SSOM

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+4 / 2009

**FISBA OPTIK-Preis**

Preisträger
***Yasin Ekinci***

**Mikroskopie-Preis**

Preisträger
***B. E. Kratochvil***

**NANO-Preis**

Preisträgerin
***Barbara Rothen-Rutishauser***

# SWISS SOCIETY FOR OPTICS AND MICROSCOPY

www.ssom.ch (services : username "ssom", password "engelberg")

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# *Table of content*

**SSOM**

# *From the president*

Dear members,

The Swiss Society for Optics and Microscopy (SSOM) was founded in 1949 as the Swiss Committee for Optics. It has existed in its present form since 1969, combining the Swiss national interests in Optics and Microscopy, and since 2006, also Nanotechnology. Thus, the society celebrates its 60th anniversary in 2009.

We celebrated the 60th anniversary in the form of a symposium, 30th of October 2009 at the Berner Fachhochschule in Burgdorf. It was an excellent organized day by the optical section with many contributions for all interests.

In the afternoon, the obligatory general assembly was held. There were changes in the board of the SSOM. I would like to welcome the new members and thank the resigning ones for their great work over the past years. We elected also four new honorary members (see contribution).

After the obligatory business we could come to the award show. We could award the FISBA optics prize and two SSOM prizes (see contribution).
An exquisite dinner rounded the day up.

We can look back over the last 60 years and I really wonder how the future will be. Time is passing by and the SSOM exists since a whole lifespan of a human being. Let's keep it alive with our work for the next couple of years.

The sands of 2009 are running out. I hope this was a fruitful year for you.
I wish you all a merry Christmas and a happy new year.

Markus Dürrenberger
President SSOM

*Annual SSOM Meeting 2009*
*60th Anniversary of the SSOM*

## Program

| | |
|---|---|
| **Date:** | Friday, 30 October 2009 |
| **Location:** | Berner Fachhochschule BFH<br>Technik und Informatik TI<br>Pestalozzistrasse 20<br>3400 Burgdorf |
| 10:00 - 10:30 | Arrival of the participants |
| 10:30 - 12:00 | Grand Challenges in Optics and Photonics (see Anhang) |
| 12:30 - 13:30 | Lunch |
| 13:30 – 14:30 | General Assembly |
| 14h30- 16:00 | SSOM/Industry prizes |
| 16:15 – 17:45 | Aperitif - Museum Franz Gertsch |
| 17:45 | Departure to the restaurant for dinner<br>(www.gedult.ch) |

Please register (Name and Affiliation) by September 30 either by e-mail, phone or fax and indicate whether you will participate in the evening dinner.

| | |
|---|---|
| Registration: | Frau Beate Schröder |
| E-mail: | beate.schroeder@unibas.ch |
| Phone: | +41 61 267 14 05 |
| Fax: | +41 61 267 14 10 |

# Grand Challenges in Optics and Photonics

**Date:** Friday, 30 October 2009

**Location:** Berner Fachhochschule BFH, Technik und Informatik TI
Pestalozzistrasse 20, 3400 Burgdorf

10:30 – 11:00 Bernhard Braunecker, früherer Leiter Optikentwicklung Leica-Geosystems.
***Grand challenges in technology***
**- Optical telescopes for space applications**

11:00 – 11:30 Olivier Martin, EPFL
***Grand challenges in photonics***
**- Negative refraction and cloaking at optical wavelengths**

11:30 – 12:00 Peter Seitz, CSEM
***Grand challenges in imaging***
**- Single-photon electronic imaging**
**- Uncooled IR electronic imaging**
**- Optical time-of-flight ranging with micrometer resolution**

Bernhard Braunecker

Martin Forrer

Martin Olivier

Peter Seitz

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Schweizerische Gesellschaft für Optik und Mikroskopie

# Protokoll der SSOM Mitgliederversammlung 2009

Freitag, den 30. Oktober 2009 13:45 – 14:30
In der Berner Fachhochschule BFH in Burgdorf

Anwesend: 47 Personen
Markus Dürrenberger eröffnet um 13.415 Uhr die Mitgliederversammlung.
Entschuldigt haben sich: Sousan Abolhassani, Guy Delacrétaz, Rolf Gotthard, Richard Guggenheim, Simon Wagner.

