

Swiss Society for Optics and Microscopy Société Suisse pour l'Optique et la Microscopie Schweizerische Gesellschaft für Optik und Mikroskopie

## Mitteilungsblatt/Bulletin d'information 3/2006



Putting fs-lasers into practice

## SWISS SOCIETY FOR OPTICS AND MICROSCOPY

www.ssom.ch (services : username "ssom", password "engelberg") BOARD MEMBERS 2004 - 2006

## President

### Dr. Kurt Pulfer

SOLVIAS AG, Klybeckstrasse 191, WKL-127.634, Postfach, CH- 4002 Basel, Tel. +41 61 686 62 21, Fax +41 61 686 65 01, kurt.pulfer@solvias.com

### Redactor

#### Dr. Reto Holzner

Apfelbaumstrasse 2, CH-8050 Zürich Tel. +41 1 312 15 63, reto.holzner@hispeed.ch

### Optics Section Secretary

### Prof. Dr. Hans Peter Herzig

Institut de Microtechnique, Rue A.-L. Breguet 2, CH-2000 Neuchâtel, Tel. +41 32 718 32 70, Fax +41 32 718 32 01, hanspeter.herzig@unine.ch

### Optics Section Board

#### Dr. Bernhard Braunecker

Braunecker Engineering GmbH, Haldenweg 10, CH-9445 Rebstein, Tel. +41 071 777 2919, braunecker@bluewin.ch

#### Dr. Fabienne Marquis Weible

Institut de Microtechnique, Université de Neuchâtel, Jaquet-Droz 1, CH-2007 Neuchâtel, Tel. +41 32 720 54 77, Fax +41 32 720 57 11, fabienne.marquis-weible@unine.ch

#### Dr. Markus Rossi

Heptagon Oy, Moosstrasse 2, CH-8803 Rüschlikon, Tel. +41 44 497 30 03, Mobile +41 79 470 24 91, Fax +41 44 497 30 01, markus.rossi@heptagon.fi

#### Prof. Dr. Markus W. Sigrist

Institut für Quantenelektronik, ETH-Hönggerberg HPF D 19, CH-8093 Zürich, Tel. +41 1 633 22 89, Fax +41 1 633 10 77, sigrist@iqe.phys.ethz.ch

### Prof. Dr. Thomas Graf

Institut für Strahlwerkzeuge Universität Stuttgart, Pfaffenwaldring 43, D-70569 Stuttgart, Tel. +49 711 685 6840, Mobile +49 172 625 3905, Fax ++49 711 685 6842, graf@ifsw.uni-stuttgart.de

#### **Dr. Berthold Schmidt**

Bookham Switzerland AG, Binzstrasse 17, CH-8045 Zurich, Tel. +41 1 455 85 94, Fax +41 1 455 85 86, berthold.schmidt@bookham.com

### Dr. Guy Delacrétaz

Laboratoire d'Optique Appliquée, EPFL, CH-1015 Lausanne, Tel. +41 21 693 51 84, Fax. +41 21 693 37 01, guy.delacretaz@epfl.ch

## **Treasurer** Marcel Düggelin

Zentrum für Mikroskopie ZMB, Bio-Pharmazentrum, Universität Basel, Klingelbergstrasse 50/70, CH-4056 Basel, Tel. +41 61 267 14 02, Fax +41 61 267 14 10, marcel.dueggelin@unibas.ch

### Webmaster

### **Daniel Mathys**

Zentrum für Mikroskopie ZMB, Bio-Pharmazentrum, Universität Basel, Klingelbergstrasse 50/70, CH-4056 Basel, Tel. +41 61 267 14 01, Fax +41 61 267 14 10, daniel.mathys@unibas.ch

### Nanotechnology Section Secretary

#### PD Dr. Harry Heinzelmann CSEM, Nanoscale Technology & Biochemical Sensing, Jaquet-Droz 1, CH-2007 Neuchâtel, Tel. +41 32 720 55 33, Fax +41 32 720 57 50, harry.heinzelmann@csem.ch

Nanotechnology Section

Board

Prof.Dr. Christian Schönenberger

4056 Basel, Tel: +41 61 267 36 90

Fax: +41 61 267 37 84

Institut für Physik, Klingelbergstrasse 82,

markus.duerrenberger@unibas.ch

Zentrum für Mikroskopie ZMB, Bio-

Pharmazentrum, Universität Basel,

Klingelbergstrasse 50/70, CH-4056

Basel, Tel. +41 61 267 14 04 , Fax +41

### Microscopy Section Boad

Microscopy Section

Secretary

#### Prof. Dr. med Peter Eggli

Dr. Markus Dürrenberger

Anatomisches Institut Uni Bern, Bühlstrasse 26, Postfach, CH- 3000 Bern 9, Tel:+41 31 631 84 79, Fax +41 31 631 34 10, eggli@ana.unibe.ch

#### **Dr. Heinz Gross**

61 267 14 10.

