Newsletter, 29 April 2021

Dear Reader,

This Newsletter is intended for all SPS members, researchers, industries, students, interested specialists and physics friends. Feel free to share this Newsletter within your community, and follow this link if you want to add a person to our mailing list.

If you wish to give your contribution with news or suggestions, please do not hesitate to contact me at: margherita.boselli@cern.ch

Kind regards,

Margherita Boselli

WHAT'S UP IN SWITZERLAND?

Joint Annual Meeting of the Swiss and Austrian Physical Societies - call for abstracts

The 2021 Annual Meeting is organized by the Swiss Physical Society and the Austrian Physical Society jointly to continue the well established tradition of holding the respective meetings together every two years, alternating the conference location between Switzerland and Austria. This year's edition will take place in Austria in the week **30 August - 3 September** at the "Campus Technik" of the University of Innsbruck, and the plan is to hold the conference in the usual way (in presence). The scientific program is enriched by the direct contributions of the Swiss Institute for Particle Physics (CHIPP) and the SFB BeyondC consortium. Thanks to all these collaborations, the joint Annual Meeting will offer again an exciting program, covering latest advancements of physics in a wide range of fields at its best.

We encourage you to submit your contributions and to register to the event, the important dates to keep in mind are:

- **Abstract submission deadlines, 31 May 2021**
- **Registration deadline, 10 August 2021**

After the very difficult year we all went through, we are looking forward to meeting you in Innsbruck! For more information please visit the dedicated section of our website.

Call for nominations for the Charpak-Ritz Prize 2022

The **Charpak-Ritz Prize** is awarded by the French Physical Society and the Swiss Physical Society in memory of **Georges Charpak** and **Walther Ritz** who both have profoundly contributed to physics in their respective times.

The prize distinguishes exceptional contributions in

physics or in its development to honor, in odd years, a physicist (or a small team of physicists) who has produced significant contribution in France, and, in even years, a physicist (or a small team of physicists) who has produced significant contributions in Switzerland.

Our Society is inviting nominations for the **Charpak-Ritz Prize 2022** to honour significant contributions achieved in Switzerland. The nomination file should include the usual items (CV, laudation, list of publications as well as the most important publications, reference letters, …), and we remind you that self-nominations will not be considered. The dossiers shall be sent to awards[at]sps.ch as PDF files with the mention "Nomination for the Charpak-Ritz prize 2022" **by May 31 2021**.

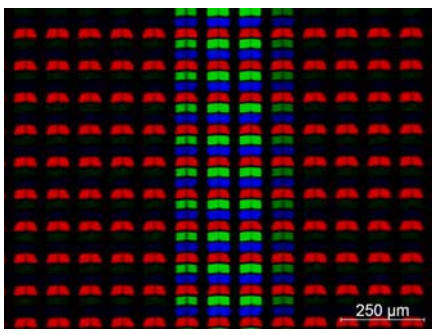
A short-list of the three best evaluated candidates will be sent to the French Physical Society, who will take the final decision.

Roadmaps for research infrastructures

On a mandate of the Confederation, the Swiss Academy of Sciences (SCNAT) elaborated a series of thematic roadmaps for research infrastructures together with the scientific communities by March 31 2021. The Swiss Roadmap for Research Infrastructures is a planning instrument for research infrastructures updated by the State Secretariat for Education, Research and Innovation (SERI) every four years in preparation for the ERI (Education, Research and Innovation) Dispatch. It gives an overview of future needs and likely developments in different areas of research, including **Particle Physics, Photon Science and Neutron Science**. The roadmaps, coordinated by SCNAT since 2019, will serve as a basis for the 2021–2024 ERI Dispatch.

Image from SCNAT press release.

Technological, data, media literacy in the science classroom

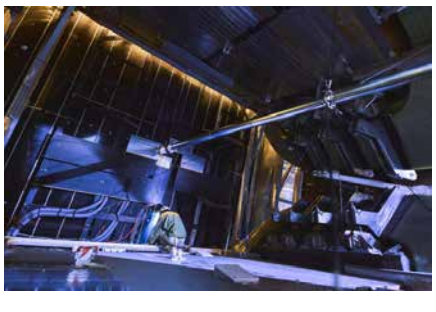


The Berzelius project is an interdisciplinary science education approach offering an outstanding, borrowable high-tech instrument park and dedicated theme-oriented multimedia laboratory journals (MLJs). A team of highly skilled science educators elaborates these MLJs using high-class videos, graphics and audios to get students hands on the lendable high-tech instruments that are generally far beyond school reach.

