Swiss Institute of Particle Physics

an Association according to Swiss law

Annual Report 2022

Participants at the CHIPP Annual meeting 2022, Fribourg.

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4 February 2022/AB

This report is to be delivered to SCNAT and is thus structured along the SCNAT guidelines.

SUMMARY

Highlights of the Year

This year CHIPP had many highlights, one of which was the Annual CHIPP meeting. This year it was held along with the SPS, the NCCR Bio-inspired material and the Swiss Neutron Science societies at the end of June in the Fribourg University. During the first day of the meeting CHIPP held its Board meeting while the young CHIPP members organised their ECR meeting. For lunch, the whole community was invited for a buffet where senior members and young ones had the opportunity to meet and discuss. In the afternoon, everybody joined the Annual Plenary meeting where reports of the activities of various committees were presented. The reports from the representatives can be found on the public webpage: The CHIPP/CHAPS working group, The Gravitational Waves Working Group, The CHIPP Computing group European Committee for Future Accelerators, the International Particle Physics Outreach Group, the Astroparticle Physics European Consortium (APPEC) and the Advisory Committee of CERN Users (ACCU). For three days presentations were scheduled from the CHIPP PhD students and postdocs (SPS website), which covered the three pillars of physics: particle physics at the high-energy and intensity frontiers, astroparticle physics, and neutrino physics. The last day of the meeting a satellite event: Women in Physics Career Symposium was organised. The goal of this symposium is to boost women in the early career stage, starting from undergraduate up to postdoctoral studies, by building a professional and mentoring network in physics. Among the mentors: Annapaola de Cosa (ETHZ).

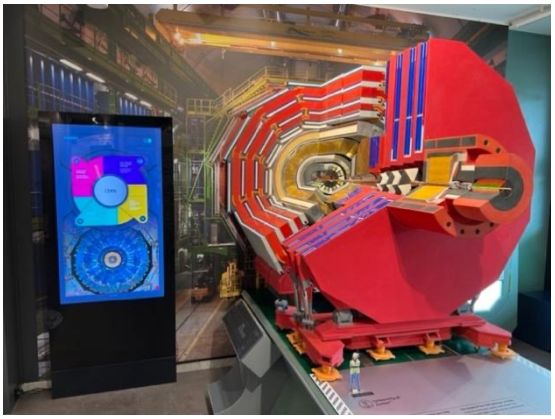
At the SPS award ceremony where all winners of the various SPS prizes were honoured, the CHIPP prize for the best 2022 PhD thesis work in particle physics was awarded to Guillaume Pietrzyk, scientist at the École Polytechnique Fédérale de Lausanne (EPFL). Guillaume received the award for his doctoral thesis on his experimental studies within the LHCb collaboration. His work led to determine with unprecedented precision the rare phenomenon of particle-antiparticle oscillation in the neutral charm-meson system.

Another very successful event organized in parallel in several institutes was connected to the discovery of the Higgs boson 10 years ago.
In Zurich, the University of Zurich (Ben Kilminster and Katharina Müller) organized a dedicated walk on the 3-4 July 2022 in Irchel park. Along the path, 10 posters introducing particles, interactions and LHC, FCC and the experiments were set up.
The link at the event web page is here.

- What is an atom made of?
- What connects particle physics with pyramids?
- Is it true that antimatter is used in medicine?
- What exactly is the Higgs particle and how is it searched for?

These are just some of the questions addressed on this walk. UZH physicists were there to answer questions and guided tours were offered.

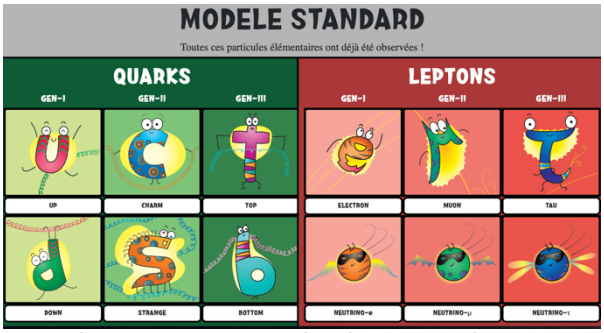
The event had a discrete success; private citizens and two school classes participated, with the advertisement of the event being done mainly via social media and direct invitations sent to the schools. All the participants received a present of a set of particle cards.

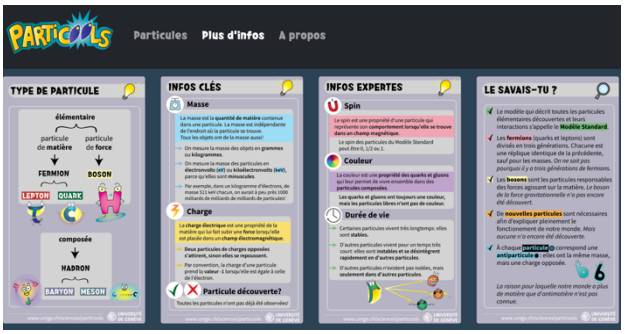


In Geneva, two main events were organized, one under the supervision of Anna Sfyrla (DPNC department) and the other under the supervision of Francesco Riva (Theory department).