Elektronenmikroskopie-Zentrum der ETH Zürich, c/o Institut für angewandte Physik, CH-8093 Zürich, Tel. +41 1 633 33 04, Fax +41 1 633 11 05, heinz.gross@iap.phys.ethz.ch

#### Prof. Dr. Lukas Landmann

Universität Basel, Anatomisches Institut, Pestalozzistr. 20, CH-4056 Basel, Tel: +41 61 267 39 33 , Fax +41 61 267 39 59, lukas.landmann@unibas.ch

#### Dr. Robin Schäublin

Centre de Recherches en Physique des Plasmas, EPFL, CH-5232 Villingen-PSI, Tel. +41 56 310 40 82, Fax +41 56 310 45 29, Robin.Schaublin@psi.ch

#### Dr. Patrick Schwarb

IMAGIC AG, Kanalstrasse 27, CH-8152 Glattbrugg, Tel. +41 1 809 40 60, Fax +41 1 809 40 61, schwarb@imagic.ch

#### Prof. Dr. Pierre Stadelmann

EPFL, CIME, MXC , CH-1015 Lausanne, Tel. +41 21 693 29 76, Fax +41 21 693 44 01, pierre.stadelmann@epfl.ch

## Christian.Schoenenberger@unibas.ch **Dr. Jens Gobrecht** Paul Scherrer Institute, Laboratory for Micro-

and Nanotechnology, CH - 5232 Villigen-PSI, Tel: +41 56 310 2529, jens.gobrecht@psi.ch

## Biomedical Photonics working group

#### PD Dr. Martin Wolf

Clinic of Neonatology, University Hospital Zurich, Frauenklinikstr. 10, CH-8091 Zurich, Tel: +41 44 2555346, Fax: +41 44 2554442 martin.wolf@alumni.ethz.ch

## Table of content

## SSOM

From the President	by Kurt Pulfer	4
Putting fs-lasers into practice	by Martin Frenz, Jaro Ricka	5

## **Optics Section**

SSOM Agenda 2005	11
Courses and Conferences 2005	12
SSOM Anmeldeformular / Demande d'adhésion	

Dear Member,

Rio de Janeiro will be the next host city fort the International Microscopy Congress IMC17 in 2010. This was decided at the General Assembly of the IFSM at the IMC16 in Sapporo, Japan. As you know from the last bulletin, Basel was also one of the bidders together with Lisbon and London, and we had a good bid and solid and well balanced budget. But we had no chance against the attractive Brazilian destination. In the third round 33 delegates voted for Rio and 25 for London. It is with a laughing and a crying eye that we accepted the verdict because we know from the congress in Davos how much work the organisation of such an event means. But just too bad for all the energy and work the SSOM and specially Markus Dürrenberger has put into the bid.

On the other hand we have good news: Prof. Ueli Aebi, president of the EMS and member of the SSOM was elected into the board of the IFSM. Congratulations from our side and we wish him all the best and a successful time in this new assignment. We think that it is very important that the EMS is well represented in the IFSM, especially with respect to the IMC18 which should definitely take place in Europe.

The delegates also elected a new IFSM president. As the term of David Cockayne ends in December Christian Colliex from France was elected as the new president of the IFSM.

The congress was perfectly organized by the Japanese society and it was also very successful. There were about 2000 delegates from over 60 countries participating. Sometimes the lecture rooms were too small to hold all the interested scientists.

By the way did you know that the presidents of our neighbouring societies in Germany and France are both Swiss? Pierre-André Buffat, our former member of the board is president of the SFµ and Paul Walther president of the DGE!

The next activities of the SSOM will be the section meetings. The meeting of the Optics division will already have taken place at the ETH Hönggerberg when you read these lines. The Microscopy meeting will take place later in fall. The secretary will inform you about the program.

With kind regards

Kurt Pulfer President SSOM

## Putting fs-lasers into practice

Since a couple of years, the Department of Biomedical Photonics at the Institute of Applied Physics of the University of Bern runs a fs-laser facility for basic research and applications in different areas such as medicine, biology or even geology. The heart of the facility is a Ti:sapphire laser system with both an oscillator and an amplifier, which produces either approximately 150 fs pulses at a repetition rate of 76 MHz at wavelengths tunable from 700 nm to 900 nm or amplified pulses at 800 nm wavelength with a repetition rate up to 250 kHz and pulse energies up to 4 mJ. Several beam lines around the laser system are equipped for imaging (multi-photon fluorescence, second harmonic or lifetime imaging) and for precise ablation of biological tissue or other materials. Sophisticated diagnostic tools in combination with the use of photonic crystal fibers for beam transmission ensure that pulse length, beam profile and pulse energy can precisely controlled at the focal plane, a prerequisite for performing quantitative measurements (see Fig. 1).



**Figure 1:** Information from the far-field of a tightly focused laser beam obtained with a tapered profiler camera (left) is used to simulate the spatial properties in the near-field of the beam using a nonparaxial beam propagation model that includes information about the electrical polarization. Right: Total electric near-field intensity in the focal plane overlaid with a streamline plot of the electric field components. It can be seen that the polarization is well preserved throughout the focal region.

An interesting side line of our applied research is a study of fluid inclusions in quartz, currently carried on in collaboration with LFA-Labor für Fluideinschluss-Analytik, a small geological company. Fluid inclusions are micro-sample of crustal fluids trapped in minerals like quartz during their growth or healing of fractures. An important prerequisite is the knowledge of the density of the enclosed fluid. Therefore the geologists have developed an ingenious but simple procedure: At the time of formation at high pressures and temperatures the enclosed fluid is homogeneous, but upon transferring to earth surface conditions it may phase separate, forming a small bubble. If one finds an inclusion containing a bubble, one heats the sample up and watches the bubble to diminish until it vanishes at the so-called homogenization temperature Th. If the composition and phase diagram of the fluid are known (e.g. pure water) then the density

can be determined uniquely from Th. However, under certain conditions the fluid may exist in a long lived under-tensed metastable state without phase separation and thus the technique can't be applied. Here our femtosecond laser tool comes in: by depositing the required amount of energy precisely in the laser focus in the chosen inclusion we are able to induce the bubble nucleation in a highly controllable fashion (Fig. 2). In the same way we achieve the nucleation of crystallites (halite) in supersaturated inclusion liquids.



**Figure 2**: Laser induced simultaneous nucleation of the vapor bubble and halite in a metastable one-phase inclusion at room temperature: (a) before and (b),(c) after the laser pulse. (L = liquid phase, V = vapor phase). The position of the laser spot is indicated in image (b).





**Figure 3**: (a) Femtosecond second harmonic generation imaging of a x-z section. (b) Plot of the second harmonic signal along the line indicated in (a). The positive axis points in direction of the laser beam.

In the same project we also make use of the unique imaging capabilities of femtosecond laser pulses: Often the inclusion liquid contains gases at unknown concentrations.



**Figure 4**: Three-dimensional image of a fluid inclusion in quartz.

In such a case the knowledge of Th alone is not enough, one rather needs to measure the volumes of the bubble and of the inclusion. Recently we have shown that the latter task can be elegantly fulfilled by femtosecond second harmonic generation imaging. The phase-matching conditions in the quartz lead to generation of frequency doubled light only at the surfaces of the fluid inclusions and not in the bulk material. Using a highly focussed laser beam we detect the inclusion wall with a high contrast and high axial resolution (Fig. 3). Thus, by scanning microscopy we are able to threedimensionally image fluid inclusions down to a size of 1 mm, as shown in Fig. 4.

Martin Frenz, Jaro Ricka

## Second Announcement The SSOM Engelberg Lectures on Optics 2007

## Photonics in Space - a challenge for modern technologies -

12<sup>th</sup> SSOM Engelberg Lectures on Optics 5-7. March 2007, Hotel Regina Titlis, Engelberg, Switzerland

Organised by:	The Swiss Society for Optics and Microscopy SSOM The Swiss Space Office SSO
Organisation Committee:	B. Braunecker, J. Frauchiger, H. P. Herzig
Contact:	Prof. Hans Peter Herzig hanspeter.herzig@unine.ch

Since the first man made satellite was launched 50 years ago, spacecraft have not only gained vision, but photonic systems are often at the very heart of satellite payloads and equipments. High reliability of the equipment to be embarked on a spacecraft is needed. The harsh environment of space requires special design, selection of suitable materials and extensive qualification procedures. There is a wide range of photonic applications in the programmes of the European Space Agency, where Swiss companies and institutes contribute.

Satellite navigation, advanced imaging, photonics at extreme wavelengths are driving forces for ongoing developments in our country. The interdisciplinary approach of the SSOM Engelberg lectures offers the opportunity to the Swiss academia, technology institutes and industry to identify at a very early stage novel space applications, based on photonic systems, and the necessary technology developments.

A special session is foreseen on Wednesday morning to update in modern optical production tech-nologies. Input of the latest technology know-how from of renowned optical companies will be pre-sented concerning aspheres.

Monday, 5 March 2007

Extreme Wavelengths and Advanced Imaging

Chair: K. Knop / CSEM, Neuchatel

Many violent astrophysical processes in our universe may be observed outside the visual spectrum, i.e. at very short wavelengths and in the far infrared. Latest achievements in imaging with g- and X-rays on the one side, but also at TeraHertz frequencies will be presented. Future developments focus on the development of new collimating and detecting schemes, and on spacecraft formation flights acting as giant space based observatories. In the second session part 'Advanced Imaging' new spatial and spectral methods to observe and explore the star generation process with space telescopes are described in detail. Finally hyperspectral instruments, characterized by their high spectral and radiometric resolution, and well suited for 'remote sensing and imaging' in space and airborne applications, are presented.

### Monday, 5 March 2007

### ESA Programmes

Chair: J. Frauchiger / Swiss Space Office, Berne

An overview of Photonics applications on ESA scientific spacecraft will be given. Highlights of selected areas and spectral ranges will lead to perspectives for future scientific mission requirements transforming in technology needs and developments. In this session the basic mechanisms of the ESA System will be introduced to facilitate the identification of opportunities for the Swiss photonics community to participate in space technology developments. This will include career opportunities. Nearly all scientific, exploration or application programmes of ESA are supported by technology development programmes to be presented. The latest developments in common ESA-EU Navigation and Earth Observation initiatives will be presented too.

Tuesday, 6 March 2007

## Time and Frequency

Chair: H. P. Herzig / University of Neuchatel

Atomic frequency standards are the basis of today's satellite navigation and positioning systems. Rubidium gas-cell clocks constitute the ideal frequency standard for this kind of space applications, because they combine short- and medium-term stability with small size, as well as low weight and power consumption. The development of the key technologies (reliable diode lasers, atomic vapor cells) will prepare the way towards low-power and miniature chip scale atomic clocks for industrial and domestic applications. The lectures will explain the physics of atomic clocks, introduce the miniaturization concepts and show possible applications.

Tuesday, 6 March 2007

Chair: J. Frauchiger / Swiss Space Office, Berne

Swiss research teams play a leading role in the detection of Exoplanets. Their achievements and their methods will be presented. Perspectives for new detection schemes and their photonic principles will be further elaborated. Photonics for remote sensing planetary missions is continuously developing. However, opportunities for insitu measurement on evolving exploration missions open a new field for photonics applications in scientific instruments. This session will include an ESA presentation on technology developments in preparation of one of the most challenging scientific missions ever to be flown.

## Wednesday, 7 March 2007 Advanced Optics by Aspherical Elements

### Chair: B. Braunecker / Braunecker Engineering GmbH, Rebstein

Space optics use, whenever possible, aspherical elements to optimise the system performance with a minimum number of components. However, aspheres need sophisticated production technologies. The Wednesday morning session provides a broad overview about modern optical production methods with special focus on aspherical elements. We will review in detail the manufacturing process segments: 'Applications & Design, Materials, Surface shaping, Metrology, Coatings and Assembly'.

## SSOM Agenda 2006

Veranstaltung	Ort	Datum	Bemerkungen
SSOM Vorstandssitzung	Bern	18. Januar	
SAOG/GSSI Meeting	Fribourg	20. Januar	Functional Interfaces and Surfaces
EOS Topical Meeting	Engelberg	27. – 29. April	Molecular Plasmonic Devices
ICN&T 2006	Basel	30.7. – 4.8.	International Conference on Nanoscience and Technology
Sektion Optik	ETH Zürich	21. September	Sektionstagung
Sektion Mikroskopie	Basel	November	Sektionstagung
Sektion Nano	Basel	anlässlich der ICN&T 30.7. bis 4.8.	Sektionstagung
Arbeitsgemeinschaft Biomedical Photonics			Tagung
SATW	Bern	27./28. Sept.	Jahreskongress
Sektion Nano	Brugg- Windisch	13. Oktober	Preliminary announcement : 14 h – 17h at INKAFHNW
SC NAT	Zürich	12./13. Oktober	186. Jahreskongress / Congrès annuel