Die Traktandenliste wird wie folgt genehmigt:

**Traktanden**

1. Wahl der Stimmenzähler
2. Protokoll der Mitgliederversammlung 2007
   (in den Mitteilungen publiziert)
3. Jahresberichte und Rechnung 2007/2008
4. Entlastung des Vorstandes
5. Ernennung von Ehrenmitgliedern
6. Wahlen
7. Verschiedenes

**1. Wahl der Stimmenzähler**
Evi Bieler und Daniel Mathys werden als Stimmenzähler gewählt.

**2. Protokoll der Mitgliederversammlung 2007**
Das Protokoll der GV 2007 wird genehmigt.

**3. Jahresberichte und Rechnung 2007/2008**
Die Jahresberichte 2007/2008 sowie die Rechnungen 2007/2008 wurden in den SSOM Mitteilungen veröffentlicht.
Kassier Gianni Morson präsentiert die Jahresrechnungen nochmals.
Beide Berichte werden ohne Gegenstimme genehmigt.

**4. Entlastung des Vorstandes**
Der Vorstand wird einstimmig von seinen Pflichten entlastet.

**5. Ernennung von Ehrenmitgliedern**
Fritz Gloor und Ruedi Schmid wurden letztes Jahr anlässlich der Sektionstagung als Ehremitglieder ernannt. Jetzt werden sie von der Mitgliederversammlung bestätigt und bekommen sie ihre Urkunden.

Auch unsere beiden Altpräsidenten Karl Knop und Kurt Pulfer wurden als Ehrenmitglieder vorgeschlagen. Die Versammlung ernennt alle 4 Mitglieder per Akklamation zu Ehrenmitgliedern.

**6. Wahlen**
Den Rücktritt aus dem Vorstand haben bekanntgegeben:
- Vice President Optics: Hans Peter Herzig
- Section Microscopy: PD Matthias Ochs
- Section Microscopy: Lukas Landmann
- Section Microscopy: Heinz Gross
- Webmaster: Daniel Mathys

Der Vorstand schlägt folgende Personen zur Wahl vor:
- Neu Vice President der Sektion Optics: Beat Neuenschwander
- Neu im Vorstand der Sektion Optik und Delegierter der SSOM bei der EOS: Andreas Ettemeyer

- Neu im Vorstand der Section Microscopy: Lorenz Holzer
- Neu im Vorstand der Section Microscopy: Barbara Rothen-Rutishauser
- Neu im Vorstand der Section Microscopy: Roger Wepf

Die Position des Webmasters ist derzeit vakant.

Die vorgeschlagenen Personen werden von der Mitgliederversammlung einstimmig gewählt und vom Präsidenten begrüsst.

**7. Verschiedenes**
Der Präsident ermuntert die Anwesenden, etwas für die Mitgliederwerbung zu tun.
Patrick Schwarb schlägt eine Kursgeldreduktion für Nichtmitglieder vor, wenn sie SSOM Mitglieder werden. Der Präsident sagt, dass das bereits heute so gehandhabt wird, z.B. bei Beiträgen für den Besuch Mikroskopie Kongressen.
Bernd Braunecker fragt, ob es eine Geschichte der SSOM gäbe.
Wir haben das Buch von John Günter „History of Electron Microscopy in Switzerland“, daneben werden die SGOEM und SSOM Mitteilungen archiviert sowie die Protokolle der Vorstandssitzungen und Mitgliederversammlungen.
Der Präsident sagt, dass er etwas organisieren werde, um die Daten zusammenzufassen.

Um 14.30 Uhr schliesst der Präsident die Mitgliederversammlung.

Im Anschluss daran fand die Verleihung des FISBA OPTIK**-**Preises an Yasin Ekinci, des SSOM Mikroskopie-Preises an B. E. Kratochvil und des SSOM Nano-Preises an Barbara Rothen-Rutishauser statt.

Der Protokollführer

Basel, 06.11.09 kp

Kurt Pulfer

# *Honorary members*

Karl Knop

Kurt Pulfer

Ruedi Schmid

Fritz Gloor

# *Thanks*

Hans Peter Herzig

Heinz Gross

Daniel Mathys


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Dieses Jahr sind es drei gleichwertige Preise, die auf der Jahrestagung zum 60 Jahre Jubiläum der SSOM am 30. Oktober 2009 in Burgdorf (www.ssom.ch) verliehen worden sind. Die drei Preise, die je mit **CHF 2500.-** dotiert sind, wurden von der Firma FISBA OPTIK AG sowie von der SSOM selbst gestiftet.