Sfyrla collaborated with a graphic designer and proposed a particle physics card game. The interactive card game is also available on the dedicated website.
Riva presented a card game at the Nuit de la Science in Geneva, the 9-10 July 2022. The game was partially funded by an SNSF Agora grant, inspired by Feynman diagrams and the Higgs boson is the card that gives most points; more information can be found here.

The game was enthusiastically received, and later in the year Riva presented it to high-school students in Geneva. The Night of Physics 2022 also attracted many visitors in PSI and Zurich:





UZH physicists were involved in two other events with large visibility: Science and Nature Day, where the LHC experiments were explained and visitors could 'see' particles in cloud chambers and the 'Long night of Museums' with a well attended talk on particle physics and a fascinating dance illustrating the collision of protons.

PSI, in collaboration with ETHZ organised events for the Night of Physics 2022, with more than 10,000 visitors, link and photos. The Kirch group attended the "Night of Physics" June 17, 2022 and the Wallny group at "Night of Physics" organised the stand/exhibit (see the description below: One cup of Cherenkov).

During 2022, the CHIPP Executive Board and the CHIPP Board were very active in pursuing what started in 2020, with the conclusions stated by the European particle physics strategy update (EPPSU). EPPSU concluded that 'an electron-positron Higgs factory is the next highest-priority collider. For the

longer term, the European particle physics community has the ambition of operating a proton-proton collider at the highest achievable energy.
Swiss particle physicists have started organising themselves towards participation in these long-term activities around a structure called 'CHEF' (CH Experimental research at the FCC). The term "Experimental" includes detector as well as theoretical research. A dedicated editorial team has prepared a document that aims at collecting interest for participation in concrete projects and collaborative activities to establish a strong program of work packages.
The CHIPP EB kept the FLARE Tables updated with the funding of experiments of the Swiss National Science Foundation (SNSF); the Board continued to exchange information and feedback with the funding agencies.

The CHIPP outreach activities continued supporting the thematic portal hosted on the SCNAT website, the multi-lingual "particlephysics.ch". Thanks to the SCNAT support, we could continue to keep this a lively page with 10 articles by Barbara Warmbein, a professional journalist, and several other news articles and press releases in 2022.

SECTORS OF COMPETENCE: NETWORKING AND DEVELOPMENT OF SCIENCE

Meetings, Workshops and Schools

In 2022 CHIPP continued to work on its networking and educational goals and organized directly or through its members several meetings, schools and workshops.

- 16-21 January 2022: Annapaola de Cosa (ETHZ) organized the CHIPP Winter School 2022.
- 20 January 2022, «Searching for New Physics at the Quantum Technology Frontier» organised by Paolo Crivelli (ETHZ) and al. There will be a follow up conference organised by Paolo Crivelli at al. in July 2023 at CSF (Ticino, Switzerland).
- 24-28 January 2022, PSI Online, Open CHRISP Users Meeting. Review of the PSI experiments. The main organizer was Stefan Ritt (PSI).
- ETHZ organised (Alessandro Calandri (ETHZ) and al.) LHC-wide cross-meetings with ATLAS on VH analyses in the context of the LHC Higgs working group (VH sub-group): VHcc cross-talk (May 2022) and VHbb cross-talk (Nov 2022)
- 1 July 2022, Women in Physics Career Symposium, Satellite Event (to the annual SPS Meeting), several CHIPP members in the organizing committee: Cristina Botta (UZH), Lea Caminada (UZH-PSI), Ellen Fogh (EPFL), Marc Janoschek (UZH-PSI), Christine Klauser (PSI), Klaus Kirch (ETHZ-PSI), Natalie Lerch-Pieper (PSI), Hubertus Luetkens (PSI), Marina Marinkovic (ETHZ)
- 5-7 July 2022, First international "Semivisible Jets Workshop" organised by Annapaola de Cosa (ETHZ).
- 14-20 August 2022, A. Signer, M. Spira, 25th PSI summer school on Particle Physics "Vision and Precision", A. Signer, M. Spira from PSI.
- 14-15 October 2022, Muonic atoms at PSI2022, F. Hagelstein and A. Antognini, Sattelite-Workshop, 57 Participants
- 16-21 October 2022, Physics of Symmetries and Interactions, PSI2022, K. Kirch, B. Lauss, S. Ritt, A. Signer from PSI.
- 14-26 November 2022, IEEE NPSS School of Application of Radiation Instrumentation Dakar/Senegal, S. Ritt (PSI)
- Anna Sfyrla organised the FASER collaboration meeting at the UniGe.

- Anna Sfyrla (UniGe) and Florencia Canelli (UZH) were the main organisers fort the FCC workshop organization thanks to a UniGe-UZH grant.

INTERNATIONAL ACTIVITIES

Scientific cooperation

Research in particle and astroparticle physics usually involves large infrastructures, which are the result of regional, national and worldwide collaborations. To cover the important intellectual and technological challenges, the amounts of human and financial resources required can no longer be provided by a single country. The table below shows a snapshot of the current international experimental collaborations involving CHIPP Board members.