In 2006 there will be no General Assembly of the SSOM but the sections will meet individually

## September

3 - 8	XVI International Congress on Electron Microscopy Sapporo Convention Center (SCC), Sapporo, Japan info@imc16.jp
4 – 7	Photon 06 Wien, Austria www.photon06.org
4 - 8	GCL/HPL 2006 XVI International Symposium on Gas Flow and Chemical Lasers & High Power Laser Conference, Gmunden, Austria http://info.tuwien.ac.at/gcl-hpl06
4 - 8	TNT2006 Trends in Nanotechnology Grenoble, France
10 – 15	NFO-9, Int. Conf. on Near-Field Optics, Nanophotonics and Related Techniques EPF Lausanne www.nfo9.org
27 – 29	EELS/EFTEM workshop 2006 Manchester, UK www.photon06.org

## October

13	Preliminary announcement
	Meeting of SSOM Nano Section
	14 h – 17h at INKAFHNW, Brugg-Windisch.
	Details will follow. Contact: jens.gobrecht@psi.ch
16 – 19	EOS Annual Meeting 2006 Paris, France - Extreme optics (QEOD/EPS and EOS) - Nanophotonics (QEOD/EPS and EOS) - Biophotonics and biomedical optics - Micro-Optics, Diffractive Optics and Optical MEMS - Photonic devices for space - Nonlinear optics and guided waves www.europeanopticalsociety.org/events.php

## December

5 – 7	Plasmonics and Applications to Nanotechnology Singapore
6 – 8	ODF'06, Optics-photonics Design & Fabrication Nara, Japan

## January 2007

8 – 11	Nanometa 2007 – 1 <sup>st</sup> European Topical Meeting on Nanophotonics and Metamaterials
	Seefeld, Austria

## February 2007

21 – 23	Nanotech 2007 – Conference and Exhibition
	Tokyo, Japan

## March 2007

27 – 29	Nanotech Northern Europe 2007 (NTNE2007)
	Helsinki, Finland

See also according pages on www.ssom.ch www.nanoscience.ch/events.asp www.ssom.ch/bmpn/activities.html for further events .....

## Snapshot





# Anmeldung zur Mitgliedschaft / Demande d'Adhésion Adressänderung / Changement d'Adresse

Name/Nom : Vorname/Prénom : Institut/Firma/Institution :
Adresse :
PLZ/Code Postal : Ort/Lieu : Telephon : Fax : E-mail :
Mitgliedschaft in Sektion oder Arbeitsgruppe / Demande d'adhésion en section ou groupe de travail
Jahresbeiträge als / Cotisations annuelles (Zutreffendes bitte ankreuzen) Einzelmitglied / Membre individuel : CHF 30 (Optik CHF 42.50) Kollektivmitglied / Membre collectif : CHF 150 Haupt-Delegierter / Délégué principal : Kollektivmitglieder, Namen und Adressen der Delegierten / Noms et adresses des délégués (max. 10)
Datum / Date : Unterschrift / Signature :
Bitte Anmeldung an Kassier / A renvoyer au caissier svp : Marcel Düggelin, Universität Basel, Zentrum für Mikroskonie

Marcel Düggelin, Universität Basel, Zentrum für Mikroskopie, Pharmazentrum, Klingelbergstrasse 50, CH-4056 Basel Tel. (061) 267 14 02, FAX (061) 267 14 10, Email: marcel.dueggelin@unibas.ch

## Redaktion: Dr. Reto Holzner Apfelbaumstrasse 2 8050 Zürich

Tel. 01 312 15 63 reto.holzner@hispeed.ch

Adressänderungen : Bitte direkt an Marcel Düggelin mit umseitigem Formular.

Redaktionsschluss : 15. Februar, 15. Mai, 15. August, 15. November

Die SSOM ist Mitglied bei der

Schweizerischen Akademie der Naturwissenschaften Schweizerischen Akademie der Technischen Wissenschaften

Druck: Druckerei Dietrich AG, Pfarrgasse 11, 4019 Basel

Der Druck wurde unterstützt von der Schweizerischen Akademie der Naturwissenschaften



Member of the Swiss Academy of Sciences