



e-Newsletter

of the National Center of Competence in Research on
Materials with Novel Electronic Properties / NCCR MaNEP



e-Newsletter archives

Nr. 20 / September 2009

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Editorial / Third phase: an excellent start at Les Diablerets



By Prof.
Oystein
Fischer

With MaNEP entering into its third phase we have

embarked on a new 4 years adventure together. In this phase the networking aspect of MaNEP has been reinforced and the number of members has grown considerably. Thus a great welcome to all our new members!

The stimulating atmosphere of the recent Les Diablerets meeting demonstrated the vitality of our field and showed that we are on the right track for four exciting years of science.

Three collaborators of MaNEP, Stefano Gariglio, Nicolas Reyren and Andrea Caviglia received recently the SPS Oerlikon prize 2009. They received the prize for the exceptional quality of their work on oxide interfaces.

I send them my enthusiastic congratulations.

I want also to take this opportunity to welcome our new communication officer, Adriana Bonito Aleman. Adriana is also the new editor of this newsletter and, as you can judge for yourself, she is already well installed in this job and I wish her great success for the continuation.

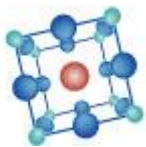
Activity report 2005-2008



The MaNEP activity report for the period 2005-2008 is available. This report contains the scientific part of the 7th progress report without all the confidential sections. It is intended to be largely spread in Switzerland and abroad to people interested in the activity of the MaNEP NCCR.

A paper version can be obtained on request to [Dr Lidia Favre-Quattropani](#).

[[link to the report](#)]



MaNEP in media

MaNEP in “Horizons”



MaNEP appears in “Horizons” this month, the Swiss National Science Foundation magazine. The article talks about NCCR. It underlines how the collaboration between

researchers is important as well as with industry. MaNEP is mentioned as an example of success.

[[read the article](#)]

Awards

Vivien Lecomte awarded



The “Journal of Physics A: Mathematical and Theoretical” has recently announced **Vivien Lecomte**, Julien

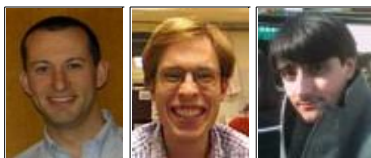
Tailleur and Jorge

Kurchan, as winners of the 2009 Best Paper Prize. The paper, entitled “Mapping out-of-equilibrium into equilibrium in one-dimensional transport models”, was chosen as it excelled in novelty, achievement, potential impact and presentation.

Congratulations to Vivien Lecomte who is working in Prof. Thierry Giamarchi's research team at the University of Geneva.

[[read the article](#)]

The SPS OC Oerlikon award



Stefano Gariglio, Nicolas Reyren and Andrea Caviglia in the group of Jean-Marc Triscone have recently received the Swiss Physical Society (SPS) OC Oerlikon award (one of the SPS prize) for the exceptional quality of their work on the superconducting interfaces. Congratulations !
For more information about their work, see article in [scientific highlights](#).

Science meetings and conference

Conference "Life and Space Sciences" By Donald Pettit, astronaut

Donald Pettit, a NASA astronaut who, among other things, stayed during several months on the international space station will deliver a conference entitled "Life and Space Sciences. Living far from our Planet : Scientific, Physiological and Psychological Stakes".

Conference will be followed by an aperitif.

Date : September 29, 2009 at 17h
Place : Ecole de physique, grand auditoire, quai Ernest-Ansermet 24, Geneva.

Tech Transfer

"Piezo-Pinch" Unigap supports researchers



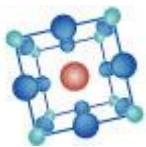
University of Geneva, through its technology transfer service called **Unitec**, has a new fund, **Unigap**, which aims to help researchers to bring their scientific discoveries to practical applications.

Prof. Christoph Renner, MaNEP deputy director, is one of the first two researchers to have benefited from this fund, with the "Piezo-pinch" technology, allowing one to measure deformations at a nanometre scale using an electrical resistance measurement. It is a particularly sensitive sensor that could be applied in various sectors.

"Piezo-Pinch" has been co-invented by: Prof. Christoph Renner, Alistair Rowe (Ecole Polytechnique de Palaiseau) and Steve Arscott (Institut d'électronique de microélectronique et de nanotechnologie de Lille).

