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Physicists in Industry (14)

Physics at Work in Industry

Lisa Sommer, Leonardo Massai (IBM Research Europe – Zurich)

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Physics at Work in Industry

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While studying physics at university, students get a good overview and insight into typical physicists' careers in academia. Despite this most obvious career path, there are a lot of other opportunities, where physicists can thrive with their knowledge, skills and mindset. Examples for this are startup companies, technology-reliant industries in a wide range of sectors, patent offices or even insurance and finance companies.

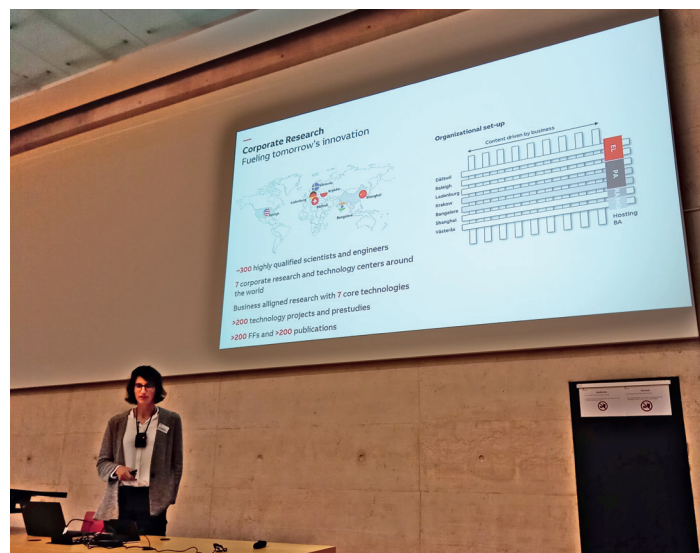
These career paths in industry, from barely hatched startups to well-established companies with a long history, were the focus of the industry session titled "Physics at Work in Industry" of this year's annual meeting of the Swiss Physical Society in Fribourg, chaired by Thilo Stöferle from IBM Research. As the following summaries show, this path results in innovative ideas and inspiring stories.

Diego Casadei, first speaker of the session, introduced himself talking about his 20-years long research experience in particle and radiation detectors for high-energy physics in laboratories (ATLAS/CERN) and space (ESA Solar Orbiter). He then decided to change his horizon by moving to industry, quickly becoming the general manager of **Cosylab Switzerland**, a company specialized in providing control systems. He explained how he was able to quickly adapt the expertise that he had attained during his physics research years to fit the industrial work. The ability of solving complex problems and of critical thinking, both common to a scientific mind, are important character traits for meeting industry challenges. This is especially so when used in combination with entrepreneurship and good management skills – with the latter two subjects unfortunately not part of a typical physics student curriculum.

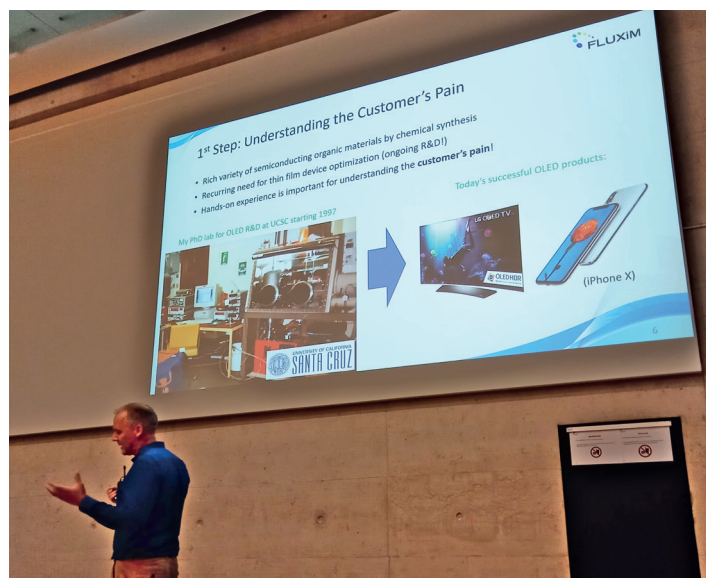
The next presentation was from **Beat Ruhstaller**, ZHAW Professor, founder and CEO of **FLUXIM AG**. His spin-off company focuses on simulation software and measurement hardware providing its products to the display, lighting, and photovoltaics community worldwide. He underlined the im-

portance of understanding the customer needs as well as differentiating the product over other competitors, especially for a startup. "Think about the nail when developing the hammer" is the useful take-home lesson. Moreover, he also discussed the differences between selling software and hardware, where the "banana concept" (release a product and let it mature at the customer) does not work well for the latter.

Elena Mengotti, working as R&D senior scientist at **ABB Schweiz AG**, talked about how she entered directly in the industry world after her physics Ph.D. at ETH Zürich. At ABB a great majority of the scientists have a Ph.D. but they work in a broad variety of topics and fields, from power supply electronics to manufacturing systems. Elena Mengotti's work currently focuses on characterizing and improving the reliability of wide band gap semiconductors, SiC in her case. For this she develops innovative tests and analyses the failure modes of these devices under real-world conditions.



