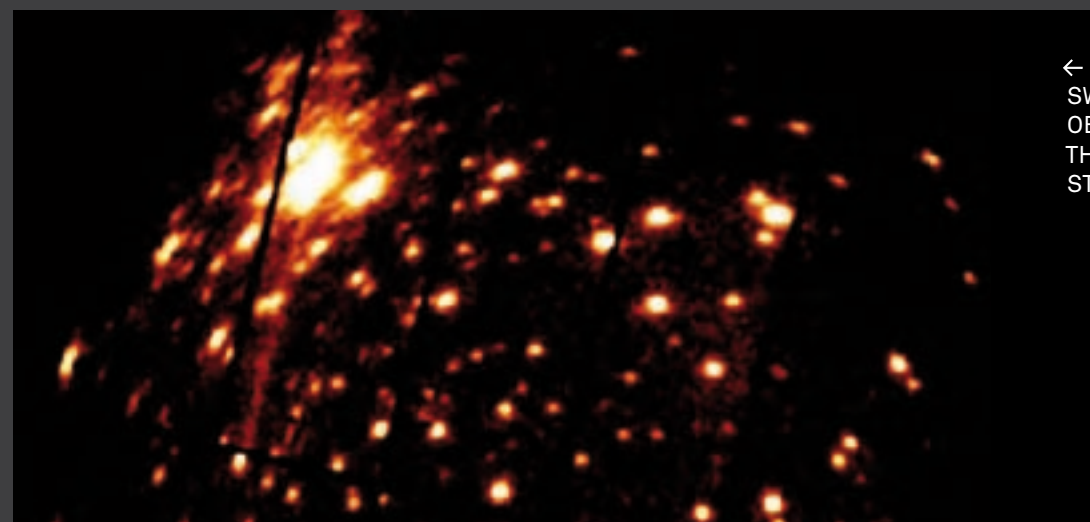
Europe's Earth observation programme is divided in an operational part including EUMETSAT and GMES (Global Monitoring for Environment and Security) and a scientific part. Whereas the GMES programme from which one expects short term benefits on the operational level is well funded, the Earth observation envelope programme (EOEP) covers the scientific part and reached a remarkable level of subscription at the Ministerial Conference in Berlin 2005. – The goal of the GMES Space Component (GSC) – Programme is to develop and implement the space and ground segment for the ESA-EU initiative for Global Monitoring and Security, an initiative that is, after Galileo, the second flagship in European space policy. It will coordinate National and other European contributions to ensure the most efficient use of available assets, avoid data gaps or duplication in order to support operational Earth Observation through GMES services from 2012/2013 for land, water and atmospheric applications. The Earth Observation Envelope Programme (EOEP) aims to develop our understanding of the basic Earth system and of human influences on it. The programme foresees innovative measurements of a very wide range of geophysical parameters, spanning the whole spectrum of the environment including land, ice and snow, oceans and the atmosphere.

A broad research and application community from several university institutes, soft- and hardware industry as well as departments of federal government are involved in various ESA- contracts. At a time when space infrastructure is becoming an essential part of our societies to maintain and develop our level of life, to manage intelligently the Earth's natural resources and the human built capital, to navigate on the continents, at sea or in the air and to predict our weather and the associated extreme conditions, mastering space technologies is absolutely necessary to guarantee Europe's independence on the world scene. The efforts associated with the pacific acquisition of knowledge are one of the most fruitful ways to gain the skills needed for this and at the same time to substantially contribute to mankind's knowledge of its environment on all scales, from the size of a continent to that of the Universe. It is therefore urgent that Europe's political authorities at the national and continental levels measure the damage done presently by the lack of solid perspectives for one of the most knowledgeable and dynamical community in the space sector, namely the space research scientists.