[[more info](#)]

[[MaNEP news, page 2](#)]



Conference "A Quantum Leap for Telecommunications Today and Tomorrow" Telecom World 2009



In 2003 "Technology Review", MIT's magazine of innovation, names 10 "Emerging Technologies That Will Change the World", among which was listed Quantum Cryptography. What is the status of security in the Telecom world ?

To embrace this question, three highly regarded National Centers of Competence in Research are teaming up to organize an exceptional Event at the [Telecom World 2009](#) exhibition.

A Quantum Leap for Telecommunications Today and Tomorrow Conference

This conference will present the state of the art in the field of quantum cryptography for Telecommunications. It will also share the vision of the top researchers in this field, including the new SwissQuantum initiative.

The Event will conclude with a VIP cocktail including an artistic performance featuring superconducting levitation. A world premier.

[[link to program](#)]

[[link to registration](#)] (before Thursday October 2, 2009).

Information swissquantum@idquantique.com

Date : October 8, 2009 from 16h to 19h
Place: Room Mont-Blanc, Palexpo, Geneva.

Education

Cité des métiers et des formations Exploring Physics



MaNEP and the University of Geneva's Physics section will be present at the [Cité des métiers](#) from 24 to 29 November, at Palexpo.

This event offers a large panorama of training in the Geneva region. Our researchers and scientists will offer fun experiments and demonstrations linked to modern physics, for example levitating objects and particles detectors.

Date: from November 24 to 29, 2009
Place: Palexpo, Geneva

University of Geneva 450th anniversary Open House at the PhysiScope



During the open House organized to celebrate the 450th anniversary of the University of Geneva, the future students of the canton are invited to come and discover activities of the different faculties and centers of research.

MaNEP will open its doors and demonstrate various experiments in the [PhysiScope](#). A guided tour of labs is also planned.

Date : from November 26 to December 8, 2009
Place: Ecole de physique, quai Ernest-Ansermet 24, Geneva.

Jobs

Postdoctoral Fellow, PSI



The Paul Scherrer Institute invites applications for a Postdoctoral Fellow in the area of multiferroics.

[[full job description](#)]

Hello & Goodbye

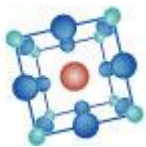


Welcome to **Pascal Cugni** who is, since July 2009, responsible of our account service in the administrative team in Geneva.



We also welcome **Adriana Bonito Aleman** in the management team in Geneva. She arrived in July 2009 and replace Anne Rougemont as our new Communication Officer.

[[MaNEP news, page 1](#)]



Scientific Highlight

Tuning the $\text{LaAlO}_3/\text{SrTiO}_3$ interface ground state using the electric field effect

By Stefano Gariglio



The electric field effect, at the heart of every electronic device, allows the carrier density to be modulated and is thus a powerful technique to explore the electronic properties of a

material. Applying this principle to switch on and off superconductivity has been a dream since the sixties. This has however proven to be a difficult task as field effect devices require an ultrathin low carrier density superconducting material in contact with a robust high permittivity gate dielectric. A particularly interesting system appeared in 2004 when Othomo and Hwang discovered that the interface between two band insulators, LaAlO_3 and SrTiO_3 , is conducting. This immediately calls to mind the two dimensional (2D) electron gas generated in semiconductor heterostructures. Correlated oxide systems are however complex materials much richer than semiconductors as Nicolas Reyren and colleagues, in the group of Jean-Marc Triscone (University of Geneva), proved in 2007 by discovering that this metallic interface undergoes a 2D superconducting transition at around 200 mK [1] [2]. The team soon realized that the configuration of this system, a low carrier density superconducting sheet, 10 nm thick, confined between two dielectrics, offers a unique opportunity for exploring the electric field modulation of superconductivity.

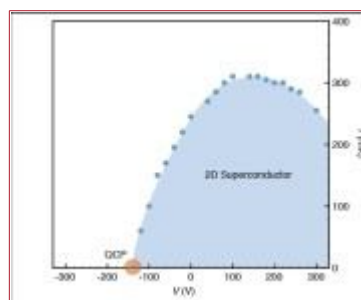


The award ceremony at Innsbruck showing Nicolas Reyren and Stefano Gariglio receiving the award from Christophe Rossel, president of the Swiss Physical Society. Andrea Caviglia was absent.