Furthermore, smaller cooperation projects exist; many of them occur spontaneously – between groups working in the same field or requiring the same type of infrastructure – or in a coordinated way by CHIPP. Here below are some of the activities coordinated by CHIPP members:
Michael Spira (PSI) is the convener of 3 Subgroups (BR, bbH, MSSM) of the LHC Higgs working group.
A team from PSI: Stefan Ritt (MEG II, Mu3e), Bernhard Lauss (n2EDM), Aldo Antognini (CREMA), Andreas Knecht (muX) manage the regular (between monthly and annually) collaboration meetings of the respective projects at PSI.
S. Schramm (University of Geneva) created an ATLAS open dataset for outreach and teaching purposes, which was made public in June 2021 see the CERN open data webpage.
Prof. Olivier Schneider is member of the Particle Data Group, and he is convener of a sub-group of the Heavy Flavour Averaging Group (HFLAV). HFLAV is responsible for calculating world averages of measurements of beauty-hadron, charm-hadron and tau-lepton properties from current and past experiments and provides a comprehensive resource for the field in terms of web pages and full documentation of results.
One particular example of scientific collaboration and help at the service of the new arrivals in the LHCb experiment has been provided by the EPFL team that has built the LHCb starterkit project where the lessons from the dedicated Workshops and online tutorials are stored. EPFL researchers organized the LHCb Starterkit lessons.

Project	Swiss institutes	CHIPP Board Members	Institutes worldwide
High-Energy particle physics			
ATLAS	Bern, Geneva	Beck, Braccini, Golling, Iacobucci, Nessi, Schramm, Sfyrla, Weber, Wu	263

CMS	ETHZ, PSI, Zurich	Botta, Caminada, Canelli, DeCosa, Dissertori, Erdmann, Kilminster, Wallny	249
LHCb	EPFL, Zurich	Schneider, Serra, Shchutska, Steinkamp	95
LHC Tier-2	ETHZ, CSCS	Donegà	> 200
HL-LHC	EPFL, PSI	Seidel	55
CLIC	ETHZ, PSI	Seidel	70
FCC	Basel, Bern, EPFL, ETHZ, Geneva, PSI	Blondel, Dissertori, Laine, Seidel	148
Na64	ETHZ	Crivelli, Rubbia	13
FASER	Bern, Geneva	Iacobucci, Sfyrla, Scampoli	17
Astroparticle physics			
AMS	Geneva	Wu	63
ArDM	ETHZ	Rubbia	7
CTA	ETHZ, Geneva, Zurich	Biland, Montaruli	210
DAMIC	Zurich	Kilminster	10
DAMPE	Geneva	Tykhonov	?
DARWIN	Bern, Zurich	Baudis	24
IceCube	Geneva	Montaruli	50
MAGIC+FACT	ETHZ	Biland	24-4
XENON	Bern, Zurich	Baudis	27
Neutrino physics			
GERDA	Zurich	Baudis	18
NA61 / T2K / HyperK	Bern, ETHZ, Geneva	Sanchez, Rubbia	33-63-75
DUNE	Bern	Kreslo, Weber	175
SHiP	EPFL, Geneva, Zurich	Kilminster, Shchutska, Serra	53
High-precision and muon physics			
CREMA/HyperMu	ETHZ, PSI	Antognini, Kirch, Soter	9
muCool	ETHZ, PSI	Antognini, Hildebrandt, Kirch, Papa, Piegsa	4
GBAR	ETHZ	Crivelli, Rubbia	18
MEG II	PSI	Hildebrandt, Ritt	15
Mu3e	ETHZ, Geneva, PSI, Zurich	Dissertori, Hildebrandt, Ritt, Serra, Wallny	8
MuMass	ETH, PSI	Crivelli	

nEDM/n2EDM	ETHZ, PSI, Bern	Kirch, Lauss, Piegsa	15
LEMING	ETHZ, PSI	Antognini, Kirch, Soter	3
PIONEER	ETHZ, PSI	Soter, Caminada	24
Other			
Medical	Bern	Braccini, Scampoli	
Novel Detectors	Bern	Kreslo,	
Ion-Beam Physics	ETHZ	Synal	

In parallel to these experimental collaborations and projects, Swiss theorists are involved in numerous international collaborations. The prominent ones, in which Swiss theory institutes are key players, is

- The LHC Higgs cross-section working group (LHCHXSWG) created in 2010 to produce agreements on cross sections, branching ratios and pseudo-observables relevant to the Higgs boson: M. Spira (PSI) was involved in the LHC Higgs cross-section working group responsible for the HDecay Manual.

At the University of Bern, the work on the review of lattice results continues. It is related to pion, kaon, D- and B-meson physics with the aim of making them easily accessible to the particle physics community.

Prof. O. Schneider (EPFL) is convener of a sub-group of the Heavy Flavour Averaging Group (HFLAV). HFLAV is responsible for calculating world averages of measurements of beauty-hadron, charm-hadron and tau-lepton properties from current and past experiments and provides a comprehensive resource for the field in terms of web pages and full documentation of results.
One particular example of scientific collaboration and help at the service of the new arrivals in the LHCb experiment has been provided by the EPFL team that has built the LHCb starterkit project where the lessons from the dedicated Workshops and online tutorials are stored. EPFL researchers organized the LHCb Starterkit lessons.

Mauro Donega (ETHZ) is the organizer of the Steering Group of the LHC Higgs Working Group.