A patent attorney plays an important role in the protection of intellectual property of a company or university. The ins and outs of this were discussed by **Torben Müller**, a patent attorney at **Bohest AG**. In an era where information is so easily accessible over the internet, it has become much easier for ideas to be stolen. This is a major risk for companies, especially when a market requires significant investments in cutting-edge research. During the presentation, Torben Müller gave an overview of different classes of IP rights: he presented classic examples such as the first patents for sewing and a car, highlighting also the very specific patent language that is used. He granted us a look behind the curtain of the interdisciplinary work of a patent attorney that spans from law to technology, being in contact everyday with experts and clients.



When talking about fabrication processes of advanced micro and nano devices, physics plays a fundamental role. This was clear in **Felix Holzner's** presentation, working at

Lab14 (previously **RSBG AMT**). The company includes a wide variety of highly specialized sub-companies such as Specs, Heidelberg Instruments, Multiphoton Optics, Osiris, 40-30 and Notion Systems. This allows Lab14 to have a broad portfolio in fabrication and analysis technologies, spanning from hard- and software for laser/e-beam lithography systems, surface analysis tools, to printed circuit boards and micro-optics. Attractive to prospective physics graduates, Lab14 has currently more than 70 open positions in these independent sub-companies.

An interesting talk was given by **Tobias Vancura**, CEO of **CO₂ Börse AG**, offering support for Swiss car importers in the processing of the CO₂ levy or CO₂ tax. He gave an overview of his career path, starting with a physics education and a transition to the industry world after his Ph.D. at ETH Zürich. He held various positions, ranging from founding the startup Nanonis, to managerial roles in multinational corporations such as Mettler Toledo. He explained that he always benefitted from his general skills in simulation and automation that he acquired during his studies. He also shared his experience on how to shape a team and acquire enough funding to buy an already established company. The latter allowed him to leapfrog over the usual period of high financial risk and founding struggle that most startups experience in their first few years of existence.

How do you connect quantum field theory with the alternative investments industry? **Christof Schmidhuber**, with more than two decades experience at various positions and companies in **finance** and now professor at ZHAW, talked about doing exactly this in his career journey. He presented surprising analogies, e.g., that the shares of financial assets can be modeled by molecules of a lattice gas, where the lattice represents the social network of investors in the background. Driving the analogy with an interacting gas further, one can investigate phase transitions and derive scaling laws in finance using quantum field theory.

For many industrial processes and research laboratories, vacuum instrumentation plays an important role. **Bernhard Andraeus**, currently Director of Product Evolution & Application at **Inficon AG**, explained past and current challenges of the technology in pressure measurements and gas composition analysis, and how to overcome those. Especially interesting is that the challenges and innovations never seem to stop, and although the company has a long history, Inficon constantly reinvents to be state-of-the-art in terms of vacuum instrumentation.

Hightec MC AG started as a thin film division of Brown, Boveri & Cie. (BBC) in 1979 and has been an independent company since 1992. **Samuel D'Hollosy** is currently the Research and Development Manager at Hightec and he told us that one of their markets is superconducting multilayer flexible cryogenic cables, which are interesting for space, aircraft and medical applications. But also, quantum computing is a field in which they participate in, since high-frequency interconnects with a high electrical and low thermal conductivity at ultracold temperatures are critical for such systems. He mentioned that the scaling to larger sizes is very challenging, since buckling from stress has a major impact on the interconnect quality. He also stated that external

collaborations for specialized test equipment are very important for such a relatively small company

Industry and academia are living from new ideas, and collaborations between them can help to bridge the gap from fundamental research to being successful in the market. The importance of this topic was described vividly by **Christof Fattinger**, who had been working at **Roche** since 1989. He is interested in extremely sensitive detection of transparent matter, especially biomolecules. For that, a minimally invasive detection technique in a crowded sample is needed, which he developed in an interdisciplinary project together with ETH Zürich. The method is called 'focal molography', which is based on a nanoscale biological grating, the mologram. When a desired molecule binds to this grating, the light diffraction intensity in the focal spot changes measurably. Christof Fattinger hereby exemplified that within such kind of collaborations, new innovative ideas are enhanced and may lead to new further scientific investigations as well as spin-off companies that can mature the idea to marketable products.

Daniel Egger's talk was an interesting presentation of how a very non-linear career journey can lead to some surprising combinations of scientific disciplines. He told us about his path from accelerator physics, over superconducting qubits to financial risk management and finally back to developing novel quantum computing applications and algorithms. After his Ph.D., he did not want to go to the US, so instead, he decided to work in the financial sector in risk management, where he investigated risk factor models using Monte Carlo simulations. After a few years, he missed the thrill of discovering new things. This is why he is currently working at **IBM Research** where he can combine the worlds of quantum computing and financial risk management, by developing algorithms for quantum computers to calculate the risk.



About 40 people attended the "Physics at Work in Industry" sessions at the SPS Annual Meeting 2022 in Fribourg.

Overall, this year's Industry session gave a broad view of possible career opportunities outside of the academic environment. From startups to established tech companies, a wide range was presented, with exciting insights. Especially the uniqueness of each of the career paths and the often close interaction between industry and academia were thrilling to see. It illustrated, how this can lead to new innovations in the industry sector or result in new physical concepts and analytical tools for the benefit of academia and society in general.