Fachverband Geschichte der Physik (GP)

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18th Symposium of the History of Physics Division
"The Tools of Physics"

Telescopes, particle accelerators, thermometers, but also Fourier series, measurement units and computer programs: Physicists have developed and employ many tools which are (not only) today essential components of their practices. Over the last decades, historians of science have become increasingly sensitive to the material and performative dimensions of scientific endeavors, and to the fact that scientific knowledge is no abstract content, but is deeply intertwined with the instruments, codes, and procedures employed to produce, communicate, and apply it. Scientific instruments as well as other tools of the scientific trade are not simply "reified theorems" (Bachelard 1933), but have a life of their own, which has often shaped not only specific scientific experiments, but also larger conceptual frameworks. Indeed, in modern physics there are many notions that are constitutively shaped by the apparatuses which helped "discover" them, e.g., in thermodynamics or electromagnetism.

The construction, diffusion, and use of scientific instruments is in itself a process of knowledge production and communication which has served and serves to connect both different cultural spheres and different cultures. Because of their often highly refined technical features, the tools of scientists – and of physicists in particular – have also at times become symbols of wisdom and power. Consequently, in premodern and early modern times astronomical and mathematical devices like astrolabes or armillary spheres were gifts fit for kings. Yet not only the devices which we regard as proper scientific instruments are worth our attention, but also more modest tools, such as telescope mounts, simple computational aids, or hand-drawn sketches. Moreover, physicists manipulate not only instruments, but also apparently abstract constructs, such as mathematical notations or computer code, which may therefore display their own specific epistemic dynamics as non-material tools.

Reconstructing how the tools of physics lead a "life of their own" constitutes a challenge, and requires, on the one hand, close cooperation between historians and museum curators and other instrument experts, and on the other hand efforts to provide a thick description of the context in which the tools have been employed. Historically accurate reconstructions of instruments and re-enactments of experiments play a central role in this context, and studies in this direction have brought to light the role of the body of the scientist in experimental practice. Likewise, the interplay between the development of an instrument and the performance with that instrument in aiming at stabilizing the experimental procedures and the knowledge production gave insights into the complexity of laboratory practices. Research on physicists-tools has also uncovered new historical actors, the "invisible technicians". More generally, a focus on tools of scientific practice reveals the entanglement of science with other cultural spheres and its manifold connections to social, economic and political contexts.

Recognizing how material instruments produce and communicate knowledge also helps bridging the gap between theory and practice in the physical sciences, as it contributes to our understanding of how theory, as well, is highly dependent on its own set of tools, like symbolic notation, diagrams, mathematical techniques, and, more recently, computing machines and codes.

Übersicht der Hauptvorträge und Fachsitzungen

(HS 9)

Plenarvortrag von Martha Lourenco

PV VII	Mi	8:30– 9:15	Plenarsaal	**Reconciling the past and the present: The shared history of physicists and museums** — •Marta C Lourenco

Hauptvorträge

GP 1.2	Mo	13:15–14:00	HS 9	**Tracing the origins of physics on the Canadian Prairies: Skills, materials, and instruments on the move.** — •David Pantalony
GP 5.1	Di	10:45–11:30	HS 9	**A solution to a number of problems: On the development of the laser as a tool for and a subject of physical research** — •Johannes-Geert Hagmann
GP 6.1	Di	14:00–14:45	HS 9	**Tools of Physics as Technological Systems: Building Big Telescopes before 1825** — •Richard Kremer
GP 10.1	Mi	11:15–12:00	HS 9	**The computer as a tool of physics: how it all began - or not** — •Arianna Borrelli

Fachsitzungen

GP 1.1–1.2	Mo	13:00–14:00	HS 9	**Conference Opening**
GP 2.1–2.4	Mo	14:00–16:30	HS 9	**The tools of physics between, research, teaching and public outreach**
GP 3.1–3.4	Mo	16:30–18:30	HS 9	**Physicists and their instruments**
GP 4.1–4.2	Di	9:15–10:45	HS 9	**Open Topic**
GP 5.1–5.4	Di	10:45–14:00	HS 9	**Instruments as tools and subjects of research**
GP 6.1–6.4	Di	14:00–16:30	HS 9	**Tools and Technologies of physics research**
GP 7.1–7.4	Di	16:30–18:30	HS 9	**The tools of physics and their replication**
GP 8	Di	18:30–20:00	HS 9	**Mitgliederversammlung des Fachverbandes Geschichte der Physik**
GP 9.1–9.2	Mi	10:00–11:15	HS 9	**Understanding tools from the distant past**
GP 10.1–10.3	Mi	11:15–14:00	HS 9	**Understanding tools from the recent past**
GP 11.1–11.4	Mi	14:00–16:30	HS 9	**The tools of physical theory**
GP 12.1–12.4	Mi	16:30–18:30	HS 9	**Technological development of tools of physics**

