swiss physical society

SPG MITTEILUNGEN

COMMUNICATIONS DE LA SSP

NR. 26 Februar 2009

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Joint Annual Meeting of the SPS, ÖPG and ÖGAA September 2 - 4, 2009 ; Universität Innsbruck

The SPS will hold its annual meeting 2009 together with the ÖPG and the ÖGAA at the "V.-F.-Hess-Haus" of the university of Innsbruck. We would like to thank Prof. Hans Briegel, head of the Institute for Quantum Optics and Quantum Information, and the local organisation team for their valuable support.

Scientific Program

Plenary Session
All plenary talks will be given in the mornings by the following speakers:

- Olaf Reimer (Stanford / Innsbruck): *The energetic universe seen through the eyes of FGST and HESS*
- Tim De Zeeuw (ESO): *Future perspectives for ground-based telescopes*
- Günther Dissertori (ETH Zürich): *LHC: Entering a new era in particle physics*
- Franz Pfeiffer (TU München): *X-ray phase contrast for better images in medical diagnostics*
- Markus Arndt (Uni Wien): *Coherent manipulation of large clusters and molecules*
- Walter Riess (IBM Rüschlikon): *Materials challenges for future nanoscale electronics*
- Karl Unterrainer (TU Wien): *THz Science: Exploring the secrets of nanostructures*
- Sonia Seneviratne (ETH Zürich): *Climate change - What are the main issues ?*
- Wolfgang Ernst (Uni Graz): *Molecules in cold helium nanodroplets*
- Denis Weaire (Trinity College Dublin): *Reflections on a bubble: Physics, history and art*

Topical Sessions
These parallel sessions will be held in the afternoons:

- Applied Physics
- Astrophysics
- Atomic- and Molecular Physics & Quantum Optics
- Particle- and Nuclear Physics
- Plasma Physics
- Solid State Physics
- Surfaces, Boundary Layers and Thin Films
- History of Physics
- Physics in School (High School Teachers Meeting)

A **public lecture** by Anton Zeilinger (Uni Wien) on Friday evening will close the conference.

Caused by the different organisation structures of ÖPG and SPS, the topical sessions include also contributions from the following fields:

- "Applied Physics": Acoustics, Medical-, Bio- and Environmental Physics.
- "Particle- and Nuclear Physics": Physics at Neutron- and Synchrotron Radiation Sources (NESY).
- "Atomic- and Molecular Physics & Quantum Optics": Quantum electronics, Electrodynamics and Optics.

- The special session "History of Physics" welcomes oral contributions about interesting persons, events or anecdotes out of the large field of physics.

A complete list of the session organizers can be found at *oepg2009.uibk.ac.at* .

Dependent on the number and contents of the contributed papers, each topical session will be split into special thematic subsessions.

Poster Session
The poster session will take place during the three lunchbreaks. On Thursday a lunch-buffet will be offered (included in the conference fee).
The posters will be presented on all three days ! The maximum poster size is A0 (portrait).

Joint Award Ceremony

The award ceremony will be held on September 4, 2009.

SPS Awards: 3 outstanding scientific works will be honoured as every year by the SPS prizes, in the fields of General Physics (sponsored by ABB Research Center), Condensed Matter Physics (sponsored by IBM Zürich Research Laboratory), and Applied Physics (sponsored by OC Oerlikon), each granted with CHF 5000.- .

The ÖPG will award the following 6 prizes: Physik-Preis der ÖPG (Kohlrausch/Boltzmann Preis), Viktor Hess-Preis, AVL-List-Preis für Angewandte Physik, Roman Ulrich Sexl-Preis, Karlheinz Seeger-Preis, AT&S Forschungspreis.

The ÖGAA will award one diploma work and appoint 3 honor members.

General Assembly

The general assemblies of all three societies are scheduled for the morning of September 4, 2009 at the same time, but in separate rooms.

Conference Dinner

The conference dinner will be held on Thursday evening, September 3, 2009, at the "Villa Blanca", Innsbruck. A bus transfer from the conference site to the restaurant and back to the city will be organised. The price is CHF 60.- per person (including meal, drinks and bus transfer). You can choose at registration between three different meals (one is vegetarian).

Vendors Exhibition

In parallel to the conference a vendors exhibition will take place. A separate letter will be mailed to interested companies in the next weeks to invite them to join in the meeting. If your company wants to participate, but did not receive a letter from us by end of March, please send an email to: *sps@unibas.ch*

Abstracts Submission

You can submit abstracts for all topical sessions (see above). Oral and poster contributions are welcome. Because of the limited number of time-slots the session organizers may have to change some oral presentations into posters. If possible, please choose both options in your submission.

The submission of abstracts is done online. Visit our webpage *www.sps.ch* and follow the link to the submission form. Further explanations are available there.

The full conference program will be available on *www.sps.ch* and *oepg2009.uibk.ac.at* in July 2009.

IMPORTANT: The submission deadline for abstracts is May 15, 2009.

Conference Fees, Registration and Payment

The conference fees cover the participation to all sessions, including coffee breaks (three days) and the lunchbuffet on Thursday (no "one-day tickets").
The conference dinner on Thursday evening will be charged separately.

Pay your conference fee in time and save money !

The regular prices, as shown in the table below, are valid for payments reaching us before August 1st, 2009. Please make sure that your name and the purpose of the payment are transmitted.
Payments can be made to the following account:

Swiss Post - Postfinance, Account 80-8738-5, for Swiss Physical Society, 4056 Basel

For payments made later you have to add a surcharge of CHF 15.-. This applies also for participants paying cash at the conference. Credit cards are not accepted.
Attention: Fees are not refundable in case of cancellation.

Category (all prices in CHF):	*Regular*	*After August 1st*
SPS members	90.-	105.-
Ph.D. Students (*)	45.-	60.-
Students BEFORE Master/Diploma degree (*)	0.-	0.-
Invited speakers, awardees, chairpersons	0.-	0.-
Other persons	120.-	135.-
"Not yet" members special offer (see below)	150.-	165.-
Teachers	45.-	60.-
Conference Dinner (**)	60.-	60.-

(*) Students licence required
(**) free for invited speakers, awardees, organizing staff

Registration Deadline: August 1st, 2009

Registration is also done completely online on www.sps.ch. The only exception is the admission form for new members, see below.

Group registrations

If several members (≥ 4) of your group or laboratory want to participate in our meeting, you don't have to fill out the online registration form for every person. Please contact the SPS-Secretariat (*sps@unibas.ch*). We will then send you a special electronic form where you can insert the necessary data.

Special offer for non-members:

Do you plan to participate in our meeting and want also to become a member of the SPS ? You can do so now for a very reduced price of only CHF 150.- (CHF 165.- after August 1st) ! This amount covers the conference fee and your new SPS membership for at least the second half of 2009 (depending on your entry date) and full 2010. Do not miss this offer ! You save at least one year's membership fees.
Just fill out the online-registration form, choose the option "Special offer", then download, print, fill and sign the admission form for new members, and return it as soon as possible by fax or ordinary mail.
(This offer does not apply for students and Ph.D. students. They still profit from the free first-year-membership and have only to pay the conference fee shown above. The membership admission form is available on www.sps.ch/uploads/media/anmeldeformular_d-f-e.pdf .)

Physik Anekdoten (4)

50th anniversary of Wolfgang Pauli's death, 15th December 2008

The father of the exclusion principle, Wolfgang Pauli, died on 15 December 1958 in Zurich. In memory of the 50th anniversary of his death, various events commemorated the famous Austrian physicist. A thorough scientific biography of Pauli was written in 2002 by Charles P. Enz, his last assistant [1].
In today's context, it is noteworthy that many years after receiving the Nobel Prize and being at the top of his fame, Pauli still took over the presidency of the Swiss Physical Society from 1954 to 1956. This at a time where the role of the highly regarded SPS was different from today, less oriented towards public outreach and the support of young school students.

In the present text we collected a few popular anecdotes about Wolfgang Pauli who was also known for his sarcastic humor and his sometimes disrespectful attitude towards his colleagues. A wonderful illustration of it is his famous citation "That's not right. It's not even wrong." [2], which became a common dictum for scientific arguments, which themselves are based on incorrect or at least unverified assumptions.

When searching archives for anecdotes about Pauli, one finds the so-called Pauli effect, a parapsychology phenomenon that was greatly feared among Pauli's colleagues, at least among the experimental physicists. In the presence of Pauli, technical installations or instruments would unexpectedly fail, and experiments turn unsuccessful. Pauli himself was conscious of his peculiar talent

Party to celebrate Pauli's Nobel prize. From left to right : Hu, unknown, Wolfgang Pauli and J. Jauch, Photographer Unknown, November 1945
© CERN Pauli Archive

and was delighted by such comic events. It is said that Pauli's friend Otto Stern never allowed Pauli to visit his laboratory in Hamburg.

In February 1950, when Pauli was at Princeton University, the cyclotron burnt, and he asked himself whether he was responsible for this catastrophe. It seems strange to the most of us that a natural scientist like Wolfgang Pauli actually believed in the existence of the effect named after him. As Pauli considered parapsychology worthy of serious investigation, this would fit with his scientific thinking. "Pauli himself thoroughly believed in his effect" can one read in ref. [1]. This is one reason why Pauli had such an intense correspondence with the Swiss psychologist C. G. Jung. The latter stated later that Pauli made important contributions to his work. In the famous article "Background-Physics", Pauli tried to find similarities between physics and psychology [3].