Institutional collaboration (in alphabetical order):

Several CHIPP Board members are acting as official delegates to international organizations in 2019:

- ***Hans Peter Beck*** (U. Bern) represents Switzerland in the European Physical Society Council. He is the Swiss representative in IUPAP as of 1 January 2019.
- ***Laura Baudis*** (UZH) is member of the Dark Matter advisory committee. She is the APPEC Scientific Advisory Committee chair. She is a member of the Academy of Sciences and Literature, Mainz, and also member of the Research Committee for Particle Physics at the PSI HIPA.
- ***Florencia Canelli*** (UZH) has been a member of commission C11 of the International Union of Pure and Applied Physics (IUPAP) on particles and fields since Nov. 2014. She was elected secretary of the IUPAP C11 Commission on 1 January 2018 for 4 years. She is a member of the Physics

Advisory Committee of Fermilab, member of LHCP international advisory committee and member of the Dark Matter workshop advisory committee. She is CMS physics coordinator.

- **Gilberto Colangelo** (U. Bern) is a member of the Research Committee for Particle Physics at the PSI HIPA
- **Paolo Crivelli (ETHZ)** is coordinator of the NuPECC working Group "Symmetries and Fundamental Interactions"
- ***Günther Dissertori*** (ETHZ) has been Chair-person of the International Advisory Committee for the FCC project since the beginning of 2017. He is chairman of the scientific policy committee of the INFN National Laboratory of Frascati. He has been the Swiss scientific delegate to the CERN Council since January 2019 on mandate of the State Secretariat for Education, Research and Innovation (SERI).
- ***K. Kirch*** (ETHZ and PSI), Vice-Chair of the Scientific Council of the Excellence Cluster PRISMA+ in Mainz/Germany, is a member of the Scientific Advisory Board of the Stefan-Meyer-Institute in Vienna/Austria, and a member of the Scientific Advisory Board of the Max-Planck-Institut für Kernphysik in Heidelberg/Germany.
- ***Teresa Montaruli*** (U. Geneva) has been the Swiss scientific delegate to the General Assembly of the Astroparticle Physics European Consortium (APPEC) since 2013 and was nominated unanimously as chair of the APPEC General Assembly. She is also member of the LNGS Scientific Advisory Committee. As APPEC Chair and she is an invited member of the European Strategy Group of EPPSU.
- ***Katharina Müller*** (UZH) has been the Swiss representative in the IPPOG Collaboration since September 2017. She is in charge of Outreach and Education in CHIPP and is in the organisation committee of the SM@LHC Conference.
- ***Olaf Steinkamp*** (UZH) is a member of the Kruger International Advisory Committee.
- ***Stefan Ritt*** (PSI) is chair of the Educational Committee of the Nuclear and Plasma Sciences Society NPSS of IEEE.
- ***Leonid Rivkin*** (EPFL) has been chair of the CERN Scientific Policy Committee (SPC) since 2022.
- ***Mike Seidel*** (EPFL) was re-appointed in 2022 as member of RECFA representing Switzerland.
- ***Olivier Schneider*** (EPFL) is a member of the Particle Data Group; he is convener of a sub-group of the Heavy Flavour Averaging Group (HFLAV) and has been the chair of the LHCb collaboration board since December 2020 (second 2-year mandate).
- ***Rainer Wallny*** (ETHZ) is a member of the Physics Advisory Committee of DESY, member of the LBNC committee of Fermi National Accelerator Laboratory, and member of the EPS HEPP board.
- ***Xin Wu*** (U. Geneva) has been re-elected as CHIPP observer in the Swiss Commission on Space Research until December 2023.

Several CHIPP members were committed to international responsibilities:

- ***Angela Benelli*** (CHIPP) has been the Swiss member of the European Particle Physics Communication Network (EPPCN) since June 2017.
- ***Thea Klæboe Årrestad*** is co-coordinator of the Fast Machine Learning Lab, an international research collective focusing on fast Machine Learning inference for science and technology (https://fastmachinelearning.org/)
- ***Luigi Marchese*** is a member of the Organising Committee of the Italian Oxbridge Society and member of the Zurich and Geneva Oxbridge club: https://www.italianoxbridgesociety.com

COORDINATIVE TASKS

Promotion of the next generation

One of the main objectives for CHIPP is to attract the young public to Physics and Astroparticle Physics. To achieve this goal, more than 50 educational events, such as information days for BSc and MSc students, for pupils finishing high school and for high-school classes, were organized, throughout Switzerland, involving more than 4000 young students. UZH organised 3 events for 30 children of young ages and about 12 events targeting high-school classes allowing many students to get in touch with the world of research.

At the University of Geneva, Anna Sfyrla organised a very successful series of events for kids: "Mercredi à l'Uni": scientific activities for kids on Wednesday afternoon, with about 18-20 kids participating every Wednesday, and "Vacances à l'Uni": scientific summer camps at the Bioscope, with a total of 40 kids participating. Both activities are conducted in collaboration with MJSR and Animascience.

Physik am Freitag is co-organized by Hans Peter Beck at the University of Bern, where high-school students, their teachers and everyone interested is invited to a series of talks. Gilberto Colangelo (Uni Be) presented how precision measurements and theoretical calculations of the magnetic moments of the electron and muon could reveal new physics beyond the Standard Model.