**Der FISBA OPTIK-Preis**

wurde für hervorragende Arbeiten auf dem Gebiet der modernen Photonik und photo-nischen Mikrosystemen vergeben.

Preisträger
***Yasin Ekinci***

**Der Mikroskopie-Preis**

wurde für hervorragende Arbeiten vergeben, welche thematisch zu den Fachgebieten der SSOM, bevorzugt der Mikroskopie stehen.

Preisträger
***B. E. Kratochvil***


**Der NANO-Preis**

wurde für hervorragende Arbeiten vergeben, welche thematisch zu den Fachgebieten der SSOM, bevorzugt der Nanotechnologie stehen.

Preisträgerin
***Barbara Rothen-Rutishauser***

# Bilayer metallic wire-grids as efficient, low-cost, and broad-band polarizers

***Yasin Ekinci***

*Paul Scherrer Institute, Laboratory for Micro- and Nanotechnology, Villigen-PSI, Switzerland*

*ETH Zurich, Department of Materials, Laboratory of Metal Physics and Technology, Zurich, Switzerland*

Metallic wire-grids with subwavelength periods transmit TM-polarized light (transverse magnetic; electric field perpendicular to the wires) and reflect TE polarization (transverse electric; electric field parallel to the wires), and therefore can be used as efficient polarizers (Fig.1). They are widely used in radio, microwave and IR region of the spectra. Since production costs are relatively high for a wire-grid polarizer operating in the visible range, they are used only for some specific applications. They are an attractive alternative to conventional polarizers, which are either crystal-based such as Glan-Thompson type (high performance, bulky, expensive, low acceptance angle) or polymer-based such as polaroid (low performance, compact, cheap, broad acceptance angle), since they are compact and planar and can have high performance (i.e. high transmission and polarization factors), acceptance over a wide incident angle and broad operating wavelength range. They are also compatible with integrated circuit fabrication which facilitates the use of optical components in nanophotonic, display, and detector devices.

We developed a new kind of wire-grid polarizers which is simpler and low-cost than the conventional single layer wire-grids (Fig. 1). Al bilayer metal wire-grids with extremely small periods were fabricated by EUV interference lithography and their optical properties were characterized both experimentally and theoretically [1]. It was demonstrated that metallic bilayer wire-grids with 100 nm period can work as high-performance polarizers down to UV range. The transmission through the grating is governed by near-field coupling and Fabry-Perot type resonance [1]. A polarizer with a transmission of 50% and polarization factor of 40 dB ($10^4$) was realized (Fig. 2). Theoretical calculations showed that by tuning the structural parameters, the transmission can be optimized as high as above 90% and the polarization factor can be above 60 dB [1]. Such a high quality polarizer certainly outperforms the currently available crystal polarizers. A bilayer wire-grid can be obtained by evaporating a metal film onto a photoresist grating, leading to two metal gratings separated by a certain distance and laterally shifted by half period. Since the fabrication process involves only photoresist patterning and metal evaporation, fabrication of a bilayer metal grating in this way is much simpler and has less manufacturing costs than that of a single layer grating. Thanks to the reduction of the costs, wire-grid polarizers may find in future a wide area of applications in the optics market with their high performance, low-cost manufacturability and IC technology-compatible fabrication.

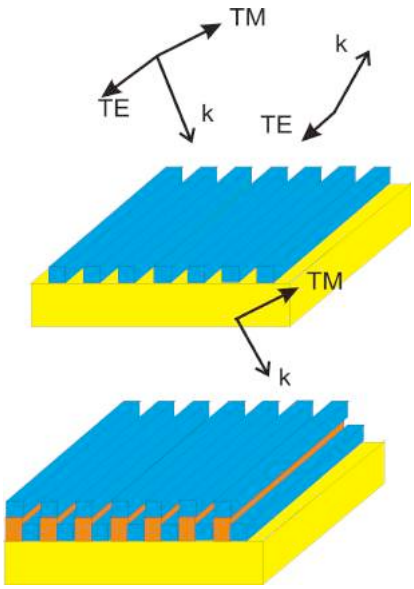



**Figure 1**:

Top: A metallic wire-grid which reflects TE-polarized light and transmits TM-polarized light.

Bottom : A schematic view of a bilayer wire-grid. Yellow: substrate, blue: metal, orange: photoresist.