To skeptical physicists who don't believe in the existence of phenomena like the Pauli effect, or that Pauli himself didn't deny it, a funny story is mentioned to have happened at the University of Göttingen. One day, an expensive apparatus stopped working without any apparent reason and restarted a few hours later to work properly, as if nothing had happened. James Franck, the director of the institute reported the incident to Pauli in Zürich with the humorous remark that at least this time he was innocent. However, it turned out that Pauli was on his way that day from Copenhagen to Zürich, with a short stopover at the Göttingen railway station, waiting for a train connection at about the time of failure.

Tibor Gyalog, SPG-Vizepräsident

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Progress in Physics (11)

Terahertz Polaritonics

Thomas Feurer, Institute for Applied Physics, 3012 Bern

In the recent past the terahertz gap between electronics (up to approximately 100 GHz) and optics (down to approximately 10 THz) has gained intense interest in connection with applications such as high-bandwidth signal processing, THz imaging, THz sensing, or THz spectroscopy. Most of these applications have become possible by the emergence of femtosecond laser-based methods for generation of THz pulses. So far none of these methods has provided an integrated platform for THz waveform generation, guidance, processing, and characterization. In the following we review our efforts to realize such a platform and which have led to THz polaritonics. The signal carriers are phonon-polaritons, coupled admixtures between electromagnetic waves and polar lattice vibrations of comparable frequency and wave vector [1]. In the polaritonics platform, they are generated by femtosecond optical pulses through a second-order nonlinear optical process and they propagate primarily in lateral directions, with the largest wave vector component perpendicular to the optical beam path. This key property, which enables interactions of the THz signals with further optical pulses or with integrated structures, arises because the THz dielectric constant is extremely high. There are three important ingredients of the polaritonics toolkit that distinguish it from more conventional THz methodology. Firstly, spatiotemporal imaging of polariton fields and their evolution, secondly, spatiotemporal coherent control over polariton generation and, thirdly, integrated polaritonic functional elements. Phonon-polaritons induce a change in the index of refraction at an optical probe wavelength, which is proportional to the lattice vibrational displacement and therefore to the THz electric field. The phase shift of a probe pulse, integrated through the crystal thickness, can be measured directly through interferometry. Moreover, with an expanded beam that is passed through the entire sample region of interest and transmitted to a CCD camera the THz field in the entire region can be visualized with unprecedented spatial and temporal precision ($\lambda/100$ and $T/100$). Recording such snapshots at progressively later times allows to assemble a movie of the THz field propagation through the crystal and also through functional elements embedded in the crystal. In the following sections we discuss THz phonon-polariton propagation through advanced polaritonics structures, such as photonic bandgap materials and through so-called meta-materials.

I. 2D Polaritonic Bandgap Structure

As an example, we present results for a two-dimensional photonic bandgap material, i.e. $LiNbO_3$ crystals with an array of air holes that form a two-dimensional lattice of regions of alternating dielectric properties. Much in the same way as a periodic potential in a crystal affects the electron motion, the periodic dielectric properties influence the propagation of electromagnetic waves [2]. Those frequencies which are allowed to propagate are called modes and groups of allowed modes are called bands; regions without bands are called photonic band gaps. Photonic band gaps, in turn, give rise to fascinating optical phenomena, such as defect-assisted wave-guiding, inhibition of spontaneous emission, omnidirectional reflection, or apparent negative refraction to name but a few. Because the basic physical principle is diffraction the periodicity of any photonic structure has to be on the order of the wavelength of the electromagnetic wave. While in the visible region this poses quite a technological challenge, in the THz region, where free space wavelengths are on the order of tens to hundreds of microns, the fabrication of such structures is much more relaxed. Moreover, our imaging technique allows for measuring THz electric fields within and outside of the structure with sub-wavelength resolution.

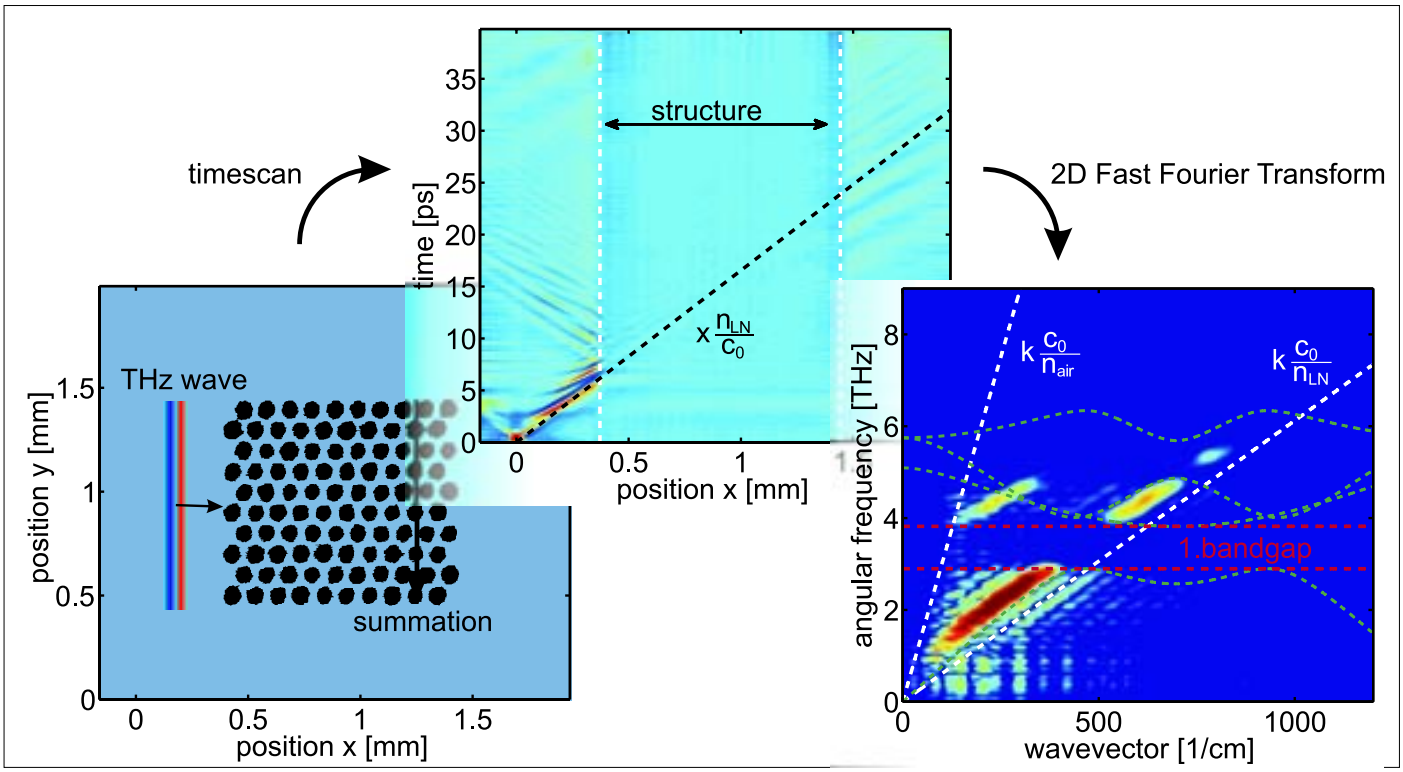

Fig. 1: A plane single-cycle waveform travels from left to right through a hexagonal photonic crystal structure consisting of an array of air hole within a $LiNbO_3$ crystal. Integrating the signal along the y dimension and stacking the resulting one-dimensional plots on top of each other yields an x-t plot with the color being proportional to the electric field strength. A two-dimensional Fourier transform results in a k_x-ω plot, better known as a band diagram.

An example is shown in Fig. 1; a plane single-cycle waveform impinges onto the two- dimensional periodic structure from the left. From a sequence of electric field measurements the band diagram can be extracted. Figure 1 shows the band diagram of the transmitted part of the THz pulse with a few prominent modes in between the two light lines and a very pronounced band gap. The experimental results agree well with the corresponding simulations and show the strength of our imaging method.

II. Meta-Materials

We close this contribution with an illustration of somewhat more complex structures, namely so-called meta-materials [3]. Such materials are composed of resonating sub-wavelength structures and exhibit fascinating electromagnetic properties. As a result, meta-materials facilitate various exciting new applications such as negative index of refraction, perfect lenses, perfect absorbers, or invisibility cloaking. Since the first experiments con-ducted at microwave frequencies rapid progress in fabrication technologies has allowed to build meta-materials for even higher frequencies, ranging from the THz to the mid-infrared and the near-infrared regime. The material properties of such materials result from the resonant electric or magnetic response of their constituting structures when interacting with an incident light wave and the associated formation of localized near-fields. Thus, a key to a basic understanding is an experimental tool to measure such localized near-fields and our method of visualizing electromagnetic fields with λ/100 resolution may proof to be such a tool.