Mitgliederversammlung Fachverband Geschichte der Physik

Dienstag, 19. März 2019 18:30–20:00 HS 9

Exkursion: Deutsches Museum München

Donnerstag, 21. März 2019 10:00–12:00
Treffpunkt: Eingangshalle Bibliothek Deutsches Museum, Museumsinsel 1.
Voranmeldung per E-Mail ist zwingend erforderlich: Julia Bloemer (j.bloemer@deutsches-museum.de)

GP 1: Conference Opening

Zeit: Montag 13:00–14:00 Raum: HS 9

GP 1.1 Mo 13:00 HS 9

Opening and Welcoming — •Christian Forstner[1] and Arianna Borrelli[2] — [1]Goethe University Frankfurt am Main — [2]Leuphana University Lüneburg

Welcoming address and conference overview

Hauptvortrag GP 1.2 Mo 13:15 HS 9

Tracing the origins of physics on the Canadian Prairies: Skills, materials, and instruments on the move. — •David Pantalony — Ingenium: Canada's Museums of Science and Innovation, P.O. Box 9724, Station T, Ottawa, Ontario, Canada

Outside of Canada, the province of Saskatchewan is not a well-known place, and yet it has a surprisingly rich history of physics. During the post-World War II period, the Department of Physics at the University of Saskatchewan was a leader in spectroscopy, plasma physics, nuclear physics, space and atmospheric science and medical physics. How did this come to be in a province that began the twentieth century as an agrarian territory? In this paper, I look at the origins of physics in this Prairie province. In particular, I study the surviving historic instruments to explore experimental and teaching traditions, a mixture of influences from Germany and Britain, as well as diverse, local precision-making cultures. Several of the instruments also reveal strong intellectual and material connections to the American Midwest (Chicago and Milwaukee). These developments in Saskatchewan physics were part of a broader emergence of a confident modernist spirit in government, the arts and sciences. By studying these historic instruments, we can enrich and challenge these broader narratives. Furthermore, the unusual context of these instrument histories, seemingly remote from the traditional cosmopolitan knowledge centres, brings to light formative material and social exchanges that are often taken for granted by scientists and historians.

GP 2: The tools of physics between, research, teaching and public outreach

Zeit: Montag 14:00–16:30 Raum: HS 9

GP 2.1 Mo 14:00 HS 9

On the relation between instruments in research experiments and their representation in teaching demonstrations — •Peter Heering — Europa-Universität Flensburg, Germany

A number of research experiments were (and still are) presented in lectures through related teaching demonstrations. This is not a recent development: at least in the early 19th century, devices for teaching demonstrations existed that were identified as representations of historical experiments (or instruments related to these experiments). It may seem clear that these teaching demonstrations are not identical to the historical experiments; and that there are similarities as well as differences between the respective instruments. However, this raises the question what actually has been represented by the teaching devices, and what was considered being worth communicating in the lecture or demonstration.

In the presentation, some examples of research experiments and teaching devices will be discussed in order to demonstrate the potential of such a discussion.

GP 2.2 Mo 14:30 HS 9

Galileo's tools for the study of motion into history physics and nature of science teaching — •Vincenzo Cioci — PhD candidate, Lille University, France

Pendulum, water clock, inclined plane, launching ramp but also the dialectical tool of dialogue and the mathematical ones of Euclidean geometry and proportions are the means used by Galileo to found the new science of motion. This work describes a comprehensive educational and experimental program on Galilean physics and mathematics to be presented in a scientific high school, based on the analysis of Galilean sources and on the most recent historical studies about Galileo's research. The overall objective of this work is to address the Nature of Science (NoS) proposing to students the fundamental kinematics experiments made by Galileo right in the context and with the tools available to him.

Selected References

Abattouy M (2017) The Mathematics of Isochronism in Galileo: From his Manuscript Notes on Motion to the Discorsi. Society and Politics (SAGE Publishing) 11, 2(22): 23-54.

Pisano R, Bussotti P (eds.) (2017) Homage to Galileo Galilei 1564-2014. Philosophia scientiae 21-1, Editions Kimé, Paris.

Damerow P, Freudenthal G, McLaughlin P, Renn J (2004) Exploring the Limits of Preclassical Mechanics. Springer-Verlag, New York.

Riess F, Heering P, Nawrath D (2005) Reconstructing Galileo's Inclined Plane Experiments for Teaching Purposes. International History, Philosophy, Sociology and Science Teaching Conference, Leeds.

GP 2.3 Mo 15:00 HS 9

On Props, Plores and Prototyping. Instrument(aliz)ing the Early Science Center — •Arne Schirrmacher — Humboldt-Universität zu Berlin

How can the physicist's tools for knowledge production be transformed into popular demonstration exhibits that provide insights into physical phenomena? I will discuss this question in the context of the establishment of a new kind of science museum–the Science Center–which was established in North America in the 1960s with the strong participation of (research) physicists and which came to Europe in the 1980s, now in a very different (political) context. Instead of talking about instruments, experimental apparatuses or demonstrations, new terms such as *props* (Frank Oppenheimer) or *plores* (Richard Gregory) were promoted and the development process was turned into *prototyping.* In Germany, the exhibits of the first science centers became a *Versuchsfeld* (Hugo Kükelhaus) or *Erfahrungsfeld* (Lutz Fiesser). It turns out that in their second public life the instruments were not only greatly changed, but also their message was adapted and interpreted anew in the respective cultural sphere.

GP 2.4 Mo 15:30 HS 9

"a token of such things": the galvanism after Galvani and the myth of Frankenstein — •Bertozzi Eugenio — University Museum Network, VIa Zamboni 33, University of Bologna

Electrostatic machines, Leiden jars, conducting arcs and Volta Piles have been central tools in the development of electric physics in the second half of the XVIII and the beginning of the XIX Century. Beside their role in the development of the discipline, scholars have pointed out their uses as demonstrational tools in the public performance of experiments and education. This presentation will explore how, toward the end of the XVIII Century, the use of these instruments alimented visions and dreams of the highest capacity in the context of the life sciences. The analogy set by the scientists Luigi Galvani between the Leiden jars and the muscles of the frogs as anatomical places for storing electricity in 1791 transformed these devices into laboratory tools for understanding and explaining the physiological apparatus of the living creatures. After Galvani*s death in 1798, the extension of his experiments on frogs to dead human bodies with the use of the new Volta pile as done by Giovanni Aldini in Bologna, Paris and London gave a token that life could be restored; this sensation is still explicitly recalled as an inspirational motive by the English writer Mary Shelley in the preface of the romance *Frankenstein*, published in 1818. The threshold between electrical physics and literary fiction and the enhancement of the cognitive potential of scientific instruments has been the focus of the project *Frankenstein Senior* carried out in 2018 at the *Museo di Palazzo Poggi* of the University of Bologna.

30 min. coffee break

GP 3: Physicists and their instruments

Zeit: Montag 16:30–18:30 Raum: HS 9

GP 3.1 Mo 16:30 HS 9

Tipping the Scales: Engineer-Captain Johann Adam Cass and His Hydrostatic Balance — •Rebecca Giesemann — Kassel

A hydrostatic balance in an unusual case has been held at the Astronomisch-Physikalisches Kabinett in Kassel for the last 300 years. Bought by Landgrave Carl of Hesse-Kassel, it was not only an object of everyday life, used to measure the salinity of brine, but also a representative item in a princely collection. Handwritten operating instructions by the inventor Johann Adam Cass have been preserved with the balance, including tables with exemplary values. Cass was a resourceful man, advertising his invention across the Holy Roman Empire. There is a three page description of it in Jacob Leupold*s Theatri Statici Universalis of 1726, alongside information on where to buy these wondrous scales: either directly from Cass or from Johann Ernst Elias Bessler, better known as Orffyreus. Orffyreus claimed he found the secret of the perpetuum mobile. In the first half of the 18th Century he thus sparked a discussion among many well-known scholars. But Cass not only was linked to Orffyreus and Landgrave Carl. In 1721 he published a book on the art of engineering, about which a quarrel flared up between him and Ludwig Andreas Herlin, important engineer for the Electorate of Saxony. Taking all this into consideration, the Cass balance serves as a starting point from which an atmospheric picture of the 18th century Inventor*s scene in Saxony, Thuringia, and Hesse can be explored.

GP 3.2 Mo 17:00 HS 9

Nature in Seclusion. Collections of Physical Instruments in Monasteries — •Bloemer Julia — Deutsches Museum, Munich, Germany

A monastery is not the first place to expect collections of scientific instruments. Nevertheless, it was one of the most important places of Southern German scholarship in the eighteenth century. Latest libraries and extensive collections were used not only to teach novices and laymen but also for thorough observations. These collections of physical devices differ from other natural collections in many aspects. They do not seek systematization nor completeness but seem to be just the sum of instruments with single demands. This talk explores the question why a monastery needed a scientific collection and how the religious context influenced it. Were monastic collections different from others?

GP 3.3 Mo 17:30 HS 9

Die Physiken der Universität Ingolstadt — •Claudius Stein — LMU, München, Deutschland

Die altbayerische Landesuniversität Ingolstadt (1472-1800) war von einem starken Dualismus geprägt zwischen weltlichem Universitätsteil und dem seit 1576 voll etablierten Jesuitenkolleg, das zeitweise den Charakter einer Paralleluniversität annahm. Besonders deutlich wurde dieser Dualismus bei der Experimentalphysik, die im Rahmen des philosophischen Kurses beim Jesuitenorden angesiedelt war. Der weltliche Universitätsteil, mit Inhalten und Methodik der jesuitischen Physik nicht einverstanden, etablierte daher Mitte des 18. Jahrhunderts eine eigene Physik. Dies führte auch zur Anlage zweier physikalischer Kabinette. Einen merklichen Aufschwung konnte die Physik an der Universität Ingolstadt erst nach Aufhebung des Jesuitenordens 1773 nehmen. Bemerkenswertes Zeugnis hierfür ist der Instrumentenbestand, der sich seit 1904 als Leihgabe im Deutschen Museum befindet. Dieser Bestand wurde bisher eben so wenig untersucht wie die Frage, in wie weit die Instrumente tatsächlich in Unterricht und Forschung Verwendung fanden.