Electric field devices, realized using the SrTiO_3 crystal as a gate dielectric, have disclosed a rich phase diagram, with a quantum critical point separating an insulating ground state from a 2D superconducting state [3]. These experiments illustrate how a quantum phase transition can be driven by the application of an electric field. They also demonstrate for the first time a continuous and reversible modulation of the superconducting state.

In its annual 2009 meeting in Innsbruck, the Swiss Physical Society has recognized the prominence of these results in the award ceremony, attributing the Applied Physics Award, sponsored by OC Oerlikon, to Andrea Caviglia, Stefano Gariglio and Nicolas Reyren.

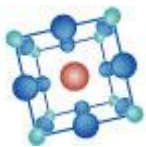
This discovery, beyond offering the possibility to study quantum phase transitions in low dimensions, opens the way to the fabrication of new mesoscopic devices where the superconducting state can in principle be switched on and off at the nanoscale.



[1] "Superconducting Interfaces Between Insulating Oxides", N. Reyren, S. Thiel, A. D. Caviglia, L. Fitting Kourkoutis, G. Hammerl, C. Richter, C. W. Schneider, T. Kopp, A.-S. Rüetschi, D. Jaccard, M. Gabay, D. A. Muller, J.-M. Triscone, J. Mannhart, *Science* 317, 1196-1199 (2007).

[2] "Superconductivity at the interface between insulating oxides", Nicolas Reyren, MaNEP E-Newsletter 14, September 2007.

[3] "Electric field control of the $\text{LaAlO}_3/\text{SrTiO}_3$ interface ground state", A. D. Caviglia, S. Gariglio, N. Reyren, D. Jaccard, T. Schneider, M. Gabay, S. Thiel, G. Hammerl, J. Mannhart & J.-M. Triscone, *Nature* 456, 624-627 (2008).



Free Column

SWM09 Diablerets Meeting : MaNEP in a nutshell

By Adriana Bonito Aleman, MaNEP communication officer



The 8th edition of the "Swiss workshop on Materials with Novel Electronic Properties" took

place on August 26, 27 and 28 in Les Diablerets. 194 participants attended and the meeting was a real success. Flash-back on a major MaNEP conference.

Initiated in 1996, this conference series preceded the existence of MaNEP itself, and was indeed its founding body. That just shows its importance.

"The objective at that time, reminds Oystein Fischer – the project initiator –, was to create a forum permitting all researchers to meet and share their scientific experiments in the field of solid state physics. We must say that, since 1986, superconductivity has had 'the wind in its sails', receiving a lot of support thanks to the discovery of the high Tc superconductors. However, around 1994, funding decreased. We had to find means to re-dynamize the field and avoid that this important energy would fade. Hence, came the idea to pool researchers in Switzerland", adds Oystein Fisher.



At that time, its founders wished to launch a new program for research, without having a precise

idea of the format. In the process came the idea to set up a national centre of competence in research and so to use Les Diablerets conference and its members to launch MaNEP. This was formalized in 2001. Les Diablerets has become the big biennial appointment that we know.

The conference objectives have sensibly evolved over time. Indeed, it still permits professors, researchers and students who take an active part in the materials with novel electronic properties field to meet. Furthermore, it strengthens the MaNEP network around a common identity. Moreover, this workshop aims at throwing new lights on topical activities in solid state physics through the invited speakers.

"We focus, as a priority, on research carried out in MaNEP, but we widen the topics to include new fields of research, mentions Christoph Renner. That was recently the case some years ago with iron-based pnictide superconductors and the interfaces".



Christoph Renner, the chair of the 2009 organizing committee, came away with positive feelings about this

event, so that he has accepted to renew the experience in two years. "We had an excellent participation, with all the main actors representing the projects of the third phase contributing", notices Christoph Renner.

'Representative', means a lot to Oystein Fischer, chair of the workshop. "Researchers submit an abstract and the program committee selects those who will give a talk and those who will present a poster. The main selection criterion is of course the scientific quality and relevance, but we also take care that groups are equitably represented".