So far, near-fields of individual resonators have mostly been analyzed through numerical simulations. In Fig. 2 we show the result of a double split-ring resonator; such a device exhibits magnetic resonances and may serve as an individual sub-wavelength building block for negative μ meta-materials. When performing such three-dimensional simulations for various frequencies the resonant

behavior of the structure becomes obvious as shown in the lower part of Fig. 2. While the outer ring has a strong resonance at around 0.075 THz, the inner ring has its strongest resonance around 0.16 THz.

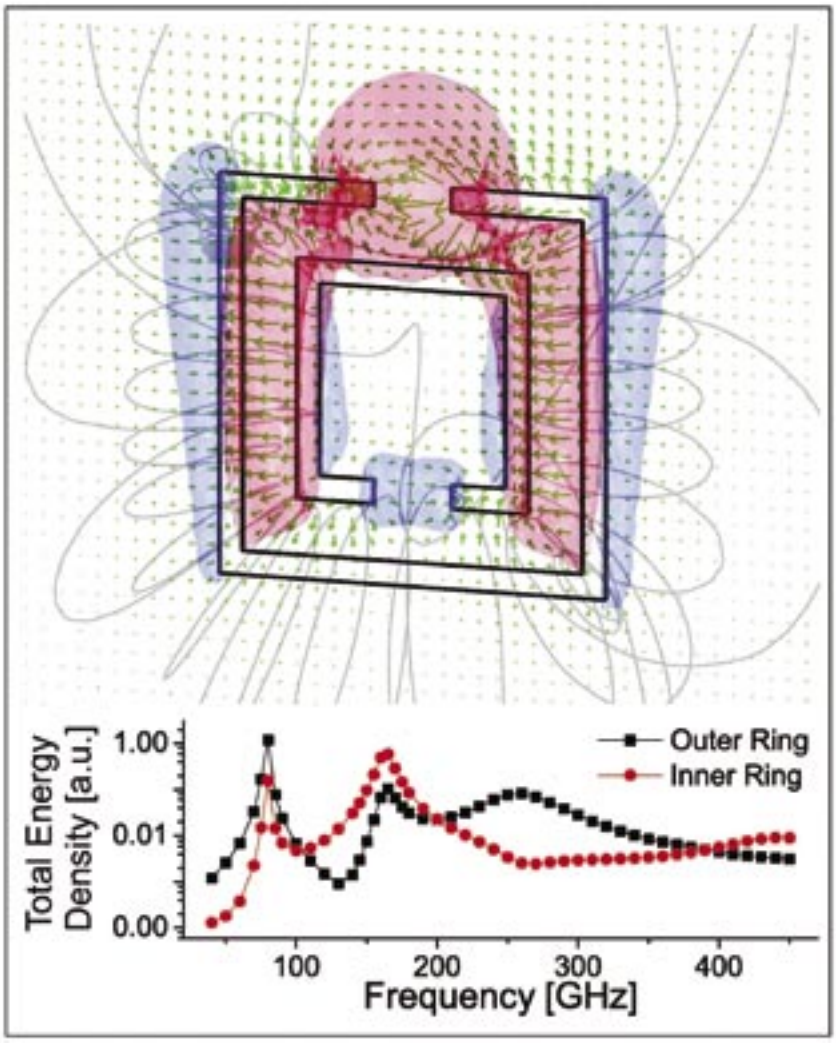

Fig. 2: The green arrows and the colored regions indicate the strength of the electric field at a frequency that is resonant with the outer ring and the solid lines are magnetic field lines created by the currents in the split ring. The resonant behavior is obvious when analyzing the current density in the two rings as a function of frequency.

In conclusion, we demonstrated the possibilities of our THz polaritonics platform to visualize electromagnetic fields within complex structures with sub-wavelength resolution. The method will be useful in analyzing photonic bandgap structures as well as novel meta-materials.

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Progress in Physics (12)

Molecular Junctions based on Aromatic Coupling

S. Wu, M.-T. González, R. Huber, S. Grunder, M. Mayor, Ch. Schönenberger & Michel Calame
University of Basel, Klingelbergstrasse. 82, CH-4056 Basel, E-mail: michel.calame@unibas.ch
Adapted from S. Wu et al., Nature Nanotech. ***3****, 569 (2008).*

If individual molecules are to be used as building blocks for electronic devices, it will be essential to understand charge transport at the level of single molecules. Most existing experiments rely on the synthesis of functional rod-like molecules with chemical linker groups at both ends to provide strong, covalent anchoring to the source and drain contacts. This approach has proved very successful, providing quantitative measures of single-molecule conductance, and demonstrating rectification and switching at the single-molecule level. However, the influence of intermolecular interactions on the formation and operation of molecular junctions has been overlooked. Here we report the use of oligophenylene ethynylene molecules as a model system, and establish that molecular junctions can still form when one of the chemical linker groups is displaced or even fully removed. Our results demonstrate that aromatic $\pi - \pi$ coupling between adjacent molecules is efficient enough to allow for the controlled formation of molecular bridges between nearby electrodes.

To determine the electronic properties of devices based on single molecules [1, 2, 3], a single or a few molecules need to be wired between at least two electrodes, a source and a drain electrode. We use a gold wire with a constriction in its center that is continuously stretched, resulting in a narrowing of its diameter at the constriction (Fig.1a & b). This process is carried on down to the atomic scale and ends with the breaking open of the gold bridge, giving access to two atomic contacts [4]. This technique, termed mechanically controllable break junction (MCBJ), can be used to form molecular junctions in a liquid environment. [5, 6] Traditionally, molecules are synthesized with two terminal anchor groups (typically -SH) at both ends which allow the immobilization of the molecule between the two atomic contacts. The electrical conductance G is measured while opening the junction. When the Au bridge is stretched, G(z) decreases, showing conductance plateaus for G values above the quantum conductance unit $G_0 \equiv 2e^2/h$ (Fig.1c). There is a so-called “last plateau” at $G \approx G_0$. This last plateau corresponds to a single atom Au bridge. If the junction is elongated further, it breaks open. The down-jump in conductance typically stops at a value of $G \approx 10^{-3}\ G_0$, when electron tunneling between the electrodes sets in. Electron tunneling with a constant tunneling barrier height results in a linear dependence of log(G) versus *z* as observed in the measurements. To form molecular junctions, the breaking process is performed in presence of a solution containing molecules bearing two anchor groups. Because a Au-S bond is stronger than a Au-Au bond [7, 8], Au atoms are pulled and migrate to the ends of the Au electrodes forming elongated tips when the electrodes are further separated apart. This process continues until the force which has been built up exceeds the limit given by the Au-Au bond. Then, the molecular junction breaks open. In our study we use conjugated oligo-phenylene ethynylene (OPE) molecules as a model system. Conjugated molecules are interesting candidates for electron transport due to the delocalization of electrons throughout the molecular backbone [9, 10]. Such a structure results in a lower HOMO-LUMO gap ($\sim$ 3 eV) as compared to that of saturated molecules ($\sim$ 7 eV), leading to a higher charge transport efficiency through the molecule. Measuring the electrical conductance G during the breaking process in presence of molecules, we can anticipate that G will stay approximately constant during stretching when a molecular junction forms until the junction breaks open (Fig.1d). A statistical approach is used, in which sequential open-close cycles are performed to repeatedly form molecular junctions. Conductance histograms are then built as shown in Fig. 1c & d and Fig. 2. A peak in the histogram, e.g. at $G \approx 10^{-4}\ G_0$ in Fig. 1d, represents the signature of the molecular junction formation. For molecules with a single anchor group, one would a priori presume that no stable metal-molecule-metal junction can form since the molecules cannot at-

tach on both sides of the junction. The data in Fig. 2 compare conductance histograms obtained for OPE molecules bearing two (top) or only one (bottom) anchor group. While the peak in the top histogram is expected due to the presence of the two anchor groups, that of the second histogram comes more as a surprise. It clearly shows that stable molecular bridges can form, even if a single anchor group is present in the molecule. We think that the connection between the electrodes is made possible by $\pi - \pi$ stacking interaction between a pair of adjacent molecules [11, 12, 13]. If one molecule is anchored via its thiol linker group on e.g. the left electrode, another one bound to the right electrode can complete the mechanical assembly of the junction via $\pi - \pi$ coupling through the phenyl rings. This interpretation is supported by the shift of G_{peak} to lower values by more than one order of magnitude. A reduced average conductance value can indeed be expected because a molecular bridge formed by a stacked pair of molecules will be longer ($\sim$ 29.1 Å) than a single dithiol molecule anchored between Au electrodes ($\sim$20.7 Å). The distance that electrons have to tunnel between the Au electrodes is therefore slightly larger for the stacked bridge. Fromthe study summarized above, we can infer that intermolecular π–π stacking interaction between monothiol molecules composed of alternating phenylene and ethynylene units is strong enough to induce the formation of molecular junctions. This is a significant finding for molecular electronics. Intermolecular aromatic stacking plays a determinant role in stabilizing nanoobjects. The importance of $\pi - \pi$ overlap has long been recognized in thin-film organic electronics, molecular mechanics, and especially in biomolecular and supramolecular chemistry. We show here that $\pi - \pi$ stacking can also be used as the dominant guiding force for the formation of molecular bridges in few molecules electronic junctions. These experimental findings provide a strong ground for the design of future electro-mechanical and sensing devices operating at the single molecule level.