The fusion of instruments and MLJs similarly aims at fueling students' sense of wonder and excitement, demonstrating straightforward scientific concepts and theories and at developing technological, data and media literacy. By arousing students` ability to question scientific topics in big data context, «Berzelius» is an invaluable product in modern science education. The MLJs are full to the brim with selectable digressions from literature, philosophy, art and other related areas, so that the multimedia experience can be tailored to the specific school needs. Last but not least, highly skilled students have the possibility to express their experimental findings in MLJs preparing them for later science careers.

Image from the Berzelius Project.

Recent results from LHCb challenge the Standard Model - the Swiss contribution



As reported in the last edition of our Newsletter, the LHCb experiment reported an intriguing result that strengthens hints of a violation of lepton flavor universality in b-decays involving muons or electrons. Members of the group at the University of Zurich led

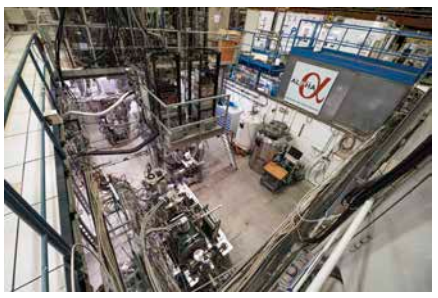
by Prof. Nicola Serra were part of the small team of researchers that worked directly on the measurement. Since the start of data taking in 2009, the Zurich group has played a leading role in measurements of decays of particles containing beauty quarks. The latest measurement is the latest of a set of consistent deviations from the predictions observed in decays of beauty quarks by LHCb with researchers from Zurich at the forefront of many of these measurements.

Switzerland is in an exceptional position of not only having a strong group leading the measurements of rare b decays, but also having a theory group led by Prof. Gino Isidori working on the theoretical description of these decays. His group deals with some of the most interesting open questions about the nature of basic constituents of matter and their fundamental interactions, closely connected to the research questions of the LHCb experiment. A close and fruitful collaboration occurs also with Prof. Andreas Crivellin, based at PSI. His group is deeply involved in understanding the possible implications of these results for other experiments. In particle physics, the gold standard for discovery is five standard deviations, corresponding to a probability of less than 0.00003% for a statistical fluctuation, and so it is too early to draw a final conclusion. However, this deviation agrees with a pattern of anomalies which have manifested themselves over the last decade. Fortunately LHCb is well placed to clarify the potential existence of new physics effects in these decays, with many related measurements in the future.

For more information: LHCb preprint, and LHCb news.

Image: opening of the LHCb detector in 2018, from LHCb/CERN.

Laser cooling of Antimatter at the CERN's ALPHA experiment



On March 31 2021, the CERN's ALPHA collaboration announced their successful attempt in cooling down antihydrogen atoms using laser light. This historical result has been published on Nature on the same day. The technique used in this experiment, known as laser cooling, was first demonstrated 40 years ago on normal matter and is applied in many research fields. Its first application on antihydrogen paves the way to considerably more precise measurements of the internal structure of antihydrogen and of how it behaves under the influence of gravity. Comparing such measurements with those of the well-studied hydrogen atom could reveal differences between matter and antimatter atoms. Such differences, if present, could shed light on why the universe is made up of matter only, an imbalance known as matter–antimatter asymmetry.

At the ALPHA experiment, antihydrogen is produced by taking antiprotons from the CERN's Antiproton Decelerator and binding them together with positrons originating from a sodium-22 source. The resulting antihydrogen atoms are then confined in a magnetic trap, which prevents them from coming into contact with matter and annihilating.

For more information: CERN press-release, and CERN video News release.

Image: view of the ALPHA experiment (CERN).

WHAT'S UP IN EUROPE?