A. Papa (PSI) organised "La fisica delle particelle al PSI". Una Pinta di FISICA. Physics at the Pub. Organised by Associazione Studenti di Fisica, Pisa. At the UZ, two events were organized, one in March and one in September, hosting more than 250 students. ETHZ organized visits to PSI for more than 100 students per semester. The PhD student Noshin Tarannum (Uni Geneva) gave 6 lectures / semester on particle physics and the Higgs discovery to high school students attending a special seminar series "athenaPlus", organized in collaboration with other departments of the physics section.

Information days for pupils in the last year before their Matura/baccalaureate were organised:

- A. Papa: "Fisica delle particelle alla frontiera dell' intensità. Modelli teorici ed esperimenti". Istituto Tecnico Superiore "Meucci", Firenze.
- S. Kollatzsch, "Vom Johanneum in die Teilchenphysik", Johanneum, Hoyerswerda/Germany, 23.11.2022
- Günther Dissertori "Unsichtbares sichtbar, und Unmögliches möglich machen - Teilchenphysik und Anwendungen", Kantonsschule Winterthur, Feb 2022
- A. Antognini, Nov 30, 2022, Kantonsschule Schaffhausen, Event: "ETH Unterwegs", Presentation: "Laser, exotische Atome und Teilchen", 80 students
- A. Antognini, Dec 9, 2022, Kantonsschule Menzingen. Event "ETH Unterwegs", Presentation: "Laser, exotische Atome und Teilchen", 200 students
- Ettore Zaffaroni, Ronchetti Federico, Paul De Bryas, Frieden Jennifer, Sonia Bouchiba, Guido Haefeli, Olivier Schneider , Lab visit at EPFL for last-year high-school students (17-18 year old) for a 2-day event organized by EPFL.
- Organization of CAMAL and participation in faculty-wide CAFE-S, to accompany incoming bachelor students through math at the beginning of their studies. About 100 students participated in the first year of CAFE-S.

Information days for other school classes were organised as well, in UZH: 5 events with more than 100 pupils: at the EPFL Jennifer Frieden, Sonia Bouchiba, Serhii Cholak, Elena Graverini, Federico Ronchetti, Marie Bachmayer, and Guido Haefeli organised 2 lab visits at EPFL for secondary school students (13–16 years old), mostly from the local area, involving several lab members, with 35 students attending the events.
Some members of the particle physics are involved in the activities for school classes within the iLab at PSI. Members of CHIPP also participated in special events organised for students in their high schools: Angela Papa (PSI): "Il mondo della fisica delle particelle". Istituto Tecnico Superiore "Meucci", Firenze, Katharina Mueller (UZH) held 14 talks for about 280 participants in Zürich. The University of Geneva organised two events, one in March and one in November, with more than 150 students participating.

Talks targeted the general public were organised: Katharina Mueller (UZH) 9 talks, about 120 participants, Olaf Steinkamp (UZH), 1 talk, 70 participants and Laura Baudis (UZH) 5 talks, about 500 participants. We would like to point out some special events:

- Malte Hildebrandt (PSI), Zukunftstag Fachschaft Physik & Astronomie, University Bern, «Detector Physicist in Particle Physics», 07.10.2022
- K. Kirch (PSI) held a public lecture at "Night of Physics", "Ganz Kleines und Ganz Grosses – von Teilchenphysik und Musik" with musical interludes by Ukrainian singer and composer Marina Krut, link to the video.
- Günther Dissertori: "Was haben das Higgs Teilchen und Alzheimer gemeinsam" Nacht der Physik 2022
- Rainer Wallny,"Quarks, Higgs und Co.: Neues vom Large Hadron Collider"
- Thea K. Årrestad: "Advances in AI: Ultrafast Machine Learning Inference at the Large Hadron Collider", Lake Como School of Advanced Studies
- Particle theory outreach event on the EPFL campus (organized by Joao Penedones and his group), for 25 Bachelor students from the Maastricht Science Programme

More than (61 UBE, 65 UZH + ETHZ, 20 EPFL) Swiss high-school pupils were invited to participate in the International Masterclasses 'Hands on Particle Physics', where over 13'000 Gymnasium level students in about 215 institutes over 52 countries can actually work with real data from the CERN Large Hadron Collider (LHC).
A very successful LHCb Masterclasses was organised at EPFL (March 23, 2022), by Fred Blanc, and involved several lab members (Elisabeth Niel, Sonia Bouchiba, Jennifer Frieden, Maria Vieites Diaz); in addition, Maria Vieites Diaz served on several occasions as "moderator" or "pit expert" for international LHCb Masterclasses.

Federico Sanchez (UniGe) at the DPNC hosted several students under the umbrella of the CERN summer students. The DPNC also hosted two bachelor students from the Boston-UniGe exchange program. Some engineers are doing the internship at the Particle Physics department.
In the following we outline a few of the key activities for the general public and high-school students of the past years:

Figure 2 Masterclasses

- **Visits to CERN**: CERN as the centre of high energy research is extremely attractive for visits which are organised regularly by CHIPP members. In recent years, about 50 visits a year were organised for university students in physics and other disciplines, high-school students, alumni, politicians, members of companies (?), the media, and the general public at large.