GP 3.4 Mo 18:00 HS 9

Von Referenten, Wunschlisten und Sammlungen — •Frank Dittmann — Deutsches Museum

Bereits drei Jahre nach der Gründung im Juni 1903 eröffnete das Deutsche Museum im November 1906 die ersten Ausstellungen. Innerhalb einer sehr kurzen Zeit musste ein Konzept erarbeitet, die nötigen Exponate eingeworben und eine Präsentation aufgebaut werden. Um diese Aufgabe zu meistern, bat die Museumsleitung namhafte Experten aus Wissenschaft und Technik, insbesondere aus dem akademischen Bereich, die wichtigsten Meilensteine in der Geschichte ihrer jeweiligen Fachgebiete zu benennen. Die Ergebnisse wurden zu sogenannten *Wunschlisten* zusammengefasst. Anschließend setzte man alles daran, möglichst viele dieser Objekte zu erwerben, als Stiftung, Ankauf oder auch als Replikat. Der Beitrag erläutert anhand einiger Beispiele den Aufbau der frühen Sammlungen im Deutschen Museum und unterstützt mit diesem Blick auf die Gründungs- und Prägephase des Museums den notwendigen Akt einer reflexiven Selbstvergewisserung.

GP 4: Open Topic

Zeit: Dienstag 9:15–10:45 Raum: HS 9

GP 4.1 Di 9:15 HS 9

Why Minkowski Led Physics Astray — •Alexander Unzicker — Pestalozzi-Gymnasium München

Since his legendary talk about space and time at the meeting of the Gesellschaft Deutscher Naturforscher und Ärzte in 1908, Herrman Minkowski is undoubtedly one of the most influential figures in mathematical physics. It is argued however that his key idea, amalgamating space and time to a four-dimensional spacetime, is at the origin of a long-term crisis in theoretical physics. Glossing over the phenomenological differences of space and time may be a subtle, but grave denial of reality.

GP 4.2 Di 9:45 HS 9

"Deutsche" und "Proletarische" Physiken als Schlachtfelder der Ideologie und der Wirtschaft — •Alexey Iakovlev — TU Dresden, Dresden, Deutschland

In den Jahren 1923-38 (besonders 1925-30) in der Sowjetunion und in den Jahren 1936-42 gab es in der Sowjetunion und im Dritten reich die Versuche die alternative Physik, die die Relativitätstheorie nicht anerkannte zu entwickeln. In den Jahren 1925-27 gab es eine aktive Polemik zwischen den Unterstützer der alternativen Lehre und den paradigmatischen Physikern. Die Sowjetische Presse veröffentlichte unterschiedliche Artikel, aber bald ist die Industrialisierung angefangen und dank der Politik der Regierung und der Sorge der Physiker wurden alle Versuche die (laut der Meinung der Gegner) idealistische Lehre zu leugnen marginalisiert und später abgeschafft. In Deutschland war die Deutsche Gesellschaft für technische Physik auch am Anfang der Geschichte mit der Leugnung der Jüdischen Physik nicht dagegen, bisher der Staat die Erfolge der modernen Physik (konkret die relativistische Quantenmechanik) für das Uranprojekt brauchte. Damals wurde die früher aktiv polemisierte (dank Werner Heisenberg kritisierte) Lehre sehr schnell marginalisiert. Beide Lehren waren politisch motiviert und ihre Protagonisten konnten sich wohl fühlen bisher der Staat für die Industrialisierung keine Normalwissenschaft (nach Kuhn) brauchte.

30 min. coffee break

GP 5: Instruments as tools and subjects of research

Zeit: Dienstag 10:45–14:00 Raum: HS 9

Hauptvortrag GP 5.1 Di 10:45 HS 9
A solution to a number of problems: On the development of the laser as a tool for and a subject of physical research — •Johannes-Geert Hagmann — Deutsches Museum, Munich, Germany

The first laser came into existence in the year 1960. At the time, a popular quote within the community of inventors coined the new light source as ”a solution looking for a problem”, a phrase frequently repeated and cited up to a level achieving perpetuity. 60 years of development onwards, laser light has reached a distribution over an extremely wide area of scientific and technological applications, creating a sharp antipode to its initially ascribed assessment. Is the laser a tool for physics of comparable scientific agency to say the microscope or telescope in earlier centuries? The the impact of the laser on the development of science and technology has been recognized by a number of historians from a variety of perspectives, including military, technological and economic viewpoints. In this talk, we aim to trace the historical development and the distinction of the use of the laser as a research technology / instrumentation and laser light as a subject of scientific research. We discuss consequences both for the context of the formation of new disciplines and their representation in museum collections.

