Wilhelm Conrad Röntgen Symposium

Saturday, 18 September 2021, 13:15 - 17:45,

ETH Zürich, Robert-Gnehm-Weg 15, 8093 Zürich (Hönggerberg), Room HPV G4

This public symposium is dedicated to the physicist Wilhelm Conrad Röntgen (1845 - 1923) and his vibrant legacy today. Röntgen studied mechanical engineering at the ETH Zürich and obtained his PhD in physics in 1869 from the University of Zürich. In 2020 his 175th birthday and the 125th anniversary of his discovery of X-rays should have been celebrated, but the occasion had to be shifted to 2021 due to the pandemic.

13:15 - 14:00	***Ralph Claessen,*** *Universität Würzburg* **Röntgen's discovery: from serendipity to scientific revolution**
14:00 - 14:45	***Marco Stampanoni,*** *ETH Zürich and Paul Scherrer Institut* **125 years of X-ray imaging and still eager to push further**
14:45 - 15:15	*Coffee Break*
15:15 - 15:45	***Clemens Schulze-Briese,*** *Dectris Ltd. Baden* **X-rays in industry and society, what we do today and what can be done tomorrow**
15:45 - 16:15	***Davide Bleiner,*** *Empa & University of Zürich* **Progress in small scale X-ray lasers**
16:15 - 16:45	***Stéphane Paltani,*** *Université de Genève* **The revolution of X-ray astronomy**
16:45 - 17:45	*Apéro*

⟨S|P|S⟩ swiss physical society

Physikalische Gesellschaft Zürich PGZ

Free entrance, no registration needed *
Further information:
www.sps.ch, *www.pgz.ch*, *www.scnat.ch*

* If a registration should be required due to COVID regulations, information will be availabe in due time on the web.

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Time	Wilhelm Conrad Röntgen Symposium
13:15	**Röntgen's discovery: from serendipity to scientific revolution** *Ralph Claessen, Universität Würzburg* On the eve of November 7, 1895 Wilhelm Conrad Röntgen, then physics professor at the University of Würzburg, made a curious observation while performing experiments on gas discharges: a fluorescence screen lit up despite being well separated from the experimental set-up. This moment 125 years ago marks the discovery of x-ray radiation and eventually led to the first ever Nobel Prize in physics. This lecture will highlight Röntgen's interesting biographical background – almost impeding his academic career and with Zürich playing an important role in it – and provide an overview of the enormous impact that his discovery had on modern science and technology. Beyond their well-known use in medical diagnostics and therapy, x-rays find today widespread application in many diverse fields, ranging from materials science to astrophysics, from preservation of cultural heritage to molecular biology. They may even play a key role in fighting the current corona virus pandemic.
14:00	**125 years of X-ray imaging and still eager to push further** *Marco Stampanoni, ETH Zürich and Paul Scherrer Institut* 125 years after the discovery of X-rays by W. Röntgen, scientists around the world are still pushing the limits of X-ray imaging exploiting the unique features of latest generation synchrotron facilities. Modern X-ray micro- and nanoimaging rely on the coherent properties of synchrotron beams, suitable optics, and algorithms to sense wavefront disturbances from samples and – consequently – to reconstruct their inner structure. Tomographic microscopy has been pushed to isotropic resolutions of a few tens of nanometers while tomographic scans can be performed as fast as hundreds of tomograms per second. These capabilities opened a plethora of new applications, for instance, the in-vivo observation of complex biomechanical dynamics in small animals and insects or the visualization of foaming processes in metal alloys. Originally developed to measure fundamental properties of synchrotron beams, grating interferometers evolved into sophisticated tools for advanced X-ray imaging in the lab and, recently, for clinical applications. Grating interferometers generate image contrast exploiting refraction and scattering, rather than absorption and can potentially revolutionize the radiological approach to medical imaging because they can detect subtle differences in the electron density of a material and measure the effective integrated local small-angle scattering power generated by microscopic structural fluctuations. The talk will provide insights into cutting-edge X-ray imaging and discuss upcoming developments.
14:45	Coffee Break
15:15	**X-rays in industry and society, what we do today and what can be done tomorrow** *Clemens Schulze-Briese, Dectris Ltd. Baden* Since the discovery of X-rays in 1995, the average brilliance of X-ray sources increased by 2 orders of magnitude every 10 years. This offers completely new opportunities for the investigation of the structural, chemical and magnetic properties of matter. The brilliance allows for highest resolution in real and reciprocal space and even extremely tiny amounts of sample can be analysed successfully. In combination with fast and sensitive detectors, methods originally developed for fundamental research can be applied to *in situ* and *operando* experiments to improve our understanding and ultimately the performance of catalysts, fuel cells or batteries. In laboratory applications, advances in X-ray sources and detectors enable the characterisation of the size and concentration of Nanoparticles by Small-Angle X-ray Scattering (SAXS). Since the beam coherence is proportional to its brilliance, coherence-based synchrotron and X-FEL methods such as X-ray Photon Correlation Spectroscopy (XPCS) were successfully developed to provide insight into the bulk dynamics of condensed matter. Recently, synchrotron SAXS studies contributed to the optimisation of the transfection efficacy and the production protocol of lipid nanoparticles as vehicles for mRNA developed as a vaccination against COVID-19.
15:45	**Laboratory X-ray Lasers: Beyond Proof-of-Principle Science** *Davide Bleiner, Federal Institute of Materials Science & Technology (Empa) & University of Zürich* Light sources have enabled a number of analytical applications in the industry and society, such as medicine or security. The cutting down of wavelength well below the UV, about 125 years ago, has permitted deeper inspection, atomic resolution, photoionization, and structural analysis. The generation of X-ray is largely linked to cathode tubes, in which electrons bombard an anode to induce fluorescence or Bremsstrahlung. This mechanism to incoherent radiation is typical in lamps. The demonstration of the laser, 60 years ago, has permitted a dramatic progress in diagnostics and therapy thanks to the enhancement in brightness and coherence. Although this technology is half the age of that of X-rays, a merging is foreseeable to combine the advantages of both in the future. Present-day X-ray lasers are essentially fourth generation beamlines of linear particle accelerators of km length, which strictly speaking are not based on the laser effect. Beamlines are not accessible on a daily basis and the related research is mainly of fundamental character. Such proof-of-principle research is important in academic domains, but less of immediate impact in the industry and for societal applications. Intense work is however done to generate coherent X-Ray radiation with much smaller devices, and in this lecture a complete overview is given. Many of the above-mentioned concepts are elucidated.
16:15	**The revolution of X-ray astronomy** *Stéphane Paltani, Université de Genève* In June 1962, a rocket equipped with an X-ray detector veered off its trajectory, leading to one of the most remarkable serendipitous discovery in astronomy, rightly rewarded by the Nobel Prize in Physics in 2002. X-rays track the most extreme physical conditions in the Universe, like the highest densities, the highest energies and the deepest gravitational potential wells. Thus they opened the door to the study of some of the most fascinating astrophysical objects, like black holes and neutron stars. X-rays also represent our best hope to find the missing baryonic matter in our universe, which is some of the most important cosmological questions of our times. What has started as a niche research field has now become a major observation tool, that is relevant to almost any domain of astrophysics. In this lecture, I will show the very broad impact of X-ray astronomy on our understanding of the Universe through the lens of some of the most important discoveries made by observing the sky in X-rays.
16:45	Apéro
17:45	***END***