"We must underline the quality of speakers, notes Christoph Renner, and particularly the invited talks on

subjects not always directly linked to MaNEP activities, but that are of interest for its members. Examples include Eduard Cartier's presentation on high-k dielectrics in CMOS technologies, the one of Andrea Cavalleri about innovative time resolved photon spectroscopy, or the talk of Marco Grioni on RIXS. They may open new fields of investigation for MaNEP. As for poster presentations, they are much appreciated; they allow having interactions and are a means for longer in-depth discussions".



Traditionally held in September, this conference was organized for the first time in August.

We are looking forward to the next edition on July 29, 30 and 31, 2011, with a new series of exciting contributions and lively discussions. If you would like to make suggestions about the conference organisation, do not hesitate to send them at : info@manep.ch.

Many thanks to the members of the organizing committee for their efficiency and all their efforts : Marie Bagnoud, Ginger Laughlin, Matthias Kuhn, Greg Manfrini and Ivan Maggio-Aprile.

Some figures

Participants : 194
among which 69 students
Talks : 39
Posters : 97



Publications – p1

Journal of Solid State Chemistry

Structural properties of $\text{Pb}_3\text{Mn}_7\text{O}_{15}$ determined from high-resolution synchrotron powder diffraction



By **Julia C. E. Rasch** (picture/PSI), D. V. Sheptyakov, J. Schefer, L. Keller, M. Boehm, F. Gozzo, N. V. Volkov, K. A. Sablina, G. A. Petrakovskii,

H. Grimmer, K. Conder, J. F. Löffler
Journal of Solid State Chemistry 182 (2009) 1188-1192
[[link to publication](#)]

Physical Review B

Heat production and current noise for single - and double-cavity quantum capacitors



By M. Moskalets and **M. Büttiker** (picture/UniGE)

Phys. Rev. B 80, 081302 (2009)
[[link to publication](#)]

Magnetic ordering in electronically phase-separated $\text{La}_{2-x}\text{Sr}_x\text{CuO}_{4+y}$: Neutron diffraction experiments



By L. Udby, N. H. Andersen, F. C. Chou, N. B. Christensen, S. B. Emery, K. Lefmann, J. W. Lynn, H. E. Mohottala, **Ch. Niedermayer**

(picture/PSI), and B. O. Wells
Phys. Rev. B 80, 014505 (2009)
[[link to publication](#)]

Suppression of the structural phase transition and lattice softening in slightly underdoped $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ with electronic phase separation

By D. S. Inosov, A. Leineweber, Xiaoping Yang, J. T. Park, N. B. Christensen, R. Dinnebier, G. L. Sun, **Ch. Niedermayer**, D. Haug, P. W. Stephens, J. Stahn, O. Khvostikova, C. T. Lin, O. K. Andersen, B. Keimer, and V. Hinkov
Phys. Rev. B 79, 224503 (2009)
[[link to publication](#)]

Modifying the electronic structure of semiconducting single-walled carbon nanotubes by Ar^+ ion irradiation



By Antti Tolvanen, **Gilles Buchs** (picture/EMPA), Pascal Ruffieux, Pierangelo Gröning, Oliver Gröning, and Arkady V. Krasheninnikov

Phys. Rev. B 79, 125430 (2009)
[[link to publication](#)]

Depinning of domain walls with an internal degree of freedom



By **V. Lecomte** (picture/UniGE), S. E. Barnes, J.-P. Eckmann, and T. Giamarchi

Phys. Rev. B 80, 054413 (2009)
[[link to publication](#)]

Creep dynamics of elastic manifolds via exact transition pathways



By **Alejandro B. Kolton** (picture/UniGE), Alberto Rosso, Thierry Giamarchi, and Werner Krauth

Phys. Rev. B 79, 184207 (2009)
[[link to publication](#)]

Ferromagnetism in $\text{Co}_7(\text{TeO}_3)_4\text{Br}_6$: A byproduct of complex antiferromagnetic order and single-ion anisotropy



By M. Prester, I. Živković, **O. Zaharko** (picture/UniGE), D. Pajić, P. Tregenna-Piggott, and H. Berger

Phys. Rev. B 79, 144433 (2009)
[[link to publication](#)]

Spin-glass state and long-range magnetic order in $\text{Pb}(\text{Fe}_{1-x}\text{O}_2\text{Nb}_x\text{O}_2)\text{O}_3$ seen via neutron scattering and muon spin rotation