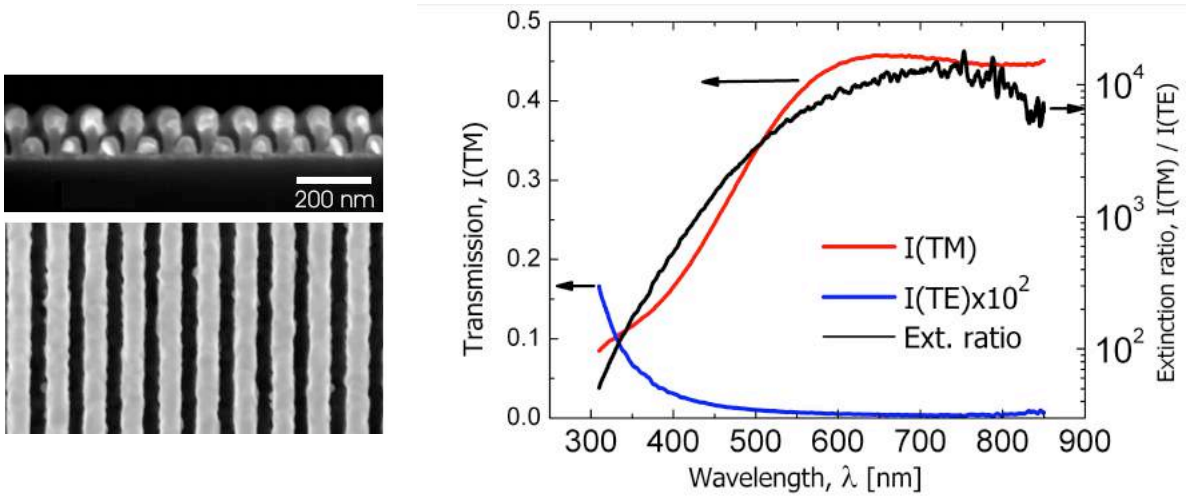



**Figure 2**. (Left) Cross-sectional and top-down SEM images of a subwavelength aluminum bilayer wire-grid grid with a period of 100 nm. (Right) Measured transmission spectra and extinction ratio.

[1] Y. Ekinci, H. H. Solak, C. David, and H. Sigg, Opt. Express **14**, 2323 (2006) (also the references there in).

# Visual Tracking for Nanorobotic Manipulation and 3D Reconstruction in an Electron Microscope

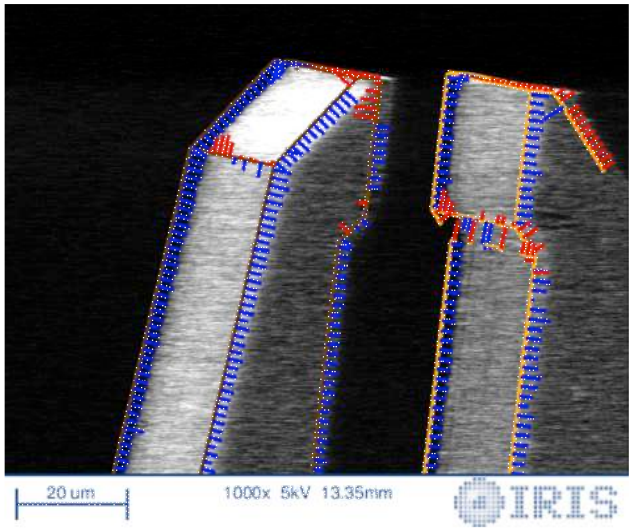
***B. E. Kratochvil***

*Institute of Robotics and Intelligent Systems, Tannenstrasse 3, ETH Zurich, 8092 Zürich, Switzerland*