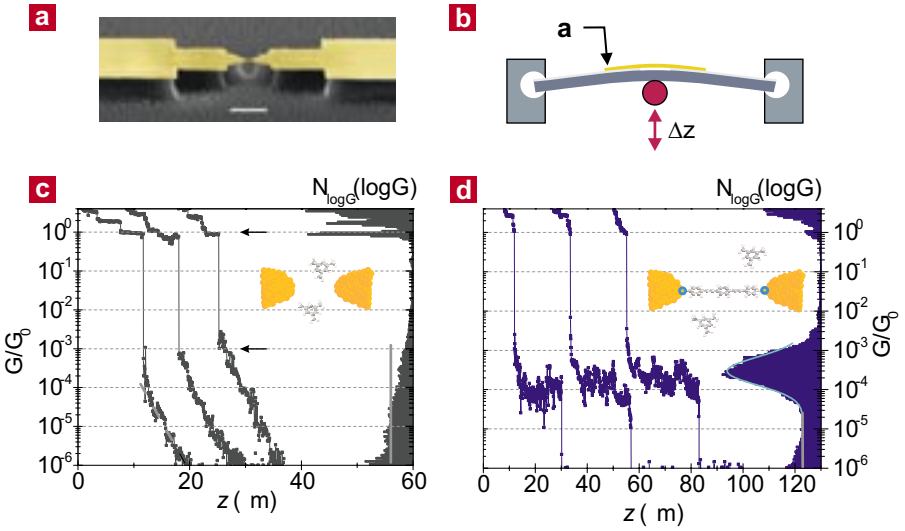

Fig. 1: **a:** *Scanning-electron microscopy (SEM) image of a typical sample used in this mechanically-controlled break junction (MCBJ) apparatus. The top part, colored in yellow, is made from Au. (Scale bar: 1 µm). The Au structure has a constriction at its center and is fabricated by electron-beam lithography on a flexible steel plate that includes an insulating polyimide top layer. After plasma etching, the Au constriction forms a suspended bridge.*
b: *The sample is mounted in a mechanical bending apparatus in which a pushrod is pressing from below against the flexible sample. An upward pushrod movement Δz increases the bending of the substrate. As a consequence, an increasing pulling force is established at the constriction of the Au electrode structure (a). The Au bridge elongates and finally breaks in the narrowest section.*
c, d: *Three typical single G(z) curves measured in pure solvent (c, black) and in the same solvent to which OPE-dithiol molecules were added (d, blue). The curves are shifted horizontally for clarity. The two black arrows indicate respectively the breaking point of the Au junction at $G \approx G_0$ and the onset of the tunneling regime at $G \approx 10^{-3} G_0$. The Figures also show histograms ($N_{log\,G}$(log G)) of log(G) values obtained from 100 opening curves each. In the tunneling regime, the solvent contribution results in a constant number of counts in the histogram (vertical grey lines). In presence of OPE-dithiol molecules a clear peak signature develops from which we deduce the molecular junction conductance (Gaussian fit).*

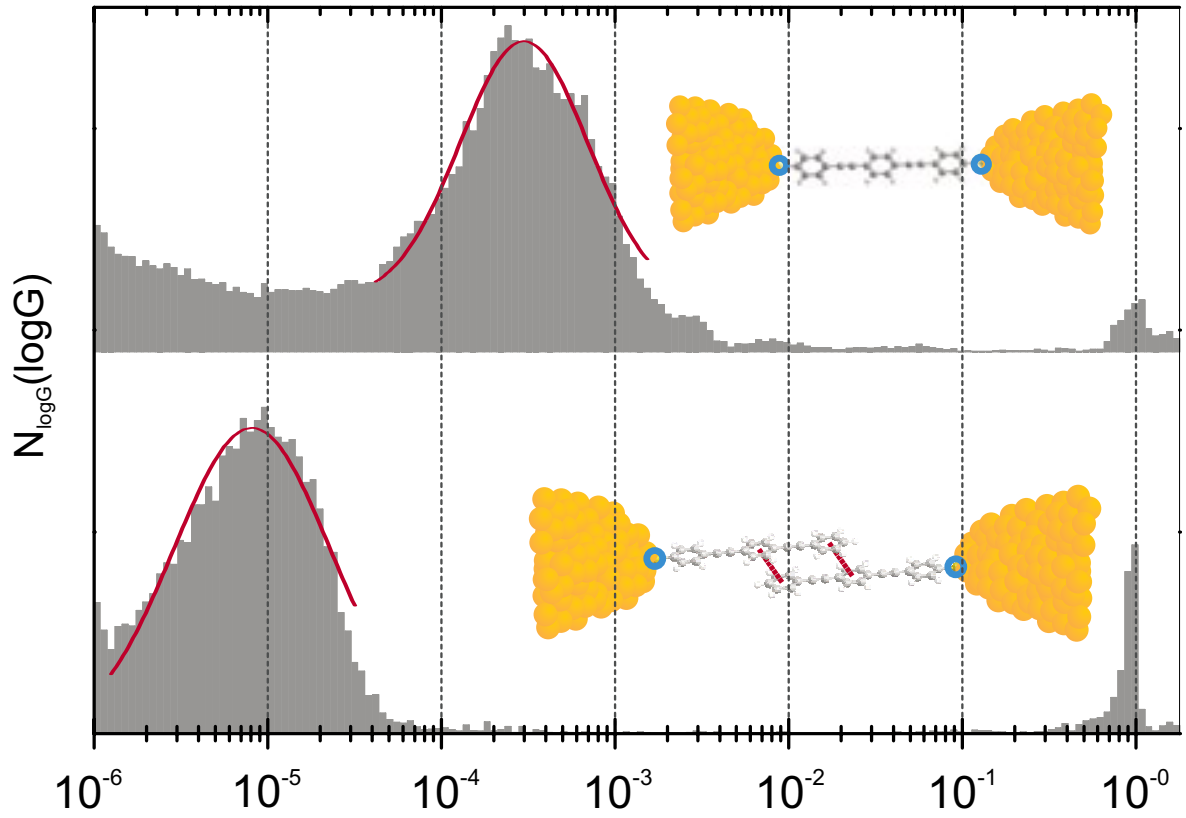

Fig. 2: Comparison of log(G)-histograms for OPE molecules with two linking terminals top, and with only one thiol linker bottom. Each histogram was built from 100 conductance traces obtained during successive opening cycles, similar to the example shown in Figure 1d. The pronounced Gaussian-like peaks (solid lines) in the log(G) histograms represent the signatures of the specific molecule investigated. The molecular junction conductance is deduced from the peak conductance G_{peak}. The corresponding schematic representations show the junction formation mechanisms. For the OPE molecule bearing a single anchor group, a staggered $\pi - \pi$ stacking configuration between neighboring OPE molecules is proposed. The bridging process is made possible in this case via the intermolecular interactions.

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The Herschel Space Observatory

The ESA Space Observatory **Herschel** will be launched from the Guiana Space Centre, Kourou, French Guiana, at *April 16th, 2009* by an Ariane-5 ECA, together with ESA's **Planck** spacecraft, a mission to study the cosmic microwave background radiation.
Both spacecrafts will separate after launch and will be directly injected into a Lissajous orbit around L2, the second Lagrange point of the Sun-Earth system, at a distance of around 1.5 million km from Earth. L2 is chosen since the Sun, Earth and Moon are intense sources of both straylight and thermal radiation, and at this location these sources are all easily shielded from the payload.

Mission

Herschel represents a landmark mission in many regards. It is the only space facility to cover the far infrared to sub-millimetre parts of the spectrum (from 60 to 670 μm), which cannot be observed well from the ground. Many interesting *astronomical phenomena* become observably within this spectral range like dust obscured and cold objects, but also the forming of galaxies in the early universe and their evolution. Furthermore, the *prime mirror* of the Herschel telescope with 3.5 m in diameter is the largest mirror ever built for a space telescope and finally, three extraordinary *spectrometric instruments* comprise the Herschel science payload, provided from scientific institutes in ESA member states, Canada and the USA.
Herschel has a nominal routine operational lifetime of three years, with a possible extension of one year. About 7000 hours of science time will be available per year. Herschel is a multi-user observatory accessible to astronomers from all over the world.
We describe in the following some scientific and technical aspects.

A) Astronomy

Aurora Sicilia-Aguilar, Max-Planck-Institute for Astronomy Heidelberg, Germany

Among many others, one important field of study for Herschel will be the *formation of stars and planetary systems*. Herschel will trace not only the disks where planetesimals are forming, but also reveal the initial conditions in a collapsing molecular cloud that will produce a cluster of stars with their protoplanetary disks.

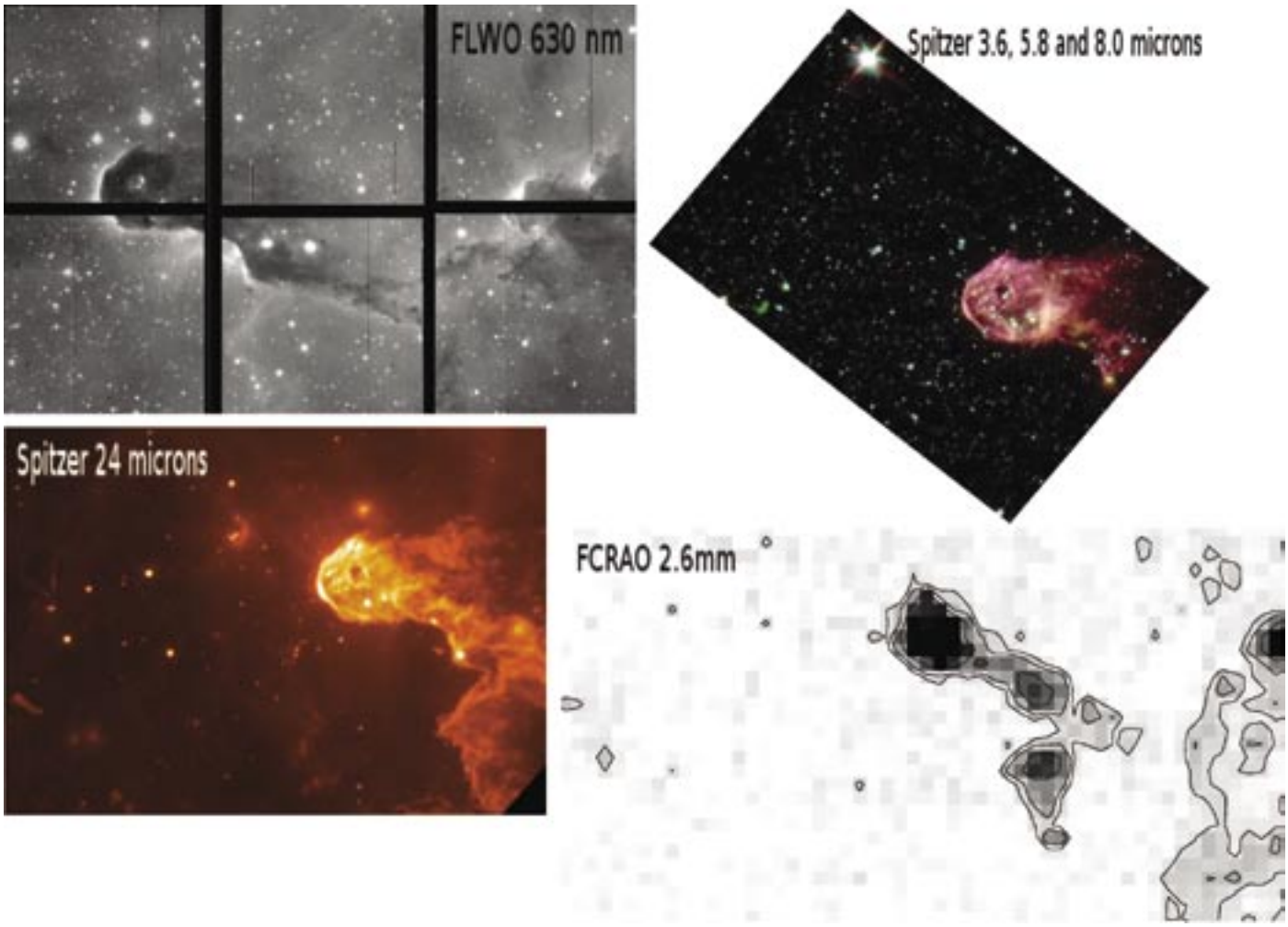


Fig. 1: A multiwavelength journey through the star-forming cluster Tr 37, located at 900 parsecs distance. Optical data show the young (4 Myr old) stars. The obscuring interstellar cloud becomes transparent in the near-IR, revealing multitude of recently formed stars, but emits strongly at mid-IR wavelengths. The innermost disks (0.1-20 AU) around the stars detected in optical appear bright at IR wavelengths (SA et al. 2006, Astrophys. J. ***638****, 897). Finally, millimetre observations trace the colder dust and gas and the global dynamics (Patel et al., 1998, Astrophys. J.* ***507****, 241).*

The Complexity of Proto-Planetary Systems

The formation of planetesimals and planets takes place inside protoplanetary disks, composed of gas and dust, which are usually too far to be imaged in detail or even resolved. Multi-wavelength observations, covering the range from ultraviolet to millimetre wavelengths, help to construct a picture of the whole system since the wavelength at which the emission peaks depends on the temperature (Fig. 1). Optical images trace the young star (with a temperature around 4000-6000 K) providing its luminosity, age, and radius. Near-IR observations show the innermost, warm (T~1000 K) part of the disk. Mid-IR data reveal the colder (~300 K) planet-forming regions. Finally, millimetre data trace the bulk of the cold (~20 K) disk material, which comprises most of the mass available for planet formation. Planet formation is thought to open inner holes and gaps in the disks, which can be observed as a lack of near-IR emission from the disk.

The Origin of Planetary Systems

The NASA Spitzer Space Telescope showed in singular detail the structure of the innermost disk. While most of the mass in the disk, optically thick, produces a continuum emission (similar to a collection of black bodies integrated over the range of disk temperatures), the material in the optically thin upper layers of the disk (disk atmosphere), overheated by the external radiation, shows an emission spectrum with the lines of some gaseous components and the solid state features of small (micron-sized) silicate particles. The analysis of the dust emission reveals grains with different silicate composition (olivine, forsterite, enstatite, silica), variable sizes, and in crystalline or amorphous state, which indicates strong dust processing and grain growth in protoplanetary disks. Spitzer, together with ground-based facilities operating in the millimetre range, confirmed that a large fraction of the dust accumulates into large grains, which remain “hidden” from the view of current instrumentation. Moreover, the disk structure varies from the inner to the outer parts, and may determine the type of planetary system that can arise from the disk.

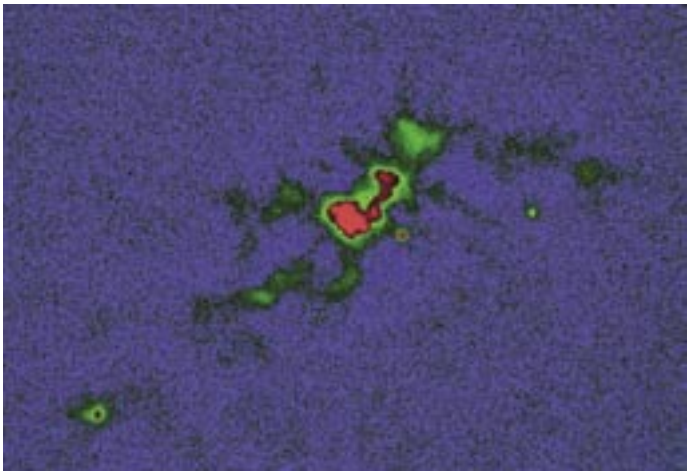


Fig. 2: Map of the CrA star forming region at 870 μm, using the APEX (Atacama Pathfinder Experiment) antenna, precursor of the ALMA interferometer in Chile. Protostellar condensations, as well as colder disks, appear bright at these wavelengths. Herschel will offer a slightly higher spatial resolution than APEX, and operates at a different wavelength range, being more sensitive to protostellar condensations.

Herschel: Probing Colder Regions, Larger Grains, and Disk Chemistry

The instruments available so far have shown the importance of studying the larger dust grains as well as colder disk regions. Observations in the 100-600 μm range are crucial to obtain the size distribution of dust grains in disks, which is necessary to estimate the total dust mass available to form planets. It is also required to determine the structure of the planet forming region in solar-like planetary systems during and after planet formation. Colder systems, similar to our Kuiper Belt, will be also traced by observations in this wavelength range. Herschel fills in the gap between near- and mid-IR instruments like Spitzer, and millimetre and submillimetre wavelength detectors like APEX, the precursor of ALMA (Fig. 2). It will also allow to study the disk mineralogy of non-silicate components, as well as the chemistry in the planet-forming regions, in particular, the water-related chemistry. In addition, Herschel will probe the early stages of star formation, which occur in heavily obscured molecular clouds and condensations, opaque at IR wavelengths. Most of the energy of a collapsing protostar is emitted at Herschel wavelengths, and Herschel is powerful enough to detect the initial phases of formation of objects down to brown dwarf masses, as well as details of the inner structure of protostellar condensations. These initial stages of star formation determine the initial disk characteristics and probably the fate of the planet-forming disk and the kind of system (multiple star, different types of planetary systems) that will be formed.

(See also http://www-optics.unine.ch/events/engelberg2007/ -> "Stars, Disks and Newborn Planets: Imaging Proto-Solar Systems".)

B) Technology

Bernhard Braunecker, SPS-Secretary

The Spacecraft

The Herschel spacecraft is approximately 7.5 m high and 4 x 4 m in overall cross section, with a launch mass of around 3.3 tonnes. The spacecraft comprises three sections, the *telescope*, protected by a sunshade, the *scientific instruments* in the focal plane of the telescope and third, the *service modules* with the electronics for the instruments and the satellite.

Fig. 3: The Herschel telescope during an earlier test phase. A Leica laser tracker is seen (left) to measure the distance between both mirrors with interferometric precision.
Photo: EADS/ M. Dumas

Telescope

The Herschel telescope is a Cassegrain design, i.e. a concave parabolic prime and a convex hyperbolic secondary mirror, the latter acting as entrance pupil (Fig. 3). The overall focal length is 28.5 m with f-Number 8.7. The diameter of the secondary is kept rather small with 34 cm, not to obscure too much the collecting area of the prime. The distance between both mirrors was specified to only about 1.6 m to achieve a compact packaging size of the telescope.