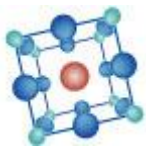
By **G. M. Rotaru** (picture/PSI), B. Roessli, A. Amato, S. N. Gvasaliya, C. Mudry, S. G. Lushnikov, and T. A. Shaplygina

Phys. Rev. B 79, 184430 (2009)
[[link to publication](#)]

Correlation of chemical coordination and magnetic ordering in $\text{Sr}_3\text{YCo}_4\text{O}_{10.5+\delta}$ ($\delta=0.02$ and 0.26)

By **D. V. Sheptyakov**, V. Yu. Pomjakushin, O. A. Drozhzhin, S. Ya. Istomin, and E. V. Antipov
Phys. Rev. B 80, 024409 (2009)
[[link to publication](#)]

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Publications – p2

Physical Review Letters

Magnetic-Field-Enhanced Incommensurate Magnetic Order in the Underdoped High-Temperature Superconductor $\text{YBa}_2\text{Cu}_3\text{O}_{6.45}$

By D. Haug, V. Hinkov, A. Suchaneck, D. S. Inosov, N. B. Christensen, **Ch. Niedermayer**, P. Bourges, Y. Sidis, J. T. Park, A. Ivanov, C. T. Lin, J. Mesot and B. Keimer
Phys. Rev. Lett. vol. 103, 017001 (2009)
[[link to publication](#)]

Magnetic-Field-Induced Soft-Mode Quantum Phase Transition in the High-Temperature Superconductor $\text{La}_{1.855}\text{Sr}_{0.145}\text{CuO}_4$: An Inelastic Neutron-Scattering Study



By **J. Chang** (picture/PSI), N. B. Christensen, Ch. Niedermayer, K. Lefmann, H. M. Ronnow, D. F. McMorrow, A. Schneidewind, P. Link, A. Hiess,

M. Boehm, R. Mottl, S. Pailhe's, N. Momono, M. Oda, M. Ido, and J. Mesot
Phys. Rev. Lett. vol. 102, 177006 (2009)
[[link to publication](#)]

Anomalous Magnetic Excitations of Cooperative Tetrahedral Spin Clusters



By **K. Prsa** (picture/PSI), H. M. Ronnow, O. Zaharko, N. B. Christensen, J. Jensen, J. Chang, S. Streule, M. Jimenez-Ruiz, H. Berger, M. Prester,

and J. Mesot
Phys. Rev. Lett. vol. 102, 177202 (2009)
[[link to publication](#)]

Quantum Effects in a Weakly Frustrated $S = 1/2$ Two-Dimensional Heisenberg Antiferromagnet in an Applied Magnetic Field



By **N. Tsyulin** (picture/PSI), T. Pardini, R.R.P. Singh, F. Xiao, P. Link, A. Schneidewind, A. Hiess, C. P. Landee,

M. M. Turnbull, M. Kenzelmann
Phys. Rev. Lett. vol.102, 197201 (2009)
[[link to publication](#)]

Universal detector efficiency of a mesoscopic capacitor

By Simon E. Nigg and **Markus Büttiker**
Phys. Rev. Lett. vol. 102, 236801 (2009)
[[link to publication](#)]

Reduced and projected two-particle entanglement at finite temperature

By Peter Samuelsson, Izhar Neder, and **Markus Büttiker**
Phys. Rev. Lett. vol. 102, 106804 (2009)
[[link to publication](#)]

Two-particle non-local Aharonov-Bohm effect from two single-particle emitters

By Janine Splettstoesser, Michael Moskalets, and **Markus Büttiker**
Phys. Rev. Lett. vol.103, 076804 (2009)
[[link to publication](#)]

Coupled Magnetic and Ferroelectric Domains in Multiferroic $\text{Ni}_3\text{V}_2\text{O}_8$



By I. Cabrera, **M. Kenzelmann** (picture/PSI), G. Lawes, Y. Chen, W.C. Chen, R. Erwin, T.R. Gentile, J.B. Leao, J.W. Lynn, N. Rogado, R.J. Cava, and C. Broholm

Phys. Rev. Lett. vol. 103, 087201 (2009)
[[link to publication](#)]

Orbital Order at Mn and O Sites and Absence of Zener Polaron Formation in Manganites