Bonn Declaration on Freedom of Scientific Research

At the end of March 2021 all 27 EU Member States have signed the Bonn Declaration on Freedom of Scientific Research, a document that provides the common basis for taking further steps to protect the fundamental values of the European Research Area (ERA). The Bonn Declaration was initiated in October 2020 under the German Presidency of the European Council and, due to the coronavirus pandemics, not all Member States were able to sign the declaration at the Ministerial Conference on the ERA in Bonn. The

declaration was therefore circulated subsequently to the Member States in order to collect the missing signatures. International partners including Switzerland also support the declaration.

By signing the Bonn Declaration all EU Member States and the European Commission have confirmed their common understanding and commitment to freedom of scientific research. Researchers must have the freedom to define their research topics, determine research methods and select public platforms.

WHAT'S UP IN THE WORLD?

2021 International Day of Light

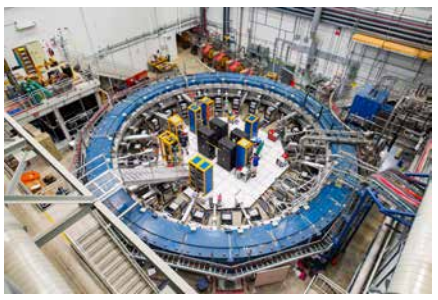
The International Day of Light (IDL) is a global initiative, supported by UNESCO, that provides an annual focal point for the continued appreciation of light and the role it plays in science, culture and art, education, and sustainable development, and in fields as diverse as medicine, communications, and energy. The event is held on May 16 every year in occasion of the anniversary of the first successful operation of the laser in 1960 by physicist and engineer, Theodore Maiman. The laser is a perfect example of how a scientific discovery can yield revolutionary benefits to society in communications, healthcare and many other fields. Ahead of this year's International Day of Light celebration, the International Day of Light Steering Committee announces the launch of the Trust Science pledge, a worldwide campaign to promote support for the scientific process and to acknowledge the many benefits of science for society.

United Nations Educational, Scientific and Cultural Organization

International Day of Light 16 May

The registration of events organized in different countries on and around 16 May 2021 is still open. One specific contribution from Switzerland will be the Stellarium Gornergrat, a remote control observatory for educational and amateur/citizen science purposes, and a range of selected offers (hands-on experiments, out-of-school educational offers, historical aspects) will be available on a dedicated page of the SPS website.

Important results from the Muon g-2 experiment at Fermilab



On April 7 2021 the Muon g-2 experiment at the U.S. Department of Energy's Fermi National Accelerator Laboratory released the results of the first run of measurements, started in 2018. The analysis shows that muons, fundamental particles, very similar to the electrons but approximately 200 time heavier, behave in a way that is not predicted by the Standard Model of particle physics. This result, made with unprecedented precision, confirms a discrepancy that has been gnawing at researchers for decades.

The Muon g-2 experiment searches for telltale signs of new particles and forces by examining the muon's interaction with a surrounding magnetic field. By precisely determining the magnetic moment of the muon and comparing with similarly exact theoretical predictions, the experiment is sensitive to new physics lurking in the subatomic quantum fluctuations surrounding the muon. The Muon g-2's predecessor experiment at DOE's Brookhaven National Laboratory, which concluded in 2001, offered hints that the muon's behavior disagreed with the Standard Model. The new measurement from the Muon g-2 experiment at Fermilab strongly agrees with the value found at Brookhaven and diverges from theory with the most precise measurement to date. The combined results from Fermilab and Brookhaven show a difference with theory at a significance of 4.2 sigma, but the data analysis on the second and third runs of the experiment is under way, the fourth run is ongoing, and a fifth run is planned. Combining the results from all five runs will give scientists an even more precise measurement of the muon's magnetic moment, revealing with greater certainty whether new physics is hiding behind the corner.

The full press release is available here, the scientific paper appeared on Physical Review Letters is here, and at this link you will find an interesting video that explains the observations.

The Swiss Physical Society (SPS) unites persons interested in physics from university, schools, research, development and industry. The SPS promotes the scientific exchange of ideas in Switzerland and with its international environment.