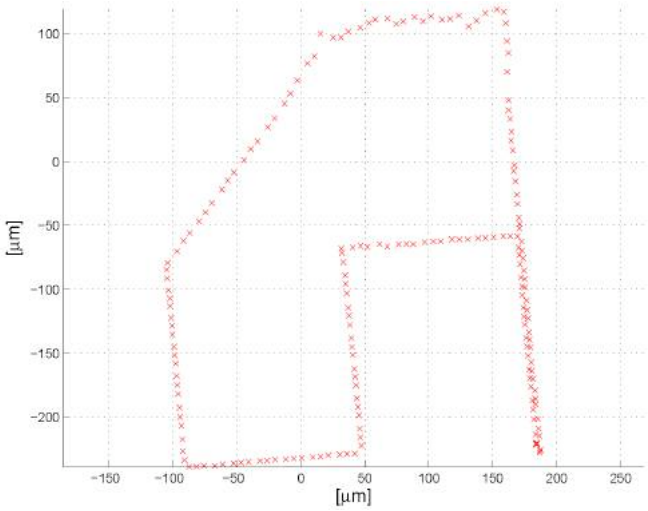
Robotics continues to provide researchers with an increasing ability to interact with objects at the nanoscale. As micro- and nanorobotic technologies mature, more interest is given to computer-assisted or automated approaches to manipulation. Although actuators are currently available that enable displacement resolutions in the subnanometer range, improvements in feedback technologies have not kept pace. Thus, many actuators that are capable of performing nanometer displacements are limited in manipulation tasks by the lack of suitable feedback mechanisms. This work proposes the use of computer vision techniques for tracking and 3D reconstruction in a scanning electron microscope to aid in enabling precise automated manipulations and measurements.

One major challenge of performing visual tracking tasks inside a scanning electron microscope is balancing the needs of image quality with real-time imaging. The sequential scanning used to create an image necessitates lower frame rates than those traditional available to computer vision applications that use optical cameras. SEM imaging quality is also highly dependent on the scale and material properties of the area being viewed. Often these parameters cannot be changed because they are directly related to the task being performed. The use of rigid models allows the user to incorporate task specific constraints into the system to improve tracking performance and stability. This system can be easily reconfigured for two or three-dimensional tracking roles. The structure of the tracking problem can additionally be analyzed for portions of the observation which have more leverage on the final tracking solution. These areas can be selectively scanned as regions-of-interest, thus alleviate one of the principle challenges to real-time operation in the SEM, frame rate.

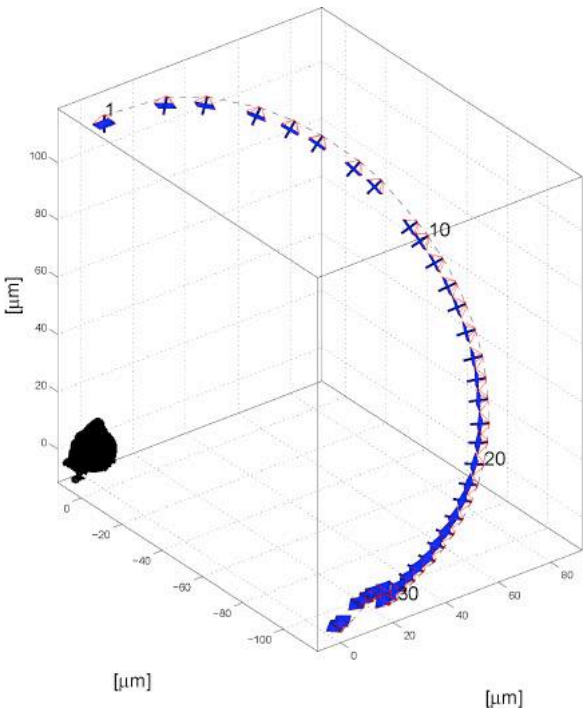
A variety of different methods exist for gathering three-dimensional information for micro- and nanoscale objects. Tilting of samples in a scanning electron microscope provides a nondestructive way of generating this data. Traditionally the reconstruction of this image data is performed by stereo photogrammetric methods which compare features from two or three frames. This work proposes the application of techniques from the structure-from-motion community as being efficient, high-precision alternatives to stereo methods which allows for automated utilization of a large number of sampled images. In addition, helical nanobelts are explored as mechanisms to generate localized rotational motion. Using this method alleviates the demand of high-precision actuators, allows 360° rotations, and provides a useful tool for micro- and nanomanipulation.



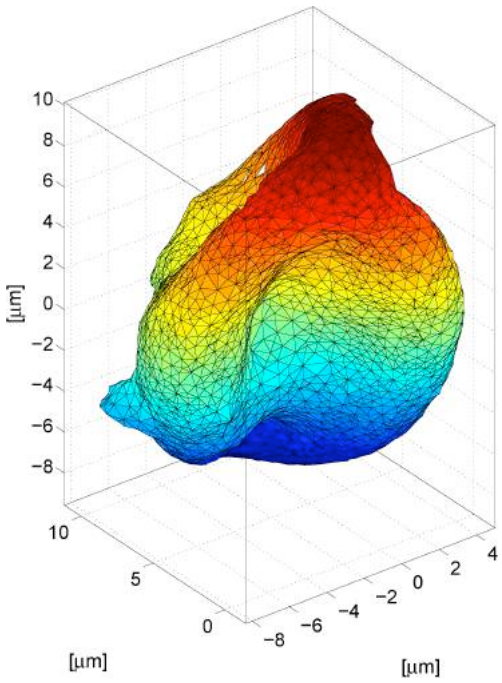

Detection of edges of a gripper




Accuracy in the micrometer region




Trajectory of positions for
sampling of images of a pollen particle




Reconstruction of a pollen particle shape

# Direct combination of nanoparticle fabrication and exposure to lung cell cultures in a closed setup as a method to simulate accidental nanoparticle exposure of humans

***Barbara Rothen-Rutishauser***[1)],
*Robert N. Grass*[2)], *Fabian Blank*[1)], *Ludwig K. Limbach*[2)], *Christian Mühlfeld*[1)], *Christina Brandenberger*[1)], *David O. Raemy*[1)], *Peter Gehr*[1)] *and Wendelin J. Stark*[2)]

[1)] *Institute for Anatomy, Division of Histology, University of Bern, Bern, Switzerland*
[2)] *Institute for Chemical and Bioengineering, D-CHAB, ETH Zurich, Zurich, Switzerland*

The tremendous application potential of nanosized materials stays in sharp contrast to a growing number of critical reports their potential toxicity. Applications of *in vitro* methods to assess nanoparticles are severely limited through difficulties in exposing cells of the respiratory tract directly to airborne engineered nanoparticles.

We present a completely new approach to expose lung cells to particles generated in situ by flame spray synthesis (Fig. 1). Cerium oxide nanoparticles from a single run were produced and simultaneously exposed to the surface of cultured lung cells inside a glove box.

Separately collected samples were used to measure hydrodynamic particle size distribution, shape and agglomerate morphology. The tightness of the lung cell monolayer, the mean total lamellar body volume, and the generation of oxidative DNA damage revealed a dose dependent cellular response to the airborne engineered nanoparticles.

The direct combination of cell culture exposure and nanoparticle production offers a reliable approach to investigate the majority of today's airborne nanoparticles and circumvents the problem of creating relevant exposure situations as traditionally encountered during in vitro experimentation using nanoparticle dispersions. Since with flame spray synthesis most of the today's known nanoparticles can be produced the potential risk of any nanoparticle on human lung cells can be assessed in a simple and reproducible way under environmental conditions.