GP 5.2 Di 11:30 HS 9
Alternative facts * 18th century vacuum experiments on replicas true to the sources — •Wolfgang Engels[1] and Falk Riess[2] — [1]HistEx GmbH, Marie-Curie-Str.1, 26129 Oldenburg — [2]Universität Oldenburg

The re-enactment of historical experiments by making use of faithful replicas can contribute to the clarification of historical laboratory practice and to the determination of the relationship between theoretical ideas and practical, experimental results in the development of science. The procedure and the results generated by such a research approach will be exemplified using the field of vacuum technology in the 18th century.

The design of vacuum pumps is well documented, and several pumps have been preserved. Finally, there are extensive descriptions of instrument makers and experimenters about (actual or alleged) experiments that served to demonstrate this then new knowledge. However, the insights gained from working replicas of vacuum pumps from the early 18th century speak a different language: our experiments show that in some cases the test results cannot be reproduced with the described instruments as claimed by the authors. This is illustrated by some examples, e.g. the silence of a sound source in the air-diluted room of the recipient. The revealed errors and mistakes allow conclusions to be drawn about the scientific concepts and ideas of the protagonists.

It is also noteworthy that, in the case of vacuum pumps, the manufacturers of the instruments often had a greater repertoire of knowledge and practical skills than the actual experimenters and readily passed on this knowledge in the form of letters, handouts or publications. However, competition between manufacturers for financially strong customers also led to copyright infringement being reminiscent of modern forms of industrial espionage or piracy.

GP 5.3 Di 12:00 HS 9
In search of higher vacuum — •Brenni Paolo — Via Pollini 14, 6850 Mendrisio Switzerland

In the second half of the 19th C. the use of vacuum pumps became more and more important in physics laboratories. If the old single or double-barrelled pumps, which had been used and improved since the beginning of the 18th.C, were good enough for lecture demonstrations, the researches in the fields of rarefied gases (with the Geissler, Crookes, Plücker tubes) required better and more performant vacuum pump. New types of mercury pumps were invented by Toepler, Sprengel, Geissler and others allowed to reach higher vacua. With the diffusion of incandescent light bulbs and later the introduction of X-rays tubes, vacuum production became also an industrial affair. In the early 20th c., thanks to the progresses of physics and also of precision mechanics, W.Gaede and others invented various types of vacuum pump (oil or mercury rotatory pumps, diffusion pumps etc.) which opened the way to modern vacuum technology. * In my presentation I will retrace the evolution of this technology and its apparatus between 1850 and 1930 both in the laboratories as well as in industries.

GP 5.4 Di 12:30 HS 9
Research Technologyies and Innovation: Analytical Interferometers — •Christian Forstner — Goethe-Universität, Frankfurt am Main

In this talk I will analyze the history of the analytical interferometer in the perspective of research technologies and innovation theory.

In 1905 Fritz Haber (1868-1934) approached his former school friend, the managing director of Zeiss Siegfried Czapski (1861-1907), with a request for an instrument that could be used to quickly and easily determine gas concentrations within 0.02%. Czapski assigned the work to his colleague Fritz Löwe (1874-1955). Since 1904, Löwe had been head of the measuring instruments department at the Zeiss factories in Jena. In close collaboration with Haber he developed two different types of analytical interferometers for this purpose: one for the academic laboratory and a more robust type for mining. Both were based on the principle a Raleigh interferometer.

The analytical interferometers were used in academic laboratories, in industry to determine the concentration of flammable gases in the air, in mines to determine the methane content of the air, and in medicine for metabolism measurements. Depending on their use all of them have been continuously improved and modified. After the end of World War II, Carl Zeiss Jena first launched a new laboratory interferometer in 1950, followed by a new mining interferometer in a compact design based on a Jamin interferometer in 1955. In 1979, the production of interferometers at the Zeiss plant in Jena was discontinued.

60 min. lunch break

GP 6: Tools and Technologies of physics research

Zeit: Dienstag 14:00–16:30 Raum: HS 9

Hauptvortrag GP 6.1 Di 14:00 HS 9
Tools of Physics as Technological Systems: Building Big Telescopes before 1825 — •Richard Kremer — Department of History, Dartmouth College, Hanover, New Hampshire, USA

The classic histories of the telescope credit Fraunhofer with inventing the parallactic mount (the ”Fraunhofer” or ”German” mount) when in 1824-25 he built the large refractor for Dorpat. Solving a host of mechanical problems, Fraunhofer's design drew wide acclaim and would be widely copied by makers of large refractors for the remainder of century. The success of the German mount provides a central theme in most narratives of telescope history.