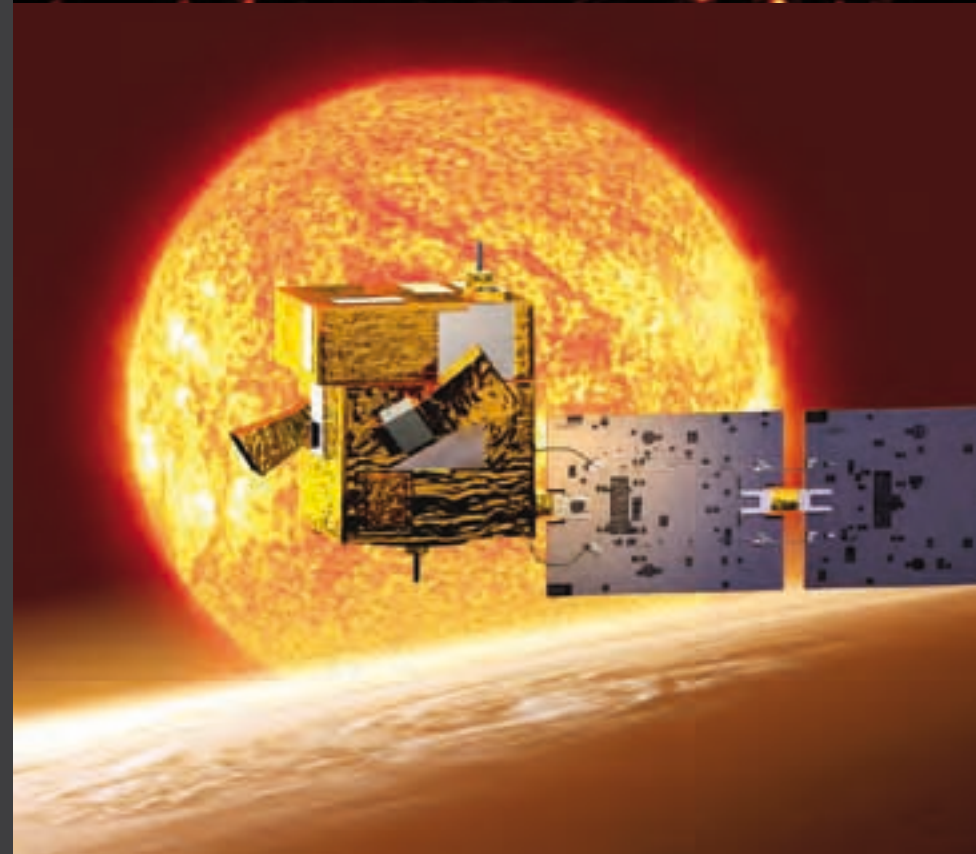
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HERSCHEL CRYOSTAT
VACUUM VESSEL
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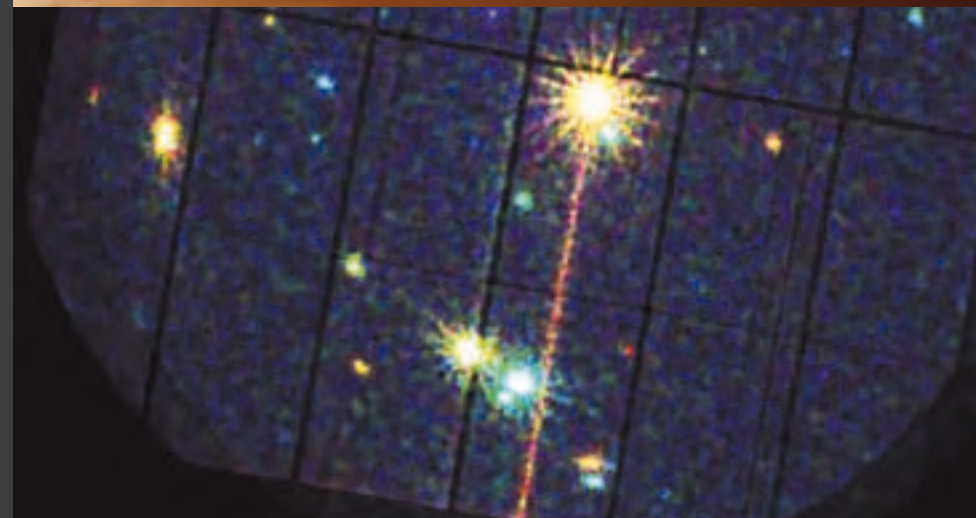
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SWISS ASTRONOMERS
OBSERVED WITH XMM-NEWTON
THE ORION REGION, WHERE
STARS AND PLANETS FORM NOW



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ARTIST VIEW OF THE FRENCH
MICRO SATELLITE MISSION
PICARD DUE FOR LAUNCH
IN THE BEGINNING OF 2009.
PICARD COMPRISES THREE SOLAR
EXPERIMENTS INCLUDING THE
SWISS EXPERIMENT PREMOS,
WHICH MEASURES TOTAL SOLAR
IRRADIANCE AND SPECTRAL
IRRADIANCE IN WAVELENGTH
BRANDS FOR WHICH THE
VARIATIONS OF THE SUN
AFFECT THE COMPOSITION OF
THE TERRESTRIAL ATMOSPHERE
AND INDIRECTLY INFLUENCE
EARTH'S CLIMATE. PREMOS
IS BUILT BY PMOD/WRC IN DAVOS.
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A SWISS LED INTERNATIONAL
TEAM OBSERVED THE NEAREST
STAR FORMING REGION WITH
XMM-NEWTON.
THESE X-RAY OBSERVATIONS
PROBE ENERGETIC PROCESSES
IN YOUNG STARS.

