

# Plenary Session

Monday, 30.06.2014, Room 002

| Time                | ID | <p style="text-align: center;"><b>PLENARY SESSION I</b><br/>Chair: Minh Quang Tran, EPFL-CRPP</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| 12:55               |    | <b>OFFICIAL OPENING OF THE SPS ANNUAL MEETING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 13:00<br>-<br>13:40 | 1  | <p style="text-align: center;"><b>Climate change and mountain water resources:<br/>results from the European "ACQWA" project</b></p> <p style="text-align: center;"><i>Martin Beniston, Institute for Environmental Science and Department of Physics, Uni Genève (p)</i></p> <p>As the evidence for human induced climate change becomes clearer, so too does the realization that its effects will have impacts on socio-economic systems and terrestrial ecosystems. Some regions are more vulnerable than others, both to expected physical changes and to the consequences they will have for ways of life. Mountain regions are recognized as particularly sensitive physical environments where the impacts of a changing climate may be large with respect to the quantity and quality of water originating in mountains, particularly where snow- and ice melt represent a large, sometimes the largest, streamflow component. There, they represent a local resource (freshwater supply, hydropower generation, irrigation), but in most cases also considerably influence the runoff regime of the downstream rivers and the related water availability. Increasing evidence of glacier retreats, permafrost reduction and snowfall decrease have been observed in many mountainous regions, thus suggesting that climate modifications may seriously affect streamflow regimes, in turn threatening the availability of water resources, increasing the downstream landslide and flood risk, impacting hydro-power generation, agriculture, forestry, tourism and, last but not least, water dependent ecosystems. The European ACQWA project, coordinated by the University of Geneva, has investigated many of these key issues related to water since 2008, and some main results will be presented.</p> |
| 13:45               |    | <b>Topical Sessions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 16:00               |    | <b>Coffee Break</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 16:30               |    | <b>Topical Sessions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 18:15               |    | <b>Postersession and Apéro</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                     |    | <p style="text-align: center;"><b>PUBLIC LECTURE</b><br/>Chair: Andreas Schopper, CERN</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 20:15               | 11 | <p style="text-align: center;"><b>The Higgs boson and our life</b></p> <p style="text-align: center;"><i>Fabiola Gianotti, CERN (p)</i></p> <p>On 4 July 2012, the ATLAS and CMS experiments operating at the CERN Large Hadron Collider (LHC) announced the discovery of a new particle compatible with the Higgs boson (hunted for almost 50 years), which is a crucial piece for our understanding of fundamental physics and thus the structure and evolution of the universe.</p> <p>This lecture describes the unprecedented instruments and challenges that have allowed such an accomplishment, the physics meaning and relevance of this discovery, and the implications for our day-by-day life.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 21:30               |    | <b>END</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Time  | ID | <b>PLENARY SESSION II</b><br><i>Chair: Hans Peter Beck, Uni Bern</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| 09:00 | 2  | <p style="text-align: center;"><b>The next life of silicon</b></p> <p style="text-align: center;"><i>Gabriel Aeppli, PSI &amp; ETHZ &amp; EPFL (p)</i></p> <p>The 20<sup>th</sup> century has been distinguished by the silicon-based information revolution, where bits are encoded as charges which are manipulated and stored via field effect transistors. The continued exponential growth of information technology based on straightforward extrapolations of this paradigm is not guaranteed, and there has therefore been a search for both alternative paradigms and materials. The new paradigms entail exploitation of spin and orbital degrees of freedom, including related quantum phenomena. While "exotic" materials have been successfully used to demonstrate some of the associated physics, we show here that silicon may be an excellent host for the new effects. In particular, laser cooling and electromagnetic traps have led to a revolution in atomic physics, yielding dramatic discoveries ranging from Bose-Einstein condensation to quantum control of single atoms. Because it is a semiconductor of extraordinary cleanliness which can be acquired at reasonable cost, silicon can also be thought of as an atom trap. We describe here the beginnings of the science of silicon as atom trap, where the trapped atoms are the donor impurities. Key tools, enabling the visualization and manipulation of the impurity quantum states, are free electron lasers and scanning tunneling microscopes.</p> |