By **M. García-Fernández** (picture/PSI), U. Staub, Y. Bodenthin, V. Scagnoli, V. Pomjakushin, S. W. Lovesey,

A. Mirone, J. Herrero-Martín, C. Piamonteze, and E. Pomjakushina
Phys. Rev. Lett. 103, 097205 (2009)
[[link to publication](#)]

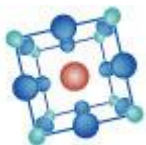
Direct Observation of Charge Order and an Orbital Glass State in Multiferroic LuFe_2O_4



By A. M. Mulders, S. M. Lawrence, **U. Staub** (picture/PSI), M. Garcia-Fernandez, V. Scagnoli, C. Mazzoli, E. Pomjakushina, K. Conder, and

Y. Wang
Phys. Rev. Lett. 103, 077602 (2009)
[[link to publication](#)]

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Publications – p3

Gate Tunable Infrared Phonon Anomalies in Bilayer Graphene



By **A. B. Kuzmenko** (picture/UniGE), L. Benfatto, E. Cappelluti, I. Crassee, D. van der Marel, P. Blake, K. S. Novoselov, and A. K. Geim

Phys. Rev. Lett. 103, 116804 (2009)
[[link to publication](#)]

Mapping the Electronic Surface Potential of Nanostructured Surfaces



By **P. Ruffieux** (picture/EMPA), K. Ait-Mansour, A. Bendounan, R. Fasel, L. Patthey, P. Gröning, and O. Gröning

Phys. Rev. Lett. 102, 086807 (2009)
[[link to publication](#)]

Electron Scattering in Intrananotube Quantum Dots

By **G. Buchs** (picture/EMPA), D. Bercioux, P. Ruffieux, P. Gröning, H. Grabert and O. Gröning
Phys. Rev. Lett. 102, 245505 (2009)
[[link to publication](#)]

Collective Magnetic Excitations in the Spin Ladder $\text{Sr}_{14}\text{Cu}_{24}\text{O}_{41}$ Measured Using High-Resolution Resonant Inelastic X-Ray Scattering



By J. Schlappa, **T. Schmitt** (picture/PSI), F. Vernay, V. N. Strocov, V. Ilakovac, B. Thielemann, H. M. Ronnow,

S. Vanishri, A. Piazzalunga, X. Wang, L. Braicovich, G. Ghiringhelli, C. Marin, J. Mesot, B. Delley, and L. Patthey
Phys. Rev. Lett. 103, 047401 (2009)
[[link to publication](#)]

Dynamical Properties of the One-Dimensional Spin-1/2 Bose-Hubbard Model near a Mott-Insulator to Ferromagnetic-Liquid Transition



By **M. B. Zvonarev** (picture/UniGE), V. V. Cheianov, and T. Giamarchi

Phys. Rev. Lett. 103, 110401 (2009)
[[link to publication](#)]

Science

Edge-state physics without magnetic fields

By **Markus Büttiker**
Science, vol. 325, no. 5938, pp.278-279 (2009)

[[link to publication](#)]

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MaNEP is a long term research programme which gathers 250 scientists from Swiss universities and industry to study new electronic materials which are at the forefront of future technologies.

MaNEP is hosted by the



MaNEP is a research instrument of the



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Calendar

Conference "Life and Space Sciences" By Donald Pettit, astronaut

September 29, 2009 at 17h

Ecole de physique, Geneva

[Learn more : <http://www.manep.ch/en/events/index.html>]

MaNEP takes part in Telecom World 2009

October 8, 2009 from 16h to 19h

Palexpo, Geneva

[[Learn more](#)]

JUM@P '09: First Joint Users' Meeting at PSI 2009

October 12-13, 2009 at PSI

[Learn more : <http://user.web.psi.ch/jump09/html/index.shtml>]

JUM@P '09 - Correlated electron systems

October 13, 2009 at PSI

[Learn more : http://user.web.psi.ch/jump09/html/correl_symp.shtml]

Cité des métiers et des formations

November 25-27, 2009

Palexpo, Geneva

[Learn more : <http://www.manep.ch/en/events/index.html>]

University of Geneva 450th anniversary Open House at the Physiscope for future students

From November 26 to December 8, 2009

Ecole de physique, Geneva

[Learn more : <http://www.manep.ch/en/events/index.html>]