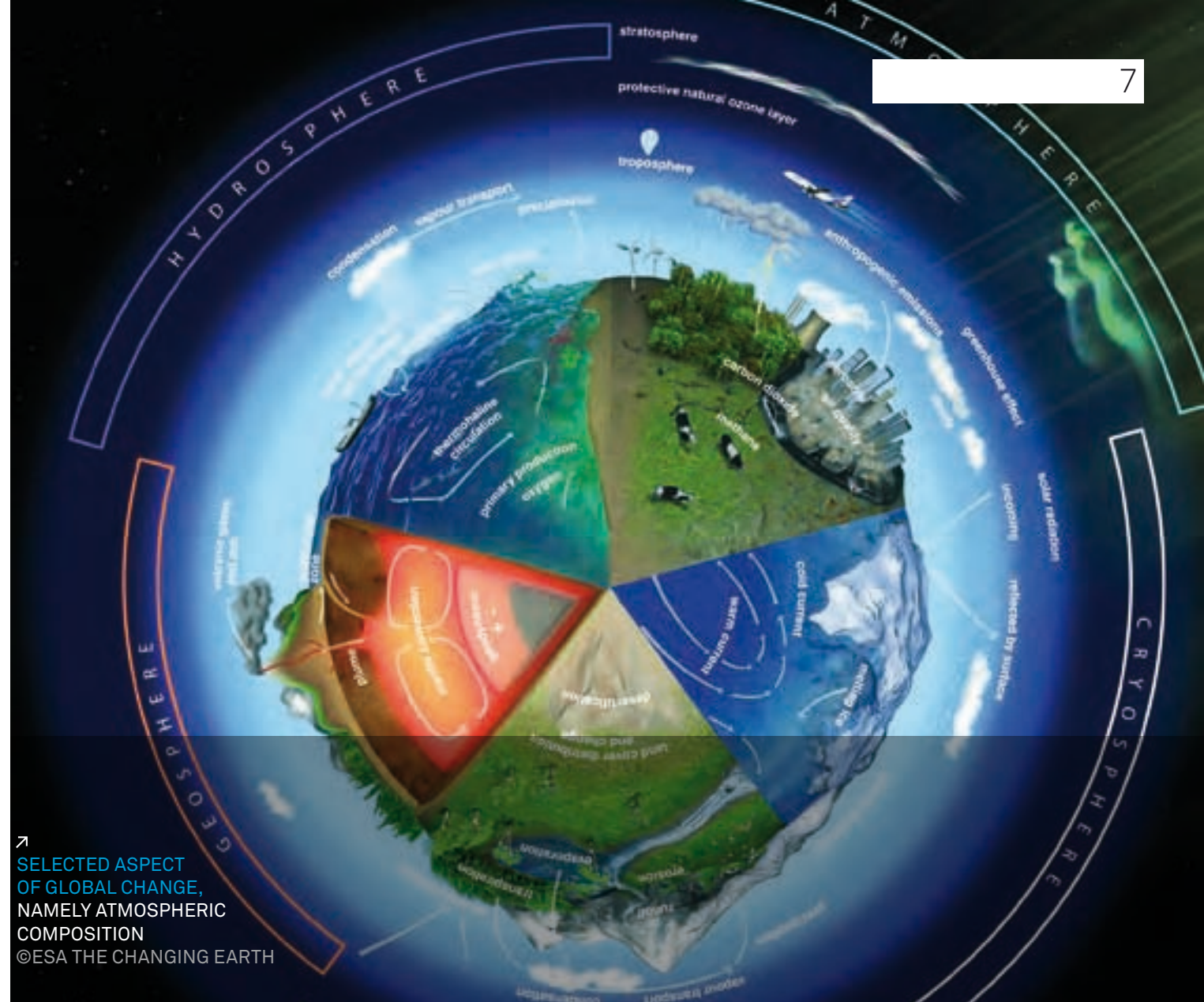




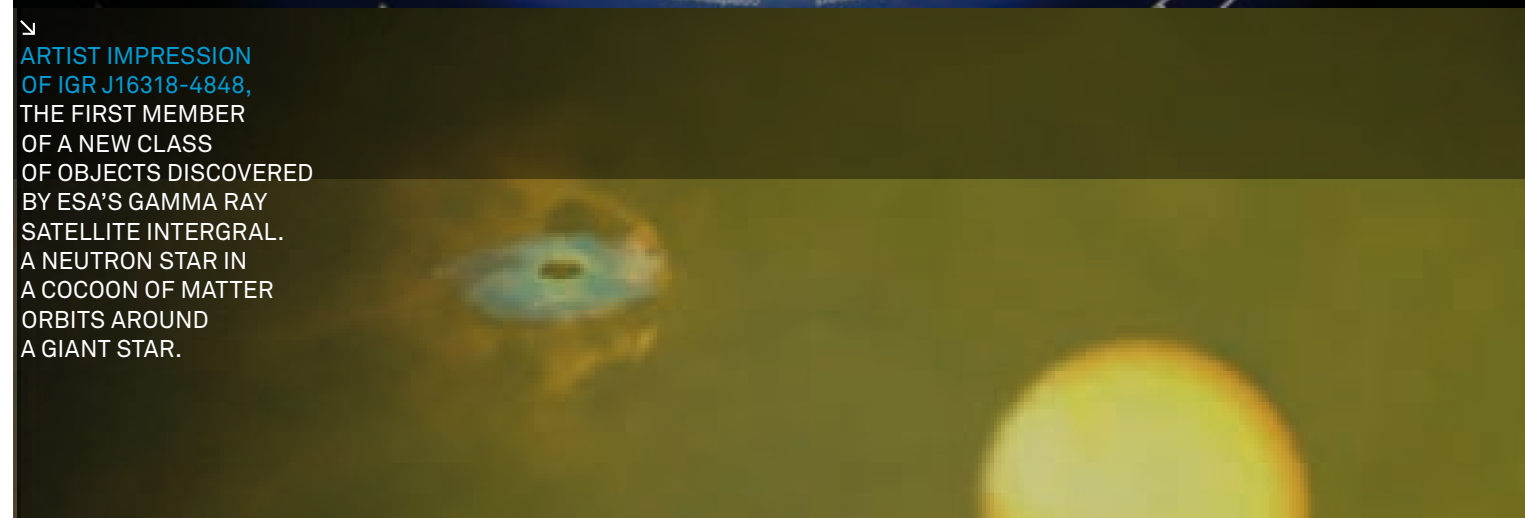
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ARTIST IMPRESSION OF ESA'S
GAMMA RAY ASTRONOMY SATELLITE
ORBITING THE EARTH
© ESA



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ARTIST IMPRESSION
OF A BLACK HOLE ACCRETING
AND SWALLOWING MATTER
FROM A COMPANION STAR.



↗
SELECTED ASPECT
OF GLOBAL CHANGE,
NAMELY ATMOSPHERIC
COMPOSITION
©ESA THE CHANGING EARTH



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ARTIST IMPRESSION
OF IGR J16318-4848,
THE FIRST MEMBER
OF A NEW CLASS
OF OBJECTS DISCOVERED
BY ESA'S GAMMA RAY
SATELLITE INTERGRAL.
A NEUTRON STAR IN
A COCOON OF MATTER
ORBITS AROUND
A GIANT STAR.

CONCLUSION

In 2004-2005 the European space scientists have been extraordinarily successful in fulfilling their mandate to enhance the knowledge available to mankind using space borne tools. This success is based on their efforts associated to those of industry and funding agencies a decade ago. The Swiss space research community is closely and sometimes very visibly associated to this success. ESA is the space agency of Switzerland, so our motto. The Swiss space research community therefore sees not only ESA's resources, but also its national efforts as primarily part of the same goal: improve Europe's position in space research. This we do through a very active participation to ESA related research activities and through national contributions to ESA's missions wherever possible. The financial effort made nationally approximately matches the Swiss contribution to the space science programme.

ESA's funding level inevitably influences the Swiss space research community. The lack of upcoming ESA missions is the source of a major worry in particular in the solar and high energy astrophysics communities, but also in the Swiss space science community as a whole. In the bleak European perspective described above, the Swiss community is active on many fronts. First in the exploitation of the results provided by the missions in orbit, then through contributions to the presently planned missions and finally through common efforts of the scientific community and the government to improve ESA's budgetary situation. Swiss scientists take an active role in ESA programmes' boards and in ESA's advisory structure. They thus participate fully in the shaping of the European future in space.

Clearly the small Swiss country has only a limited influence on the European space effort. Our conviction is nonetheless strong that substantial financial efforts should be made to very significantly increase space research activities both within Switzerland and in Europe at large. This is necessary to master all sides of space technology. Space science is, we assert, the most fruitful way to improve Europe's spatial independence.

The dynamism and strength of the space science community is a strong asset of modern societies. Its members are devoted to the peaceful exploitation of space and to further the well being of our societies through the scientific knowledge they acquire and the technologies they help master in space and on the ground. We trust that this potential will be recognised and that society in Switzerland and in Europe will give the funding needed to make an optimum use of this asset for the greatest benefit of the whole population.

PUBLISHED BY
SWISS SPACE
RESEARCH COMMISSION
SPACERESEARCH.SCNATWEB.CH

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