| 09:40 | 3  | <p style="text-align: center;"><b>Neutrino Astronomy at its sunrise</b></p> <p style="text-align: center;"><i>Teresa Montaruli, Uni Genève (p)</i></p> <p>The observation of the violent and high-energy events in the universe requires a powerful new messenger to understand how matter is accelerated, the neutrino. This is also a powerful probe for dark matter and a particle that has and will challenge physicists due to its complex and elusive nature. Recently, IceCube observed a hard diffuse component of astrophysical neutrinos on top of the atmospheric neutrino and muon backgrounds. Not only the significance of the discovery is increasing with statistics, but also it is being found in different analysis. We need more work to understand the directions of the astrophysical neutrinos but these first results already mark the beginning of neutrino astronomy. My talk will describe these results and their impact.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 10:20 |    | <b>Coffee Break</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|       |    | <i>Chair: Antoine Weis, Uni Fribourg</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 10:50 | 4  | <p style="text-align: center;"><b>Precision Spectroscopy of Atomic Hydrogen</b></p> <p style="text-align: center;"><i>Thomas Udem, MPQ Garching (p)</i></p> <p>Precise determination of transition frequencies of simple atomic systems are required for a number of fundamental applications such as tests of quantum electrodynamics (QED), the determination of fundamental constants and nuclear charge radii. The sharpest transition in atomic hydrogen occurs between the metastable 2S state and the 1S ground state. Its transition frequency has now been measured with almost 15 digits accuracy using an optical frequency comb and a cesium atomic clock as a reference. A recent measurement of the Lamb shift in muonic hydrogen is in significant contradiction to the hydrogen data if QED calculations are assumed to be correct. We hope to contribute to the resolution of this so called "proton size puzzle" by providing additional experimental input from the hydrogen side.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 11:30 |    | <b>Award Ceremony</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 12:00 | 21 | <b>Winner of the SPS ABB Award (i)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 12:30 |    | <b>Postersession (continued) with Lunchbuffet</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 14:00 |    | <b>Topical Sessions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 19:30 |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 19:45 |    | <b>Conference Dinner</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Time  | ID | PLENARY SESSION III<br><i>Chair: NN</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| 09:00 | 5  | <p><b>Attosecond science of solids and solid interfaces</b></p> <p><i>Lukas Gallmann, Uni Bern &amp; ETH Zürich (p)</i></p> <p>Attosecond science provides the tools to time-resolve some of the fastest electronic processes in nature. Studying the dynamics of fundamental ionization mechanisms has been one of the main interests in the field. However, the extension of attosecond methods beyond the gas phase and towards solid-state systems has proven to be challenging. I will introduce the experimental tools available for this task and how our new approach to attosecond experiments on solid surfaces overcomes important limitations of previous techniques. Our method enabled us to obtain energy-resolved absolute photoemission delays from clean noble metal surfaces for the first time. Our data reveals clear evidence for the influence of bulk resonances on the dynamics of the photoemission process. This is in contrast to the theoretical interpretation used for earlier, energy-integrated results and indicates that the dynamics of photoemission is more complex than initially suggested.</p> |
| 09:40 | 6  | <p><b>Pattern Formation and Collective Phenomena in Biological Systems</b></p> <p><i>Erwin Frey, LMU München (p)</i></p> <p>Reaction-diffusion dynamics endows cells with the capacity for accurate positioning, control of length, and timing of processes. Protein systems in cells employ different types of spatio-temporal patterns to ensure precise cell division and guide intracellular processes. The length of biopolymers is regulated by the interplay between polymerization kinetics and patterns of molecular motors. Under which conditions protein patterns emerge, and how these patterns are regulated by biochemical and geometrical factors are major aspects of current research. We will discuss general design principles of such biological pattern forming systems.</p>                                                                                                                                                                                                                                                                                                                                      |
| 10:20 |    | <b>Coffee Break</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|       |    | <i>Chair: Gian Michele Graf, ETH Zürich</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 10:50 | 7  | <p><b>Quantum Annealing and the D-Wave Devices</b></p> <p><i>Matthias Troyer, ETH Zürich (p)</i></p> <p>Quantum annealing - a finite temperature version of the quantum adiabatic algorithm - combines the classical technology of slow thermal cooling with quantum mechanical tunneling, to try bring a physical system towards its ground state. The Canadian company D-Wave systems has recently built and sold programmable devices that are designed to use this effect to find solutions to hard optimization problems. I will present results of experiments designed to shed light on crucial questions about these controversial devices: are these devices quantum or classical? Are they faster than classical devices? What is their potential?</p>                                                                                                                                                                                                                                                                                                                                                                        |
| 11:30 |    | <b>Best Poster Awards</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 11:45 |    | <b>General Assembly</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 12:00 |    | <b>Lunchbuffet</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 13:00 |    | <p><b>60 Years CERN Ceremony</b></p> <p><i>Details see p. 9</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 15:00 |    | <b>Topical Sessions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 18:30 |    | <b>END</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |