GP 12: Technological development of tools of physics

Zeit: Mittwoch 16:30–18:30 Raum: HS 9

GP 12.1 Mi 16:30 HS 9

Laboratory Electromagnets (E-Ms) — •Jean-François Loude[1] and Dominique Bernard[2] — [1]EPFL, Lausanne, Switzerland — [2]Université de Rennes 1, Rennes, France

The first iron-cored E-Ms were built by Sturgeon (1824) and Henry (1831). Their mechanical action on iron was used to lift heavy weights. Faraday discovered in 1845 the dia- and the para-magnetism of various substances and the Faraday rotation. The construction of E-Ms specially designed to investigate the properties of material samples immersed in a magnetic field began with Ruhmkorff (1848). Scientific principles were first applied in the ring-magnets of H. du Bois (1894). In 1907, the first big, water-cooled, truly modern E-M, designed by P. Weiss was installed at ETH-Zürich. Size and maximum field are limited by the materials and the scaling laws. Improvements were progressively introduced, notably in the cooling system and in the form of the pole-pieces. Size went up. A giant one (120 t) was inaugurated in 1928 at Meudon-Bellevue. Since around 1965, the cryogenic superconducting magnets offer an improvement of an order of magnitude in the maximum field of E-Ms. Numerous effects produced by magnetic fields, many of them of technological importance, were discovered by physicists working with the E-M locally at their disposal. Among them, on the atomic scale, the Kerr magneto-optical effect (1878-1878), the Hall magneto-optical effect (1879), the Zeeman effect (1897), the Meissner effect (1933), and, on the nuclear scale, the Nuclear Magnetic Resonance (E. M. Purcell 1946).

GP 12.2 Mi 17:00 HS 9

Indeterminate Identity: Development & Diversification of the Most Widely Influential Tool of Physics — •Keith Nier — Madison, NJ, USA

A tool of inquiry that emerged in the beginning of the twentieth century in the investigation of a particular area of research in physics has been developed and diversified so greatly during the past hundred-plus years that it has become the most widely influential tool of physics throughout the realm of research in the natural sciences. It thus has become an important aspect of the unity of natural science. This tool of physics is mass spectrometry. It was developed at first as a way to investigate certain rays produced by electrical discharge in partial vacuum. It was transformed into a various other things, the most prominent among them for some decades being techniques for determining the masses of atomic nuclei. That task was very important in the development of nuclear physics through much of the twentieth century but in more recent decades it has become comparatively rare. However, starting in the time when this role in physics still was fundamental, experimenters modified mass spectrometers through both improvements and replacements of components and by re-directing their application. These metamorphoses have made the same basic type of instrument highly important in fields from astro- and geo-physics through materials science, chemistry, physiology, ecology, and on beyond the natural sciences as well. As the main directions of these developments are traced, continuing connections can be discerned through all the diversification.

GP 12.3 Mi 17:30 HS 9

Verschieben der optischen Auflösungsgrenze in der Halbleitertechnologie - eine Erfolgsgeschichte der Carl Zeiss SMT — •Martin Espig — Carl Zeiss SMT, Oberkochen, Deutschland

Die Namen des Unternehmers Carl Zeiss und des Physikers Ernst Abbe stehen jeher stellvertretend für höchste Präzision optischer Systeme. Die Carl Zeiss Semiconductor Manufacturing Technology (Zeiss SMT) stellt weltweit die Sperrspitze in der Produktion für Ausrüstungen in der Mikrochipherstellung dar. Dieser Beitrag gibt einen kurzen Abriss über den historischen Beitrag der Zeiss SMT zur Umsetzung des Moore'schen Gesetzes und stellt ihr einzigartiges Maschinenportfolio vor, mit dem Zeiss die optische Auflösungsgrenze stetig weiter verbessert und entscheidend zum Technologiesprung mit ihren EUV-Lithographie-Optiken beiträgt.

GP 12.4 Mi 18:00 HS 9

The tools for determining the correct Easter date — •Harald Gropp — Henkel-Teroson-Str. 20, 69123 Heidelberg

Telescopes or computers programs, which is the better way to determine the correct Easter date? Otherwise said: Should I have watched the new moon crescent (with or without a telescope) or should I use a computer algorithm (or use a table) to compute the position of the sun and the shape of the moon in beforehand? Today (the day of my talk) is the 18th or 19th or 20th of March 2019 (dependant on whether and when the meeting organizers schedule my talk). Spring equinox will be Wednesday (March 20), late evening. Only 4 hours later, on Thursday (March 21), early morning, the moon will be full. Hence, the following sunday (March 24) should be Easter Sunday. However, a look into your calendar shows that Easter Sunday will be celebrated on the last sunday in April (April 21). How can this happen? What went wrong? By the way, Easter Sunday in orthodox countries will be celebrated even one week later, on April 28. This talk will discussion the question of the Easter date this year and in history from different points of view.