Preface

Jürg Osterwalder, Department Head

With a total of 21 research groups, the Department of Physics of the University of Zurich covers a variety of subfields of physics. Experimental activities include particle and astroparticle physics, hard and soft condensed matter physics, surface physics and nanoscience, and physics of biological systems. Theoretical groups work on precision calculations of processes in quantum chromodynamics and new theories beyond the standard model of particle physics, astrophysics and general relativity, as well as topological concepts in condensed matter physics. Other physics-related groups from within the Faculty of Science and beyond are affiliated to our department, and our home page gives links to their research. Together, we can offer a broad and high quality spectrum of lecture courses and Bachelor, Master and semester projects to our students. The infrastructure department with the excellent mechanical and electronics workshops and the efficient IT and administrative support teams complete our attractive research environment.
https://www.physik.uzh.ch/en/research.html

Last year brought the arrival of three new SNF professors. Marta Gibert started in February by setting up a laboratory for the controlled layer-by-layer growth of transition metal oxides and for studying the physical properties of perovskite heterostructures. Alexey Soluyanov, who is interested in materials with non-trivial topology, followed in June. With his team, he will develop computational methods for simulating real materials with existing tensor network numerical approaches. Finally, Fabian Natterer joined in October and started preparations for a low-temperature scanning tunneling microscopy laboratory in the basement of our building. He will implement electron spin resonance excitation at the tunnel junction and study quantum matter at the atom-by-atom level.

On the other hand, 2018 saw the departure of Ueli Straumann into retirement - but not entirely. After handing over the LHCb activities at CERN into capable hands (page 21) he still held on to responsibilities in the CTA project (page 34) and helped the department overcome a teaching emergency in the fall semester. Likewise,

The year 2018 saw the rising of Building Y38 just behind our building, replacing the view on green forest and cosy residential houses with modern architecture for functional office and lab space for chemistry and the life sciences. The members of our department endured the construction with patience.

Tiziano Crudeli and Lucien Pauli retired last summer after having worked for 41 and 38 years in our department, respectively. Lucien was responsible for the lecture demonstration experiments and knew every trick to get them going. Tiziano solved all the problems that nobody else could solve - I wish he could have enjoyed his retirement longer.

In July the department lost one of its most prominent former faculty members. Verena Meyer was a pioneering woman, the first ever female full professor at UZH. She served terms as Dean of the Faculty of Sciences, as Vice President and President of the University. She was very active in science policy and was for many years the President of the Swiss Science Council, among many other services to the scientific community.

Previous subscribers to our scientific annual report will note that this years issue comes in a new, more compact format. The rationale behind this is to address a broader readership also outside the department. Refraining from condensing it down to the information content of a tweet, the present form should give a broad idea of the groups' research and refer the more interested reader to the research websites. Presenting individual highlights with pride, we thankfully acknowledge the continued support from the Kanton Zürich, the Swiss National Science Foundation, the European Commission, and others who have made this fundamental research possible.

Retirement - Ueli Straumann

Ueli Straumann studied experimental physics (1972-1979) at our institute, in those years located at the Schönberggasse. He graduated in 1983 with a thesis on "Pion capture in C-14, N-15 and C-13" under Prof. Peter Truöl using an experiment at SIN (nowadays PSI). During his time as a PhD student he also spent a year at Berkeley Lab in California as a visiting scientist working on an experiment to measure the η parameter of the muon decay. After his PhD Ueli joined the University of Mainz as a postdoc working at CERN on the ASTERIX experiment. The ASTERIX spectrometer has been used to study proton-antiproton interactions at rest in a hydrogen gas target, using antiprotons from the Low Energy Antiproton Ring (LEAR) at CERN.

1986 he returned to Zurich as a senior assistant where he built up the first lab courses on computing in experiments and started to work on the first level trigger of the H1 experiment at the electron-proton collider HERA in Hamburg. He contributed significantly to the successful running of the experiment first as the trigger coordinator and later as the technical coordinator.

In 1996 Ueli Straumann was appointed professor (C3) in Heidelberg where he started to work on the development of micropattern gas detectors (MSGC, GEM) and got involved

in the LHCb experiment at CERN. Finally Ueli Straumann moved back to his home town in 1999 as he became a full professor for particle physics at our institute.

Ueli is a passionate physicist loving the experimental work in the lab as well as to develop new ideas and drive them forward from a sketch on a piece of paper to a working experiment with several hundred collaborators. In his time at UZH his group was largely involved in the high-energy experiments H1 at HERA and LHCb at LHC and in the past years the Cherenkov Telescope Array (CTA). The latter he shaped for two years as managing director commuting between Zurich, Heidelberg and Bologna in his favourite vehicle, the train.

Besides his duties as a group leader he was strongly involved in managing the institute and structuring the physics curriculum as institute director (2011 – 2016) and in the administration of the faculty as Dean of Studies (2013 – 2016). His open-door philosophy and his closeness to the students during the countless lectures he gave and his solve-a-problem-don't-create-one attitude made him a very popular teacher and mentor for the students and his own staff.