Both requirements, however, lead to an extremely 'fast' prime mirror with f-Number 0.5 at a diameter of 3.5 m! Consequently, the optical performance of the telescope is enormously sensitive to any mechanical deformations of the mirror surfaces or to changes of the spacer lengths. Since the telescope will be operated at 70 K, and since no active refocusing is foreseen, its construction must be *athermal*. Thus EADS Astrium in Toulouse, who fabricated the unit, used sintered SiC-100, a silicon carbide technology, for both mirror structures and the spacers, together with a special cryogenic Invar M93 for the spacer fittings inside the optical cavity.

But cryogenic tests performed at the Focal 6.5 facility in Centre Spatial de Liège, at the University of Liège, Belgium emphasized that large and 'fast' telescopes always surprise with unexpected problems. Some serious discrepancy was found during testing between the prediction and measurement of the telescope back focal length at its cryogenic operating temperature of 70 K.

A team of engineers and scientists including the author were collocated at ESTEC / NL, the technology centre of ESA, to review and independently rework the test results in the context of the mission requirements and predictions for the behaviour of the telescope in its operational environment. An insufficient CTE measurement accuracy was identified as the root cause of the unexpected discrepancy (see http://www-optics.unine.ch/events/engelberg2007/ -> "Technology Review of Large Space Telescopes").

Instruments

Herschel carries three scientific instruments:

• HIFI (Heterodyne Instrument for the Far Infrared), a very high resolution heterodyne spectrometer to cover two bands, 480–1250 GHz and 1410–1910 GHz, using superconducting mixers as detectors (see http://www-optics.unine.ch/events/engelberg2007/ -> "Terahertz Astronomy on the Herschel Space Observatory").

• PACS (Photoconductor Array, Camera and Spectrometer), an imaging photometer and medium resolution grating spectrometer, operating simultaneously in two wavelength bands, 60–130 µm and 130–210 µm, with bolometer and photoconductor array detectors.

• SPIRE (Spectral and Photometric Imaging REceiver), an imaging photometer and an imaging Fourier transform spectrometer, providing broadband photometry simultaneously in three bands centred on 250, 350 and 500 µm.

All three Herschel instruments will be cooled by the cryostat filled at launch with more than 2000 litres of superfluid helium, kept colder than –271 °C. Further cooling down to 0.3 K is required for the SPIRE and PACS 'bolometer' detectors. When the helium has been evaporated, Herschel will no longer be able to perform observations. Enough data will hopefully have been collected to satisfy astronomers' needs for the next decade.

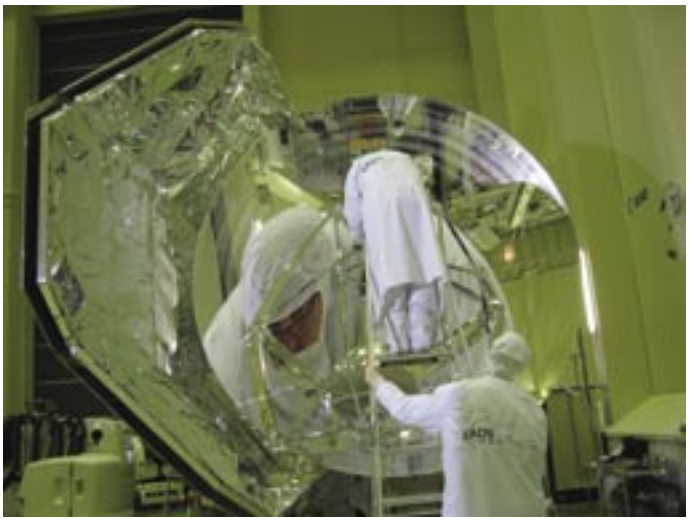


Fig. 4: Final alignment check and inspection activities by EADS at ESTEC (January 27, 2009). Photo: ESA / D. Doyle.

Assembly and final System Checks

The completely assembled and filled up spacecraft had to prove its rigidity against space environmental loads (launch vibrations, separation shock, zero gravity operation, thermal gradients) in a final test run at ESTEC. After finishing the tests the optically critical distance between both mirrors had changed by only 3 µm, indicating what masterpiece of engineering had been created. Fig. 4 shows last system alignments by EADS at ESTEC, and Fig. 5, how Herschel looks before its transfer to Kourou.

ESA Links

http://herschel.esac.esa.int/
http://sci.esa.int/herschel/
http://www.esa.int/science/herschel

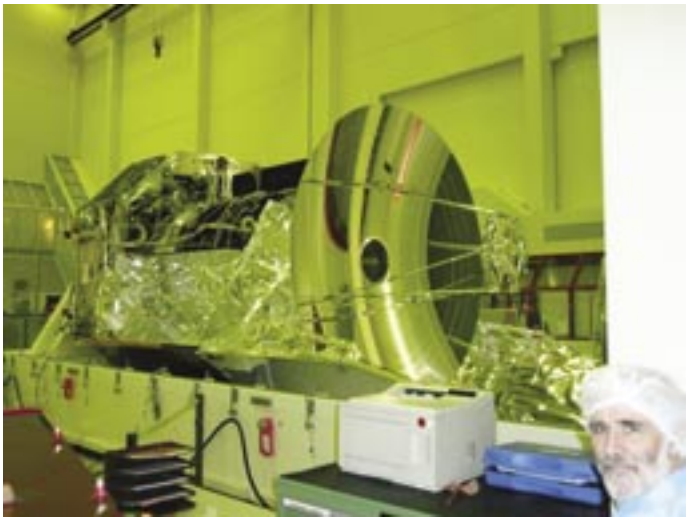


Fig. 5: The spacecraft before its transfer: In the foreground an obviously relaxed looking Dominic Doyle after the successful final testings (February 2, 2009). Photo: B. Braunecker

Physik, Gesellschaft und Nachwuchsförderung

Die unbefriedigend geringe Anzahl an Physikstudenten im ersten Semester hat vielerlei Ursachen, u.a. dass der an Gymnasien behandelte Physikstoff oft nicht über das Jahr 1890 hinausreicht. Die moderne Quantenphysik wird, wenn überhaupt, dann als sehr schwierig, ungenau und auch als immer noch nicht verstanden beschrieben. Das schmälert verständlicherweise die Physikbegeisterung der jungen Leute. Diese zeitliche Zäsur hat die Physik mit dem Geschichtsunterricht gemeinsam, der oft auch nur bis zum 1. Weltkrieg kommt und Themen der neueren Zeitgeschichte ignoriert. Diese Duplizität bewog uns, den Philosophen und Publizisten Ludwig Hasler, bekannt von seinen Tätigkeiten in renommierten Blättern wie dem «St. Galler Tagblatt» oder der «Weltwoche», um seine Sicht der Dinge zu bitten. Er stellte uns freundlicherweise den Text einer Rede zur Verfügung, die er am 16. Januar 2008 im Kursaal Bern vor Mathematikern gehalten hat, und deren Aussagen auch auf die Wechselwirkung Physik und Gesellschaft anwendbar sind. Viel Spass!

Die bereits während der Schulzeit vorzunehmende Hinführung junger Leute an wissenschaftliche Fragestellungen kann über verschiedene Ansätze erfolgen: Während in der Schweiz z.B. an den von SATW veranstalteten ‚Tec-Days' *(http://www.satw.ch/veranstaltungen/)* jeweils für einen Tag typischerweise 1000 Schüler eines Gymnasiums mit etwa 60 berufserfahrenen Referenten zusammenkommen, schlägt die deutsche Fraunhofer-Gesellschaft einen ‚reziproken' Ansatz vor, nämlich den der Förderung von circa 60 Schülern durch nicht gerade 1000 Lehrer, aber immerhin über 19 Tage. Beiden erfolgreichen Modellen, so konträr sie in der Anlage sind, ist gemeinsam, dass durch Information aus erster Hand Begeisterung erweckt und damit das Selbstvertrauen so weit gestärkt werden soll, dass man sich den Anforderungen eines wissenschaftlich-technischen Studiums zu stellen getraut. Da die Schweiz sich mittlerweile an der internationalen Fraunhoferaktion aktiv beteiligt, baten wir die Leiterin der Akademie, Frau Dr. Birgit Geiselbrechtinger, um einen kurzen Bericht.

Bernhard Braunecker, SPG Sekretär

Mehr Einsteins !

„Die Dummheit und das Universum sind unendlich. Beim zweiten bin ich nicht ganz sicher." Sagte Albert Einstein, 1908. Wie sieht das heute aus, 100 Jahre später? Das Universum bleibt nebulös. Und die Dummheit? Mal sehen.

Die deutsche Regierung erklärt das Jahr 2008 zum „Jahr der Mathematik". Weil die Zahl 2008 die hübsche Quersumme 10 hat? Weil sie aufs Schönste die 2 mit ihrer dritten Potenz 8 verbindet? Nein, die in Berlin haben kapiert: In allem, was unsere Welt bestimmt, ist Mathematik drin. Verkehr, Hedge Funds, Energie, Demoskopie, V2-Raketen, ICT-Zauber. Was die Welt im Innersten zusammen hält, ist Mathematik. Und bleibt schleierhaft für 99 von 100 Zeitgenossen. Die brüsten sich noch damit, in Mathe durchgefallen zu sein; tönt irgendwie nach edlerem Menschen. Kann das gut gehen? Nein, sagten die in Berlin. Das „Jahr der Mathematik" bringt die Zahlenakrobatik auf den Markt, kratzt am Image der Unzugänglichkeit, animiert Schüler fürs Fach. Fast täglich ist Mathematik in den Medien, mit witzigen Gedankenspielen, Hauben, Schleifen, Garben.