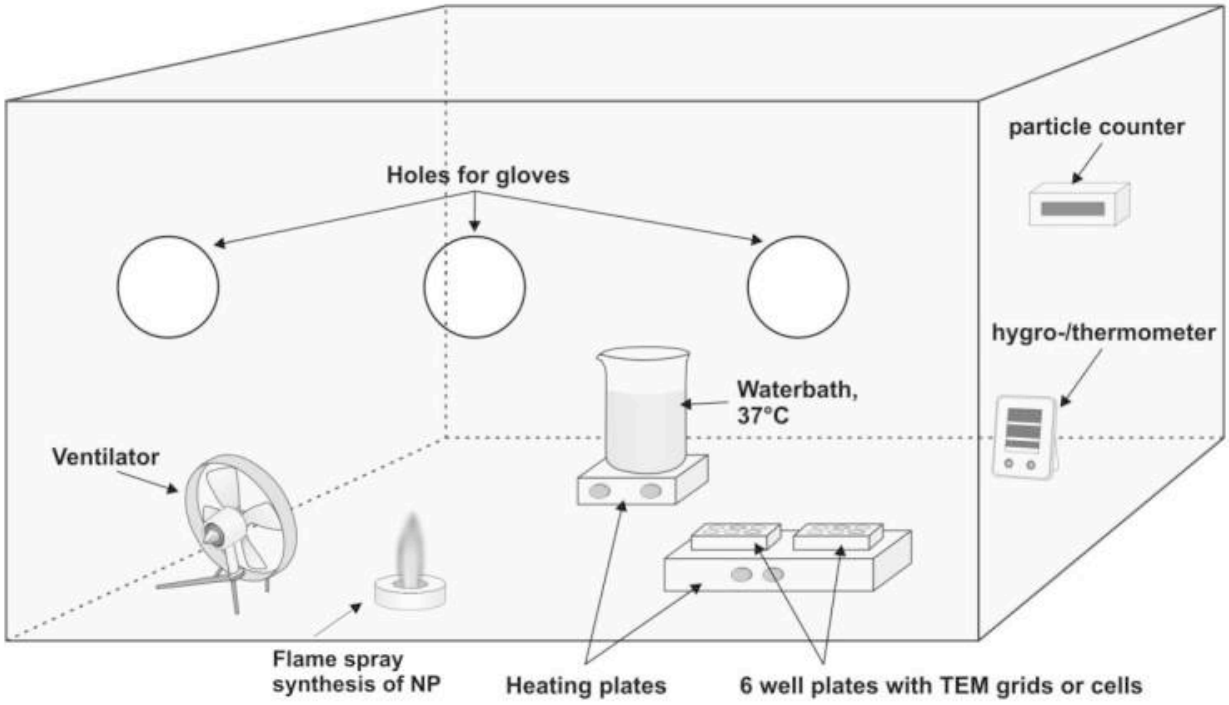



**Figure1:** The glove-box exposure set up.
Scheme of the experimental set-up of the cerium oxide production in the glove box showing flame spray synthesis within the glove box and exposure of cultured cells (Rothen-Rutishauser *et al.* 2009).

Reference:
Rothen-Rutishauser *et al.* Environ Sci Technol, 43(7):2634-2640 (2009).

This work is supported by the Lung League Bern and the Swiss National Science Foundation.

# *The impact of computers on microscopy*

Science in its larger sense designates the exact and in depth knowledge of a field of reality. In the contemporary sense the term designates modern experimental sciences which encompass such disciplines as physics, chemistry, biology, etc, in such case the term refers to the knowledge acquired through experience for understanding of the objective laws of nature and creation (1). In other terms, science is a system of acquiring knowledge based on scientific method, and to the organized body of knowledge gained through such research (1).

Science is teamwork. This is a point that experienced scientists should demonstrate to the new enthusiastic researchers who have chosen this direction, to bring their contribution to this pool of knowledge. No scientist can bring a considerable progress to the science without the support of the community of scientists.

One example of this teamwork in microscopy can be demonstrated by the impact of computers on its capacity and progress. Difficult to say from where the amazing process has started. However one thing that seems to be more probable is that microscopists first used computers to calculate the results of observations rather than to run their microscopes.

The use of computers in microscopy must have begun more than 30 years ago (2). The usage of computer programs to calculate the possible diffraction patterns of the TEM and also to simulate the high-resolution images could be given as examples of such applications. Still, nearly 20 years ago, VAX stations were used to send a batch job for the calculation of simulated HR images, the results often came after a waiting time depending on the number of jobs waiting in the queue.

The next stage was to see instruments with computer-controlled interfaces to navigate the microscope. In parallel computers were installed to analyse images and later on it was possible to acquire images, EDS spectra on SEMs and TEMs and later on even EELS spectra on line. EBSD was another example. All microscope companies used these opportunities sooner or later.

Parallel to this progress in the microscope control tools, the computers became much more powerful and with the arrival of personal computers, gradually every microscopist could acquire the data and perform calculations using image processing softwares. In materials science the calculation of the structural defects became much more powerful and we are now in a stage where methods to calculate dynamic phenomena long not foreseeable due to the slow speed of the computers are feasible (3-5). Again back to the instrumentation we are in the era of electron trajectories that are corrected using computers (6-8).

With the arrival of the computer networks to the scientific community the data became accessible at any computer post (9). Exchange of knowledge is now as rapid as the acquiring of images. The online journals are the final end to this process.

Presently, the time needed from the moment a microscopist acquires results from his/her research to the time where he/she can analyse the results and finalise the consequence of its results to a stage that is accessible to the scientific community has been extremely reduced. To compare the present situation with what was the case 30 years ago, the time saving is considerable, although not wise to quantify precisely this in this paper as it would need a very correct estimation, a rough value would be a five fold time saving if we do not consider the cases which were not even possible at that time.

Practically any scientist, any microscopist, any microscope producer, computer producer and programmer could have had a role in this progress; this is the case of all microscopy techniques including all near field microscopy techniques (such as STM and AFM) and light microscopy (10). It has been an interactive process: a real teamwork.