  The UZH team proposed 2 visits: 1 for students, 1 for high schools, for a total of 40 students. Several Italian students in their last year of high school were invited in CERN and were able to be introduced to ATLAS and LHCb, thanks to Lea Halser (U. Bern) and Serhii Cholak (EPFL). They were able to visit the Antimatter Factory, thanks to the group of Paolo Crivelli (ETHZ) and the Robotic Lab in CERN Prevessin. The EPFL members organized several visits for CERN students, friends and family members, and researchers from other fields. In addition, on December 14, 2022, Olivier Schneider organized a virtual visit of the LHCb detector for ~80-100 Bachelor students at EPF, gathered in an auditorium at EPFL. Besides the interactive virtual visit of the detector (with group members Surapat Ek-In, Elisabeth Niel, and Maria Vieites Diaz in the pit filming the detector and answering questions), presentation (Renato Quagliani) and real detector demonstrations were held in the auditorium (Sonia Bouchiba, Jennifer Frieden, and Guido Haefeli)

  Anna Sfyrla, Stefano Franchellucci from the University of Geneva and Hans Peter Beck from University of Bern participated in VIP visits at ATLAS. Swiss President Ignazio Cassis (Sfyrla, Franchelluci in April 2022); Conseil d'État des Grisons and Conseil d'État de Genève (Beck, Sfyrla in December 2022).

- **Visits to PSI**: PSI is the largest research centre for natural and engineering sciences in Switzerland, conducting cutting-edge research in three main fields: matter and materials, energy and environment and human health. PSI hosted an Open House Day the 23rd October 2022, "Tag der offenen Tür" am PSI, Oct 23, 2022, with 15,000 visitors, 30 people from the Laboratory for Particle Physics involved with public talks (every 30' up to 100 visitors) and exhibitions of science, electronics and detectors.

  Many visits are organized to PSI. G. Bison, U. Greuter, K. Kirch, A. Knecht and B. Lauss participate as tour guides to the guided tour program at PSI (addressing the general public, school classes, university excursions). A total of 10,000 – 15,000 people visit PSI per year through this tour program.

- **Teacher education**: we collaborate with secondary-school teachers in the development of innovative and interesting physics demonstrations, sometimes using particle physics data. Education of secondary-school teachers is done by providing teaching material, via the CERN Teacher program and specific topical workshops as well as open days for teachers at our institutes.

  These are the events that we would like to point out:

  - PSI: S. Ritt at the ASP2022, 7th African School of Physics, Nov 28 – Dec 9, 2022, Gqeberha/South Africa
  - UZ: 1. Approx. number of participants: 12

- ETHZ: ·V. Bondar & EPT Team: EPT – Engaging Physics Tutoring, several events in 2022 (link) typically 20 – 50 participants per event, mostly teaching assistants (TAs) involved with physics exercise classes
- V. Bondar, J. Nuber, M. Zeyen, C. Schlösser, G. Schiltz, EPT summer camp for physics TAs, Zuoz, Aug 12-14, 2022
- Particle physics seminar (by Surapat Ek-In) for ~50 Thai CERN summer students/teachers, organized by Jatuporn Puntree (Mahidol Wittayanusorn School, Thailand)
- Olivier Gaumer (UniGe) One week of conference about science shows dedicated to performers. The conference is called ShowScience and was organized in Geneva in 2022 with 55 participants.

Events organized for the public:

Luigi Marchese (ETHZ) is PI for a new project with the Italian Disney magazine for kids "Topolino (Mickey Mouse)". Together with NASA/ESA, astrobiologists for current Mars missions, virologists and gravitational-wave experts have assembled three stories to be published in the magazine in 2022-23 to teach kids about some of the most cutting-edge topics in science. The first story on Mars missions was published in 2022 and the second story on "Uncle Scrooge and the muon problem" will be published in 2023.

UNSOLVeD, funded by Agora is a platform with 10 videos addressing open questions in physics - from quantum field theory to dark matter. They are used to create a dialogue with non-scientists, with high- school students as a particular target.

Carina Trippl (EPFL): "Live media event: Run 3" at CERN; Carina was one (of four) of the people responsible for the live video material at the LHCb pit for the "Live media event: Run 3" at CERN, broadcasted for the general public on 5.7.2022 on CERN YouTube, CERN LinkedIn, CERN Facebook.

The conference ShowScience 22, organized in Geneva, ended during the week-end of the "Nuit de la Science'' with a common show and a Science Show contest in which every participant was involved. The competition welcomed 16 teams from all over Europe and even further afield (1×Switzerland; 3×Czech Republic; 2×Poland; 2×Denmark; 1×Estonia; 1×Finland; 1×Netherlands; 1×Hungary; 1×France; 1×Bulgari; 1×Ukraine; 1×Morocco) and attracted a total of 2,330 spectators under its theatre tent.

"Die Nacht der Forschung", organized by University Bern on 9 September 2022 attracted around 10,000 people who visited the "Fair of Knowledge", where more than 750 researchers shared their knowledge at over 70 stands, including with the help of around 1,000 science posters. The Albert Einstein Center for Fundamental Physics (AEC) contributed with the AEC village several attractive stands. Using virtual reality goggles a walk through the ATLAS detector was offered and using Lego bricks, ATLAS detector components could be assembled. A mechanical accelerator invited to play and experience fundamental principles of particle acceleration. Spark chambers and cloud chambers

allowed to visualize particles and their tracks and in a particle path all fundamental particles could be explored.