Statistical Data 2018

187 personnel

- professors: 19
- associated professors: 10
- senior researchers: 20
- postdoctoral researchers: 46
- PhD students: 70
- engineers and technicians: 23
- administration: 6
- + research assistants

307 students

~55 new students

175 bachelor	16 BSc degrees
62 master	23 MSc degrees
70 PhD	25 PhD degrees

8 SNF prof. and ERC grants

- 35 SNF or EU research grants
- 5 SNF ambizione fellowships
- 19 UZH and other grants

342 publications

- 291 peer reviewed papers
- 30 conference proceedings
- 26 books & others

321 conference and workshop contributions

- 354 invited talks
- 39 seminar and other talks
- 44 posters
- 25 outreach

Outreach 2018

Conferences and Workshops in Zurich

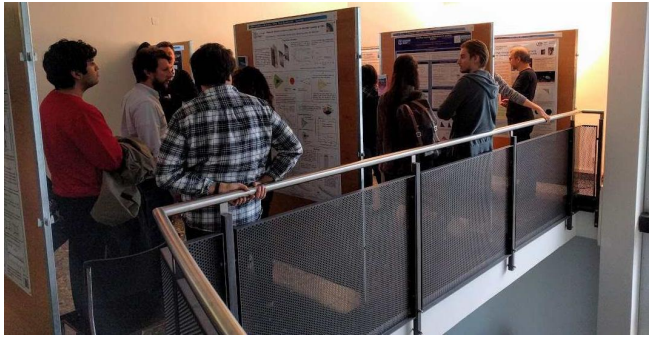
- Zurich Phenomenology Workshop
- 6th Beam Telescope and Test Beam Workshop
- Symposium on quantum matter
- International Workshop on the Interconnection between Particle Physics and Cosmology 2018
- Machine Learning for High Energy Physics

Others

- Symposium Joseph Fourier
- Einstein Ehrengast: talk from William D. Phillips
- Schrödinger Colloquium: K. Marvel, W. Hofmann, C. Macchiavello
- Verena Meyer Symposium
- Masterclass in particle physics
- How particle-physics works: hope and worries on the B-physics anomalies (video)
- Open Day of the institute

Awards

- CMS young researcher prize for Lea Caminada
- Dectris prize for best experimental master thesis: Chris Marentini
- UZH semester award for outstanding bachelor theses: Céline Nauer and Björn Salzmann
- Annual poster award of the Department of Physics for members of the groups Serra, Pozzorini and Aegerter



Teaching

bachelor
3
major options

180 ECTS physics
150 ECTS physics/30 ECTS minor
120 ECTS physics/60 ECTS minor

4
master programs

particle physics
condensed matter
astrophysics & cosmology
bio- & medical physics

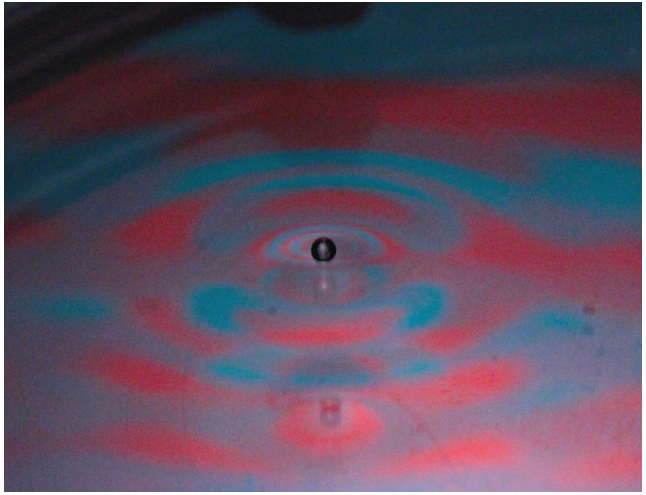
service lectures
1034
students

475 medicine
190 biomedicine
226 biology
143 chemistry

Demonstration experiments

A new experiment to visualize wave-particle duality

Wave-particle duality is one of the most fundamental concepts in quantum mechanics and due to its inherent quantum nature notoriously difficult to visualise. Based on experiments by Yves Couder, ENS Paris, we have created a macroscopic visualisation of the phenomenon that captures many of the aspects of a quantum system. A bath of liquid is vibrated just below the onset of a surface wave instability. In that case, a drop of the same liquid will not coalesce with the bulk, but locally creates a surface wave that leads to a motion of the droplet reminiscent of a pilot-wave in Bohmian mechanics. Hence, the drop and the surface wave can only exist in tandem, creating an object that shows both particle and wave-like properties. For instance if the object is sent trough a slit, a definite track can be observed, whose statistics however show a diffraction pattern dictated by the properties of the surface waves.



A new experiment visualizes the wave-particle duality.