Sehen Sie, man kann sich etwas einfallen lassen – statt den Refrain herunter zu jammern: Ingenieurmangel, Informatikerknappheit, Naturwissenschafts-Ignoranz, Mathematikflucht in Gymnasien... Stimmt zwar alles. Schlimm daran ist: In der mathematisch geprägten Welt werden wir so zu Weltfremdlingen. Doch was tun wir dagegen?

Was fiel unserem frischen Bundespräsidenten, nebenher oberster Chef der ETH, fürs Jahr 2008 ein? Weniger Raucher! Ein Drittel weniger. Meinetwegen. Aber ist das der wahre Aufbruch? Lungenkur als staatliches Jahresziel. Bringt das das Land voran? Selbstschonung statt Selbstforderung. Doof dürfen Schweizer sein, rauchen keinesfalls. Rauchen ist auch doof, nur, die Genietypen, die uns voranbringen, hatten anderes im Sinn als die Sorge ums Cholesterin. Einstein rauchte, Sigmund Freud, Thomas Mann, Picasso sowieso, Churchill erst recht. Überdies tranken sie ein Vielfaches dessen, was das Bundesamt für Gesundheit für zulässig hält. Genies kriegt man nicht durch staatlich verordnete Schonung. Genies sind unersättlich, rücksichtslos gegen sich, leidenschaftlich im Wissenwollen, besessen vom Willen zum Aussergewöhnlichen.

Mischt sich der Staat schon in unser Privatleben ein, dann pusche er doch die Leidenschaft, statt Askese zu predigen. Und sei es nur mit einem „Jahr der Mathematik". Das wirkt. Gleich zu Neujahr brachten deutsche Medien den Paradefall, mit dem ich selber gern hausiere: Carl Friedrich Gauss. Der bekam 1785, eben achtjährig, in der Schule die stumpfsinnige Aufgabe, alle Zahlen von 1 bis 100 zu addieren. Er überlegte kurz, schrieb eine Zahl auf die Schiefertafel.

Alle andern rechneten, und verrechneten sich. Sie kennen seine Überlegung: 100 plus 1 ergibt 101, 99 plus 2 ergibt 101, 98 plus 3 ergibt 101. Immer 101. Das kann man 50 mal machen. Also 50 mal 101. Macht 5050. Voilà.

Denken statt Zählen. Die Geburt des Mathematikers aus Abneigung gegen die Schafsgeduld beim Rechnen. So ein Fall wirkt, öffentlich gestreut, wie eine Einstiegsdroge. Mathematik: komplexe Probleme geistreich vereinfachen. Akkurat, was junge vife Köpfe brauchen. Nicht zum Auswendiglernen ist ihr Hirn gemacht, sondern zum Problemlösen. Dann fliessen die Glückshormone.

Der alte Gauss rauchte übrigens Pfeife. Wäre er ohne genialer gewesen? Das nervt mich an Couchepins Nichtraucher-Jahres-Vorsatz: dass die Frage tabu ist, wozu denn Gesundheit gut sei. Hauptsache, der Bürger verschont sich von allen Übeln, lebt sorgsam, clean und lange, und stirbt, so um 100, kerngesund. Ja, Herrgott, wo leben wir denn? Auf der Insel der Seligen, wo es nur um Wellness geht, wo wir – therapeutisch umhätschelt – unsere Seele baumeln lassen? Sieht der Bundesrat auch, was gesellschaftlich nötig ist, z.B. mathematisch-naturwissenschaftlicher Nachwuchs? Oder sorgt er sich nur noch – via Tabaksteuer – priesterlich um unser mickriges Wohlbefinden?

Wo es doch in der Welt verdammt viel zu tun gibt. Zu vieles läuft schief, man könnte den Schöpfer glatt für einen Dilettanten halten. Was zum Beispiel hat er sich dabei gedacht, als er das Erdöl verteilte? Statt es dort zu vergraben, wo jetzt die meisten Autos fahren, lagerte er es, wo Kamele durch ziehen. Weshalb wir bald ein happiges Energieproblem haben – aber keine Techniker, die es lösen könnten. Die fehlen auch anderswo. Sonst käme keiner darauf, den Autoverkehr in Zürich mit mittelalterlichen Schlagbäumen zu lenken – statt mit genialer Logistik. Sonst fielen UBS-Banker nicht auf Computersimulationen herein, die vom verarmenden US-Hausbesitzer noch keine Ahnung hatten.

Die Gretchenfrage lautet: Welchen Menschtyp brauchen wir in den Turbulenzen der Zeit? Den Problemknacker, der uns alle voran bringt? Oder den Spiessbürger, der sich ängstlich um sich kümmert und sicherheitshalber nie eine Frau anlacht, von wegen „sexueller Belästigung“? Den Homo faber technicus oder den Homo Biedermeier Narzissus? Eine rhetorische Frage. Ich will sie trotzdem kurz diskutieren. In bildungspolitischer Absicht.

Im Bildungsland Schweiz grassiert der Sprachenfimmel. Frühenglisch, Mittelfrühfranzösisch. Nichts dagegen. Aber müssen Zehnjährige das Nichts, das sie zu sagen haben, unbedingt in drei Sprachen ausdrücken können? Die Heilserwartungen ans Frühenglisch sind grotesk. Auch auf Englisch muss ich erst inhaltlich etwas zu bieten haben, bevor das Sprachenswitching Sinn macht. Die Fixierung auf Sprachen macht Mathematik zur Bildungslücke – und uns sprachlos in der Grundsprache unserer technisch-wissenschaftlichen Welt.

Und die Mittelschule? Blättern Sie mal im Jahresbericht eines Gymnasiums. Wie ein Prospekt aus dem Selbstfindungs-Camp: Tanzen, Gospel singen, Theater spielen, Sporttage, Schriftsteller zu Besuch, Schwerpunktfach Chinesisch... Alles okay. Wo aber bleiben Mathe, Physik, Chemie? Versteckt, hinten im Lektionenkatalog. Sind irgendwie nicht sexy. Gymnasien favorisieren ästhetische Bildung. Weil mehr Frauen als Männer am Gymi sind? Unsinn. Frauen sind intelligenter. Sie können nicht einmal viel dafür. Es liegt am Chromosomensatz. Das männliche Y-Chromosom, auffällig einfältig, schaltet auf stur, sobald die Lage brenzlig wird, weshalb nur Männer an Blitzschlag sterben, weil sie in Gewittern unbeirrt weiter Golf spielen. Frauen switchen besser, vernetzen virtuoser. Leider betrachten sie Mathematik als Männersache, neigen zu Literatur, Psychologie, Kunst. Weshalb das Gymnasium zu einer Art Vorkurs für Phil-1-Anwärterinnen gerät. Dann gute Nacht, Mathematik.

Weiter zur Hochschule. Die mathematische Sprachlosigkeit spült massenhaft Studenten in Geistes- und Sozialwissenschaften. Nicht weil die über Nacht vom Geist ergriffen wären. Germanistik- und Publizistikseminare laufen nicht über, weil es immer mehr begeisterte Leser gibt; mathematischen Stümpern bleibt wenig anderes übrig. So haben wir dann zwei Miseren: In naturwissenschaftlich-technischen Abteilungen sind zu wenig Studenten, in Geistesdisziplinen zu viele falsche; die wenden sich gerne Gender studies zu, was erneut falliert, weil sie die Statistiken nicht ordentlich lesen können.

Warum diese Flucht vor Mathematik? Weil schöngeistige Dinge höher rangieren? Schön ist Mathematik auch – bloss nicht auf Anhieb. In Psychologie läuft der Einstieg glatt, weil jeder so seine Komplexe hat. In Literatur ebenso, dank Googles Inhaltsangabe zu „Emilia Galotti“. Mathematik aber führt in eine Welt, in der man scheitern kann, und es auch gesagt bekommt. Sie setzt Selbsttätigkeit im Abstrakten voraus – nach strengen Regeln. Hartnäckigkeit ist gefragt. Qualität kommt von Qual. Das passt nicht ins akute Lebensgefühl, da muss Satisfaktion subito sein. Mathematik zögert sie hinaus, ähnlich wie das Musizieren. Weshalb die meisten auch beim Notenlesen passen – und Musik nur konsumieren. Immerhin ist klar, dass andere die Musik machen müssen. Mathematik, die Partitur des modernen Lebens, bleibt unhörbar, wo sie konsumiert wird: in Geräten, Brücken, Medikamenten. Geht aber auch nur, falls andere rechnen. Volkswirtschaftlich heisst das: Wir kaufen sie bei den Asiaten.