In this talk I will reconsider this episode in telescope history by looking not at post-1825 telescope mounts but at pre-1825 attempts to mount telescopes equatorially. Technology historian Thomas Hughes proposed a set of concepts for analysing what he called technological systems. By applying those tools to the history of large eighteenth-century telescopes, I want to look for ”reverse salients” or bottlenecks in the system (optics, mounts, operating procedures) that Fraunhofer was trying to remove. Hooke, Sisson, Ramsden, George Adams, Short, Nairne and Troughton had all devised equatorial mounts; Herschel's large reflectors employed alt-azimuthal mounts. How did these eighteenth-century makers and their customers understand the reverse salients in their technological systems? How did Fraunhofer understand those reverse salients? And how did technological systems, astronomical practices and trade secrets circulate across boundaries of nation states, scientific disciplines, and craftsmen's shops? END

GP 6.2 Di 14:45 HS 9

Fraunhofer's colored solar spectra and his prism spectrometer — •Jürgen Teichmann — Deutsches Museum, München, Museumsinsel 1

Around 1813/1814 (published 1817) Joseph Fraunhofer discovered several hundred dark lines in the solar spectrum. A new found letter from 1823 proves, that at this date he tried to color his black and white figure printed 1817 from an copper etching, which he had made by his own hands. Three such hand colored spectra remained till today, two of them in the Deutsches Museum, Munich, one in the Goethe-Museum, Weimar.

Also the prism spectrometer which he used and some of his first diffraction gratings exist in the Deutsches Museum. To what extent all these objects originate directly from Fraunhofer? Which importance had they for his research, for the discussion in his scientific environment and as objects of a self standing parallel world, of which the signs and its experimental character stayed to be exotic for most scientists before their explanation as absorption lines in 1859 (and also stayed to be strange for a big amount of scientists decades after this year)?

GP 6.3 Di 15:15 HS 9

Pushing wide-field microscopy to the limit around 1900 — •Timo Mappes — Deutsches Optisches Museum (D.O.M.), Carl-Zeiss-Platz 12, 07743 Jena, Germany — Friedrich-Schiller-Universität Jena, 07737 Jena, Germany

Experimenting with the parameters of Abbe's resolution limit formula, scientific studies on enhancing the numerical aperture (N.A.), and reducing the wavelength were performed. As such, objectives with N.A. of up to 1.6 were introduced in 1889 and successfully applied by leading diatomists. However, these objectives were eventually limited in use by the delicate mounting of their front lens, and the toxic and aggressive nature of the required immersion liquid. Still, these systems were re-introduced for conoscopy several decades later.

In 1902 wide-field microscopy at easily accessible short wavelengths was carried out, namely with sparks of Cd (275 nm) and Mg (280 nm). The entire optical train had to be manufactured out of fused silica or rock crystal. The systems were optically corrected for 275 nm only and consequently called "Monochromat". Being in the middle ultra violet the numerical aperture had to be re-defined to enable the use of Abbe's resolution limit formula, and "relative Apertur" (r.A.) was introduced for calculation. While the increase in resolution was outstanding, the images had to be caught on film to make them visible. Thus, the entire procedure was very time-consuming and not fitting for applications in biological or medical research. However, fluorescence was discovered with this setup, while initially being identified as a disturbing side-effect.

GP 6.4 Di 15:45 HS 9

Saussure's hair hygrometer: the art of measuring atmospheric humidity — •Fischer Stéphane — Musée d'histoire des sciences de Genève

Among the many instruments invented or perfected by the Swiss naturalist Horace-Bénédict de Saussure (1740-1799) the hair hygrometer is undoubtedly the instrument that has had the greatest commercial success with more than 150 copies sold.

Saussure first made many experiments in laboratory. He is one of the first to highlight the phenomenon of relative humidity (percentage of humidity compared to the saturating value). The results of his experiments are published in 1783 in his *Essai sur l*hygrométrie*, considered as a reference work in the field.

To validate its work and so that its results can be reproduced by its peers, Saussure sells its hygrometer throughout Europe accompanied by an explanatory note on its operation.

Thereafter, Saussure uses his hygrometer to perform many measurements in the field. During his ascent to Mont Blanc in 1787, he observed that the total humidity decreases with altitude. Measuring the moisture content of the atmosphere was one of Saussure's main activities. As such, it can be considered a pioneer of modern meteorology.

On the basis of these considerations, the Musée d*histoire des sciences de Genève, which conserves the instrument*s collection of Saussure, including several hair hygrometers, plans to reproduce some hygrometric experiments carried out by the Genevan naturalist at the end of the 18th century.

15 min. coffee break

GP 7: The tools of physics and their replication

Zeit: Dienstag 16:30–18:30 Raum: HS 9

GP 7.1 Di 16:30 HS 9

Abraham A. Michelson und die interferometrische Defintion des Meters — •Dieter Hoffmann — MPI für Wissenschaftsgeschichte, Boltzmannstr. 22, 14195 Berlin

Albert A. Michelson (1852-1931)zählt zu den großen Physikern des ausgehenden 19. und beginnenden 20. Jahrhunderts, dessen interferometrische Präzisionsmessungen und Methoden zu den Pionierleistungen der modernen Experimentalphysik gehören. Obwohl Teil davon stehen seine Beiträge zur Metrologie des Meters etwas im Schatten der optischen Präzisionsmessungen zum Ätherdrift oder der Bestimmung der Lichtgeschwindigkeit und sind in der physikhistorischen Literatur kaum beschrieben. Michelson war aber auch einer der ersten, der die Wellenlänge des Lichts mit großer Genauigkeit mittels interferometrischer Methoden bestimmt hatte und diese Methode auf die Defintion von Längenstandards, insbesondere des Meters anzuwenden versuchte. Der Vortrag wird Michelsons Beitrag zur modernen Metrologie und den Weg beschreiben, der zur Meterdefinition mittels interferometrischer Längenmessungen geführt hat.