It is clear, despite the fact that the amount of human knowledge is considerable, the size of unknowns are still unlimited in comparison, and it is indeed the understanding of this very fact that attracts young positive souls to the science enterprise. It could be considered that each scientist has brought even if a slightest brick to this building, it is absolutely useful and absolutely needed. So let's keep this spirit for the future studies too.

*Sousan Abolhassani*
*Paul Scherrer Institut*

(1) This definition is the collection of several descriptions collected from different sources, including that of B. Elahi, and from different dictionaries.
(2) P. W. Hawkes, Ed. Computer processing of Electron Microscope Images, Springer Verlag, New York (1980).
(3) M. Samaras, M. Victoria, W. Hoffelner, 'Nuclear Energy Materials Prediction: Application of the Multiscale Modelling Paradigm', Nuclear Engineering and Technology 41, 1 (2009).
(4) R. Schäublin and N. Baluc, (2007) Nucl. Fusion 47 1690-1695 doi: 10.1088/0029-5515/47/12/007
(5) R. Schäublin , C. Hebert : http://emmm09.epfl.ch/organizers.php
(6) P. W. Hawkes, Aberration correction past and present, Phil. Trans. R. Soc. A, (2009), 367, 3637-3664, doi: 10.1098/rsta.2009.0004
(7) Ernst Ruska-Centre : http://www.er-c.org/news/publications/er-c-booklet-english.pdf
(8) CEOS : http://www.ceos-gmbh.de/index.html
(9) Berners-Lee, Tim; Cailliau, Robert (November 12, 1990). "WorldWideWeb: Proposal for a HyperText Project".
(10) Nature milestones Commentary, The impact of technology on light microscopy, David W. Piston1, 1 October 2009 | doi:10.1038/ncb1936

# *Courses and Conferences 2009*

## January

| | |
|---|---|
| 14 – 15 | **Photonics21 Annual Meeting**<br>Brussels, Belgium, www.myeos.org/events/ait2010 |
| 17 – 22 | **Winterschool 2010**<br>Practical course in advanced microscopy<br>ETH Zurich and University of Zurich, Switzerland<br>roger.wepf@emez.ethz.ch |

## April

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|---|---|
| 11 – 14 | **Biomedical Optics (BIOMED)**<br>Miami, USA, www.osa.org |
| 18 – 23 | **Functionalized Plasmonic Nanostructures for Biosensing**<br>Centro Stefano Franscini, Monte Verità, Switzerland<br>www.bioplasmonics.ethz.ch |

## June

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|---|---|
| 20 – 25 | Int.Conference on Food and Agricultural Applications of Nanotechnologies<br>**NANOAGRI 2010**<br>Sao Carlos, Brazil, nanoagri@cnpdia.embrapa.br |
| 28 – 1 July | International Conference & Exhibition<br>**Microscience 2010**<br>Exel, London, UK, www.imc17.com |
| 29 – 1 July | EOS Toptical Meeting on Laser Ablation and Nanoparticle Generation in Liquids<br>**Angel 2010**<br>Engelberg, Switzerland, www.myeos.org/events/ait2010 |
| 29 – 2 July | EOS Toptical Meeting on Advanced Imaging Techniques<br>**AIT 2010**<br>Engelberg, Switzerland, www.myeos.org/events/ait2010 |

## July

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| 23 – 28 | **International Society on Oxygen Transport to Tissue**<br>Ascona, Switzerland<br>www.isott2010.org |

## August

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| 3 – 7 | **Microscopy & Microanalysis 2010**<br>Portland, USA, www.microscopy.org/events/annualmeeting2010/index.cfm |

## September

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| 19 – 24 | **17th International Microscopy Congress (IMC)**<br>International Federation of Societies for Microscopy (IFSM)<br>Rio de Janeiro, Brazil, www.imc17.com |

## October

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|---|---|
| 26 – 29 | **EOSAM 2010, EOS Annual Meeting**<br>Paris, France, www.myeos.org/events/eosam2010 |

*For further events see also according pages on*

***www.ssom.ch www.bmpn.ch/activities.php www.opteth.ethz.ch/news/index***
***http://photonics.epfl.ch/ www.swisslaser.net/ www.myeos.org/events***

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Jahresbeiträge als / Cotisations annuelles (Zutreffendes bitte ankreuzen)
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