Fragt sich, wie lange das gut geht. Wir führen uns auf wie Pensionäre der Weltgeschichte. Nutzen Technik, ohne sie zu kapieren. Kümmern uns um unser individuelles Glück oder Pech. Auf einen Mathematiker/Informatiker kommen zwei Dutzend Therapeuten. Vom Homo Faber rutschen wir zum Homo therapeuticus. Dieses ewige Sich-um-sich-selber-sorgen ist eigentlich ein pubertäres Pensum. 15-Jährige müssen sich um sich kümmern, sich kennen lernen, sich erleben. Heutzutage nimmt das kein Ende mehr. 49-Jährige ersetzen vielleicht Kiffen durch Rasenmähen, Sex durch Weindegustieren, Pop durch Bergwandern. Doch noch wenn sie oben auf dem Gipfel sind, wollen sie nicht das grandiose Panorama sehen, sondern sich grossartig fühlen.

In diesen Lebensentwurf passt Mathematik nicht. Sie bringt zuviel Widerstand. Dabei lohnt sich doch nur, was mir zunächst widersteht. In der Erotik sowieso, im prosaischen Leben ebenso. Immanuel Kant: „Die Taube in ihrem Fluge kommt leicht auf den Gedanken, ohne Luftwiderstand flöge sie noch viel leichter.“ Sind wir bald so blöd wie diese Taube?

Will sagen: Der Mangel an Informatikern/Mathematikern ist kein Zufall. Er kommt von unserer widerstandsflüchtigen Wohlfühl-Lebensweise: von der spiesserhaften Selbstverschonungs-Maxime, die landauf landab propagiert wird.

Was Sie tun könnten? Ganz einfach: „Science Lab“ sponsern. Noch besser: das „Haus der kleinen Forscher“, Kindergärten, die den Kleinen naturkundliche Neugier wecken: Warum ist der Himmel blau? Was qualmt denn da? Was ist Relativität? Einstein: „Wenn man zwei Stunden mit einem netten Mädchen zusammensitzt, meint man, es wäre eine Minute. Sitzt man jedoch eine Minute auf einem heissen Ofen, meint man, es wären zwei Stunden. Das ist Relativität.“

Mehr Einsteins. Wollen alle. Produzieren aber das Gegenteil. Also braucht es Sie, die ICT-Zukunftstypen. Die Politik kapriziert sich aufs Nichtrauchen.

Ludwig Hasler, lhasler@duebinet.ch

Arbeitsgemeinschaft der Alpenländer fördert die Europäische JuniorAkademie

Seit 2005 finden im deutschen Bundesland Bayern sogenannte »JuniorAkademien« für intellektuell besonders begabte Jugendliche statt. An diesen 19-tägigen Ferienakademien, die in der Regel aus drei Modulen bestehen, haben inzwischen über 200 Schülerinnen und Schüler teilgenommen. Letztes Jahr wurde nun die von der Fraunhofer-Gesellschaft in München lancierte und von der Arbeitsgemeinschaft der Alpenländer ARGE ALP finanziell mitgetragene Idee unter Einbezug von Jugendlichen aus der Schweiz (Kanton Graubünden und St. Gallen), aus Österreich (Bundesländer Salzburg, Tirol und Vorarlberg), sowie aus Italien (Südtirol) erweitert zur ersten "Europäischen JuniorAkademie ARGE ALP".

Die zweiwöchige Sommerakademie wurde vom 3. - 16. August 2008 am Bodensee-Gymnasium im bayerischen Lindau durchgeführt. In vier Kursen konnten je 28 Mädchen und Jungen ihr Wissen in Natur- und Geisteswissenschaften, Kunst und Kultur erweitern und vertiefen. Auf dem Programm standen Kurse über "Ethnologie – die Wissenschaft des kulturell Fremden", "Spielerisch lernen - das Zusammenwirken von Kreativitätstechniken, Strategie und Taktik", "Geschichte und Politik im Film – der subjektive Blick des Objektivs", und für Physiker erfreulich als Renner, "Klimaentwicklung und neue Energietechnologien".
Im eigens erstellten Dokumentarfilm *http://www.bayern.de/Doc-..9974080/d.htm* schildern die Jugendlichen ihre positiven Eindrücke über den internationalen Ansatz der Veranstaltung und über die für sie so wichtige Kontaktgewinnung untereinander.

Neben der Kursarbeit und der Arbeit im kursübergreifenden Angebot „Tanz und Chor / Orchester“ stand als ein Höhepunkt für viele der Jugendlichen das Kamingespräch mit dem Nobelpreisträger Prof. Werner Arber von der Universität Basel auf dem Programm. Im ‚Alten Rathaus‘ auf der Insel Lindau stellte sich der Wissenschaftler den Fragen der wissbegierigen Jugendlichen.

Ein weiterer Höhepunkt war die Exkursion mit der MS-Bayern über den Bodensee zur Seebühne nach Bregenz. Dort bestaunten die Jugendlichen nicht nur die einzigartige Kulisse der Inszenierung von "Tosca", sondern auch die beeindruckende Ton-, Licht- und Bühnentechnik. Im Festspielhaus Bregenz konnten sie dazu passend per Videokonferenz vom Direktor des Fraunhofer-Instituts für Digitale Medientechnologie und Entwickler des MP3-Formats, Prof. Karlheinz

Brandenburg, Details über die verschiedenen Audioformate erfahren, und wie es zur Entwicklung des MP3-Formats kam.

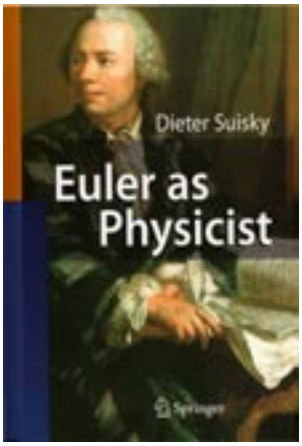
Kurs: Klimaentwicklung und neue Energietechnologien

Am festlichen Abschlussabend wurden die entwickelten und eingeübten Stücke aus den 'Kursübergreifenden Angeboten', sowie die Arbeitsergebnisse aus den vier Kursen vor rund 350 Eltern und Verwandten, der Lindauer Oberbürgermeisterin, Petra Meier to Bernd-Seidl, der Stellvertretenden Landrätin, Doris Scheuerl, sowie Pressevertretern aufgeführt und vorgestellt. Dass die neben der Wissensgewinnung wichtige Kontaktpflege nachhaltig erfolgreich ist, zeigte sich, als der Abschlussveranstaltung in der Inselhalle auf Lindau viele Alumni und Alumnae der letzten Jahre beiwohnten.

An der Fortsetzung des Programms im nächsten Jahr wird derzeit noch gearbeitet und gefeilt. Aber schon heute sind sich alle Beteiligten einig, dass dieses Angebot zur Begabtenförderung fortgesetzt wird.

Dr. Birgit Geiselbrechtinger, Fraunhofer-Gesellschaft

Book Review



"Euler as Physicist" by Dieter Suisky
Springer 2009, XXIII, 338 p. 16 illus., Hardcover, ISBN: 978-3-540-74863-2

Recently we accentuated in the second contribution of our series Physics Anecdotes, "Euler and the Fiasco at Sanssouci" the discrepancy between the merits Euler had in the development of physics in the 18th century and the lack of a contemporary esteem in comparison to Euler's contributions to mathematics. As a quite natural consequence, there are several books devoted to Euler as mathematician, but not as physicist. Very recently, however, the publication of a book on Euler as Physicist had been announced whose content is summarized as follows:
"Though his pioneering work on mechanics had an essential influence in the 18th century, its impact on the 19th century was obscured by the overwhelming success of his mathematical writings. Euler anticipated Mach's later criticism of absolute motion and Einstein's assumption on the invariance of the equation of motion in inertial systems. It will be demonstrated that even problems in contemporary physics may be advantageously reconsidered and reformulated in terms of Euler's early unified approach.
The interplay between physics and mathematics which appeared in the 18th century will be compared to the development of physics in the 20th century, especially to the development of quantum mechanics between 1900 and 1930."

The author studied physics and was later working on semiconductor physics and history of science. He took his Ph.D. at Humboldt University Berlin and wrote theses in theoretical physics and philosophy of science.

For more details, we recommend to have a look at the internet page
http://www.springer.com/physics/book/978-3-540-74863-2

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Mitgliederverwaltung, Webseite, Druck, Versand, Redaktion Bulletin & SPG Mitteilungen /
Service des membres, internet, impression, envoi, rédaction Bulletin & Communications de la SSP
S. Albietz, SPG Sekretariat, Departement Physik, Klingelbergstrasse 82, CH-4056 Basel
Tel. 061 / 267 36 86, Fax 061 / 267 37 84, **sps@unibas.ch**

Buchhaltung / Service de la comptabilité
F. Erkadoo, SPG Sekretariat, Departement Physik, Klingelbergstrasse 82, CH-4056 Basel
Tel. 061 / 267 37 50, Fax 061 / 267 13 49, **francois.erkadoo@unibas.ch**

Administratives Sekretariat / Secrétariat admin.
Susanne Johner, **SJO@zurich.ibm.com**

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Impressum:

Die SPG Mitteilungen erscheinen ca. 2-4 mal jährlich und werden an alle Mitglieder sowie weitere Interessierte abgegeben.

Verlag und Redaktion:
Schweizerische Physikalische Gesellschaft
Klingelbergstr. 82, CH-4056 Basel
sps@unibas.ch, www.sps.ch

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