GP 7.2 Di 17:00 HS 9

Analyse der Herstellung einer Zonenplatte nach Soret mit der Replikationsmethode — •Torben Klages und Andreas Junk — Europa-Universität Flensburg

In Poggendorfs Annalen der Physik wurde 1875 die Übersetzung eines Artikels des Schweizer Akademikers Jacques Louis Soret veröffentlicht, in der dieser die Erzeugung einer Fresnelschen Zonenplatte mit fotografischen Mitteln beschreibt. Dieser Artikel wurde zuvor im gleichen Jahr in zwei Versionen auf französisch publiziert.

Die Zonenplatte wurde zunächst mit Hilfe eines Stangenzirkels als übergroße Vorlage von 70 Zentimeter Durchmesser gezeichnet und später abfotografiert. Soret gibt an, durch die fotografische Verkleinerung auf das Bildnegativ auf diese Weise eine Breite der äußersten Zone von 2 Mikrometer erreichen zu können, wodurch die Zonenplatte als fokussierende Optik für den Bereich sichtbaren Lichts einsetzbar gewesen wäre. In mehreren Experimenten werden noch die Eigenschaften der Zonenplatte wie Brennpunktbestimmung chromatische Abberation experimentell ermittelt.

In diesem Beitrag wird mit dem Ansatz der Replikationsmethode die Fertigung dieser Beugungsoptik untersucht und die Randbedingungen für einen Nachbau beschrieben.

GP 7.3 Di 17:30 HS 9

Feingefühl nach Augenschein: Das Kundtsche Staubfigurenexperiment von 1866 — •Michelle Mercier — Europa-Universität Flensburg

Im Jahre 1866 veröffentliche August Kundt eine Abhandlung, in welcher er eine Apparatur zur Bestimmung der Schallgeschwindigkeit in Festkörpern und Gasen beschreibt. Kundt erhob in seinen Publikationen den Anspruch, dass bei einer geeigneten Wahl der Apparatur, die Methode sehr genaue Messungen erlaubt. Bei Zeitgenossen hoch angesehen, weit verbreitet und tradiert bis heute, ist ein moderner Aufbau des Kundtschen Rohres in universitären Sammlungen zu finden und oft fester Bestandteil in Vorlesungen oder Praktika.

Der Doppelapparat Kundt‘s wurde mit der Replikationsmethode untersucht und es wird im Rahmen dieses Beitrags argumentiert werden, dass Kundt‘s hohe Genauigkeit der Methode zwar durch die Apparatur bedingt ist, doch erst experimentelle Fähigkeiten präzise Messungen ermöglichen.

GP 7.4 Di 18:00 HS 9

Walter Nernst Apparat zur Bestimmung von Dielektrizitätskonstanten - Physikalisch wissenschaftshistorische Analyse — •Sören Werner — Europa-Universität Flensburg

1893 veröffentlichte Walter Nernst einen Artikel, in dem er einen Aufbau zur Bestimmung der Dielektrizitätskonstanten von Flüssigkeiten beschrieb. In seinem Experiment wandte er das Prinzip der Wheatstoneschen Brückenschaltung mit Kondensatoren an, um Kapazitäten anstatt Widerständen bestimmen zu können. Sein Ziel war es, eine einfache und schnelle Methode mit geringen Probenmengen zur Messung von Dielektrizitätskonstanten leicht leitender Flüssigkeiten zu etablieren.

Im Vortrag werde ich im Wesentlichen über den Nachbau der Apparatur berichten, daneben werde ich auch auf Erfahrungen in Bezug auf den Umgang und den Messungen eingehen. Ziel meiner Untersuchung war es, die Funktionsweise und Handhabung der Apparatur nachzuvollziehen und einen funktionsfähigen Nachbau zu realisieren. Ich konnte dabei zeigen, dass einem bereits etablierten Verfahren eine neue Funktion zugewiesen wurde, wobei dieses entsprechend modifiziert werden musste.

GP 8: Mitgliederversammlung des Fachverbandes Geschichte der Physik

Zeit: Dienstag 18:30–20:00 Raum: HS 9

Mitgliederversammlung

GP 9: Understanding tools from the distant past

Zeit: Mittwoch 10:00–11:15 Raum: HS 9

GP 9.1 Mi 10:00 HS 9

The ontological value of scientific objects and social history of science to offer new arenas for public encounter with the various mode of knowledge production. — •Sebastien Soubiran and Delphine Issenmann — Jardin des Sciences, University of Strasbourg, France

The Jardin des Sciences of the University of Strasbourg, sustains and develops a general policy for the preservation and the valorisation of university historical heritage including collections and museums. The investment of the University of Strasbourg is strong and had always been associated with a reflexive approach nourished by a department of Science studies (one of the first created in France).