Figure 4 iLab - PSI

Specialised school labs as well as lectures and workshops for school classes play a key role in attracting young students to study STEM related subjects. There are several dedicated laboratories at our institutes that offer special courses in cosmology as well as particle, astroparticle and neutrino physics for school classes targeting different ages of young students. With hands-on experiments, visits to the labs and by meeting Bachelor and Master students, they come into contact with state-of-the-art research and passionate researchers (iLab at PSI, Science Lab at the University of Zurich, Physioscope at the University of Geneva).

The visits to the Physiscope attracted approximately 400 physics shows for 7,200 pupils. Physiscope is a theater lab where science shows are performed. We have 8 different topics and in 2023 a 9th one will be proposed about equilibrium.

Several events were organised during the year with researchers helping and participating, giving presentations and supporting young kids to get closer to scientific topics.

Information and coordination tasks supporting research and science

CHIPP's website contains news, documents, minutes of all meetings, as well as the link to the complete membership database. The continuous dialogue between the institutes, which is enshrined in the CHIPP Statutes and By-Laws, aims at having at hand, in a timely and transparent manner, the information about current and planned research activities. As in previous years, CHIPP took an active role in the biannual meetings of SCNAT's Round Table International Organisations and Research Infrastructures. The scope of this information forum is the exchange between the research fields involving large, international infrastructures. It accounts for the participation of Swiss groups in international research facilities and also comprises representatives of the SERI, SNSF, and "Swiss universities".

Dialogue with society

The SCNAT offered a firm place with increased visibility among the other fields of science for both the CHIPP website and the more general Physics outreach website ('particlephysics.ch'). The site was kept lively throughout 2022 with the addition of 10 interviews and other news articles. As approved by the CHIPP Board, the articles are authored by B. Warmbein, a science journalist collaborating with CHIPP since many years. Katharina Müller (the University of Zurich) is responsible for their scientific content

and Angela Benelli inserted them on the SCNAT portal in Italian, German and English. CHIPP is grateful to SCNAT for supporting this activity as an important dialogue with the society.
During 2022 the CHIPP Twitter account @CHIPP news has continuously spread physics news to increase the public awareness about science and publicized available jobs in academia and outside for physicists.
At the EPFL, G. Pietrzyk is in charge of the LHCb Experiment Twitter account: @lhcbexperiment and the LHCbExperiment Instagram account with around 26.3K and 13,000 followers respectively. The University of Geneva has set the Particle Physics Twitter @DPNC_Unige. ~~The Facebook site Verflixtes Higgs continued to be fed by H. P. Beck.~~

With A. Benelli as the Swiss member in the European Particle Physics Communication Network (EPPCN), CHIPP continues its link between the CERN press office and the Swiss media, as well as with the communication offices of the institutes related to CHIPP. The contact has been established and a measure of the media coverage of particle physics in Switzerland is provided on-line.
Several articles have been published in magazines, here are some of them:

- Andreas Crivellin: SRF2: LHC restart, NZZ: LHC Restart, Scientific American, 'Rule-Breaking Particles', SRF2, 'Echo der Zeit' interview 'Das CERN meldet sich zurück'
- Ben Kilminster: W mass (futurezone.at, Der Standard, Nau.ch)
- Laura Baudis (RSI) (link?)
- Nico Serra, Gino Isidori (RSI) CERN, (Tagesanzeiger) New Physics
- Gino Isidori: Podcast for Physics Frontiers: "The Flavour Puzzle" - Interview with Joe Davighi, Podcast for the Economist" The New Physics" - Interview to G. Isidori (+ F. Gianotti, G. Giudice, B. Allanach)
- 07.04.2022, Ljiljana Morvaj, statement for the Croatian National TV News on the importance of Croatia joining CERN as Associate Member State, at the occasion of the visit of the Croatian President at CERN (link?)
- 02.06.2022, Georg Bison, Klaus Kirch, Bernhard Lauss, SNSF Horizons interview, 'Seeking the sensational on a small scale'
- 04.07 and 16.07.2022, Lea Caminada, SCNAT Interview: 'Hopp Higgs', SCNAT Interview: 'Restarting the LHC: a new era of physics data'
- 16.11.2022, Bernhard Lauss, SCNAT interview: 'Looking for just a little bit of difference'
- P. Crivelli and T. Prokscha, "Measurement of the transition frequency from $2S_{1/2}, F = 0$ to $2P_{1/2}, F = 1$ states in Muonium", Nature Communications volume 13, Article number: 7273 (2022)
- Anna Sótér et al., "High-resolution laser resonances of antiprotonic helium in superfluid 4He" Nature volume 603, pages 411–415 (2022)
- "COVID-19 effect on TB presentation and outcome" Medical paper on the impact of COVID-19 on the diagnosis of Tuberculosis (TB) in Brescia during the pandemic. Luigi Marchese was the only physicist in a team of medical doctors and WHO collaborators.
- R. Aaij et al (LHCb collaboration), "Measurement of the charm mixing parameter $y_{CP}-y^{K\pi}_{CP}$ using two-body D^0 meson decays", Phys. Rev. D 105, 092013 (2022). This paper reports the results obtained by Guillaume Pietrzyk, a former PhD student at EPFL, who obtained 3 different distinctions for his PhD thesis, including the 2022 CHIPP Prize.
- LHCb collaboration, "Test of lepton universality in $b\to s\ell+\ell-$ decays", submitted to Phys.Rev.

Lett.

- LHCb collaboration, "Measurement of lepton universality parameters in $B^+ \to K^+ \ell^+ \ell^-$ and $B^0 \to K^{*0} \ell^+ \ell^-$ decays", submitted to Phys.Rev. D
- Renato Quagliani was one of the main analysts of the results reported in these two papers. He also gave the corresponding LHC seminar at CERN on 20.12.2022. These results about lepton-flavour universality are consistent with the predictions of the Standard Model and settle one of the so-called flavour anomalies. See also the CERN Courier article and the LHCb news.
- Jan Steggemann was Interviewed and quoted for a general science article, published on 1.7.2022 in the APS Physics Magazine at the occasion of 10th anniversary of Higgs discovery.
- Maria Vieites Diaz co-authored an article in national Spanish newspaper on 29.4.2022 ("What is angular momentum?"), as part of a weekly scientific Q&A, organized by the Spanish association of women in research and technology.
- Elisabeth Niel was interviewed by a French magazine (Science et Avenir) abour recent tetraquark and pentaquark discoveries at LHCb, article published on 8.7.2022.
- Interactions between theorist and experimentalist (summary of LHCb implications workshop) Elisabeth Niel wrote an article published in the CERN Courier on 7.12.2022.
- Fred Blanc wrote the preface of "Aux sources de la matière. Le boson de Higgs" of James Gillies, published by Quanto on 24.11.2022
- Steven Schramm (Uni Geneva) on "Making (gravitational) waves in Switzerland» 08.06.2022
- Noshin Tarannum and Anna Sfyrla (UniGe) authored an outreach article «Can we read the universe's book of secrets?".

- Hans Peter Beck (UniBe) et al published a focus issue of the Swiss Physical Society "*Impact of Physics on Swiss Society -- Investing in Education and Fundamental Research to foster Innovation*", SPS Focus No 2 (2022)

Gender issue & society

Several events were organized in the contest of the "International day of women and girls in science" project of the United Nations, the week around the 11 February. Elisabeth Niel and Carina Trippl from the EPFL participated in the campaign " Women and Girls in Science and Technology / Femmes et filles de science et technologie" through presentations in primary schools in the Geneva and surrounding French areas (11-12 year old school children).

Exhibitions

As already presented in the beginning of this document Higgs@10 was one of the major events in 2022, in the Science Pavilion of the UZH several expositions were set for the occasion:

- exhibition on Dark Matter
- exhibition on CMS (until end of May)
- exhibition on LHCb (Since June)
- exhibition on superconductivity

- monthly guided tours through the physics exhibitions for the general public
- regular tours (2-3 times per month through the physics exhibitions for high-school students)

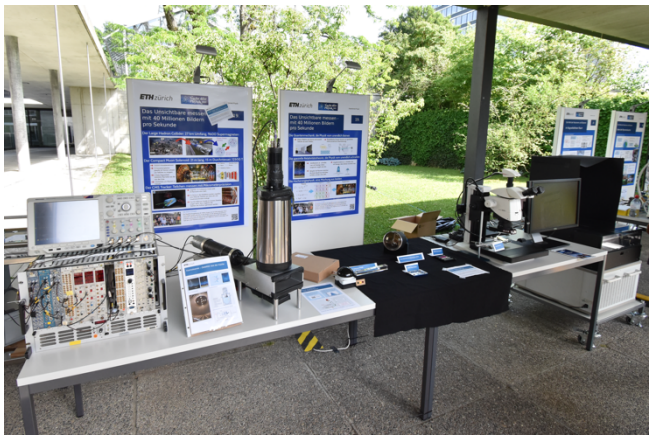
Science & Nature Festival, June 11

- guided tour: Xenoscope – A demonstrator for the DARWIN Observatory
- demo experiment: superconductors
- workshop: cloud chamber
- guided tour: CERN exhibit in the Science Pavilion

Long Night of Museum 3. September 2022

- demo experiment: superconductors
- Dance your Science
- talk on particle physics

Exhibition in UZH for the 100 years Nobel prize Albert Einstein, August 29 – September 29.



During the Night of Physics at ETH Zürich, visitors could come and see tiny particles visiting from the upper atmosphere or from outer space with their own eyes. A cloud chamber filled with a supersaturated vapour of water or alcohol would flash up every time a charged particle passed through it, a rather frequent event as there is roughly one muon passing through an area the size of a hand every second. For the competitive ones amongst the audience, there was also the chance to play a particle-betting game.

A detector consisting of a thermos coffeepot filled with water and connected to a photomultiplier, would detect the Cherenkov light produced by a charged particle traversing the detector volume. Due to its similarity with the experiment Kamikoande, a neutrino observatory in Japan consisting of 50,000 metric tons of ultrapure water, the detector was aptly named "Kamiokanne" (kanne=pot). The detector was connected to a button, and eager visitors were challenged to press the button whenever they thought the next particle would pass through. If a particle was indeed detected at the same time as the button was pressed, a loud sound would go off, to the great delight of the stands of many young visitors. There was also the chance to study the crystal structure of a diamond sensor the size of a fingertip under a microscope, a sensor designed to detect particles in physics experiments. While being guided through how particles are being detected at the CMS experiment at the Large Hadron Collider,

visitors also had the chance to see and touch real silicon sensors and calorimeter crystals like the ones currently in use at CMS.

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