In our presentation we would like to present various approaches and activities that has been developed so far within the University of Strasbourg with different partners (museums professionals, researchers, curators, designers, artists) in order to experiment different paths to built new tools of social and cultural mediation of science for large public.

We will focus on three specific projects : two exhibitions that were developed with the city museums of Strasbourg and a teaching seminars of history of science and technology for students in physics focuses on objects from physics collections.

With these case studies, we explored and questionned the ontological value of scientific objects and social history of science and science studies at large to offer new arenas for public encounter with the various mode of knowledge production.

GP 9.2 Mi 10:30 HS 9

Johann Bernoulli on the vibrating string and the nature of mechanics — •Iulia Mihai — Ghent University, Ghent, Belgium

This paper focuses on a neglected aspect of Johann Bernoulli's mechanical and mathematical practice concerning the vibrating string: Bernoulli's inquiry into the right principles of mechanics. Bernoulli's solution of 1728 to the vibrating string problem has so far been regarded as one of the first replies to Brook Taylor's earlier solution to the taut string (1714), largely concluding that Bernoulli followed Taylor closely in the assumptions he makes concerning the motion of the string and the result he arrives at. However, by closely analyzing the context of Bernoulli's enterprise and his geometrical constructions, a different picture emerges. Bernoulli gives two proofs for the problem of the vibrating string: one based on the statics concerned with the law of composition of forces, and the other on the vis viva. I show that the former is only remotely related to Taylor's proof. Moreover, Bernoulli favors the vis viva approach to the string, and to mechanics more generally. Bernoulli's attempt at establishing vis viva as the right principle of mechanics is more fruitfully interpreted in the context of Bernoulli's exchanges with Pierre Varignon on the nature of mechanics, which take place a decade prior, rather than in an alleged dispute with Taylor. In particular, Varignon argued for the principle of composition of forces, against Bernoulli's use of the vis viva. The vibrating string problem is an opportunity for Bernoulli to reopen the old debate on the principles and nature of mechanics.

15 min coffee break

GP 10: Understanding tools from the recent past

Zeit: Mittwoch 11:15–14:00 Raum: HS 9

Hauptvortrag GP 10.1 Mi 11:15 HS 9

The computer as a tool of physics: how it all began - or not — •Arianna Borrelli — mecs, Leuphana University, Lüneburg, Germany

Today it is hard to find a branch of physics which can do without computers, but how did it all begin?

Historians of physics have so far not devoted much attention to how computers rose to the high status they now enjoy as a tool of physics, but case studies show that theirs was not the triumphal march one might assume a posteriori. After electronic programmable computers became available on the market in the 1950s, they were not always regarded as necessary tools by physicists, and their potential started being exploited only by individual scientists or groups in specific contexts, and not without resistance.

After a brief overview of recent research on the topic, I will present as an example of how computers entered physics a discussion of the search and acquisition of the first mainframe computer by CERN in the late 1950s. The study is based on the papers of Lew Kowarski, Director of Scientific and Technical Services at CERN since 1954. This material, preserved in the CERN Archive, provides information on the motives for acquiring a computer, on how Kowarski gathered information on the options available both from fellow physicists and from commercial firms, and on the final decision to acquire a Ferranti Mercury.

GP 10.2 Mi 12:00 HS 9

Films of Flows. The Film camera as a Tool in Fluid Dynamics. — •Mario Schulze and Sarine Waltenspül — Zürcher Hochschule der Künste, Zürich, Schweiz

In the course of the 20th century, a lot of research effort was put into scientific film, yet there has not been much historical research in that field so far. Concerning the film camera as tool of physics fundamental questions remain largely unanswered: What did physicists expect by using film cameras? Which obstacles had occurred before the film camera was recognized as a scientific instrument? In our contribution, we would like to start filling this void and examine what happened when, in the 1910s and 1920s, film was implemented in the field of fluid dynamics, at a time when photos were a common method to visualize flows. In particular, we focus on the first experiments with film by Ludwig Prandtl and his coworkers at renowned Göttingen Institute for fluid dynamics (Aerodynamische Versuchsanstalt der Kaiser Wilhelm Gesellschaft). The case of Göttingen shows that films just like photos occupied a precarious position between qualitative imaging and quantitative measurement. However, the film camera in particular was implemented only with a considerable unease regarding its publication, measurability and visuality before becoming a standard tool in fluid dynamics in the 1950s and 1960s. In our presentation we explore the epistemic potential of the film camera and discuss why film produced this unease and why nonetheless so much effort was put into its use.

GP 10.3 Mi 12:30 HS 9

Narratives from the trading zone: Nonlinear dynamics and non-equilibrium thermodynamics in oral history interviews and textbooks — •Caroline Bauer — Lehrstuhl für Wissenschaftsgeschichte, Universität Regensburg

In 1988 James Gleick published the widely sold popular science book "Chaos - Making a new science". Quoting from interviews with nearly one hundred, mostly Western scientists, he delivers a narrative of nonlinear dynamics and non-equilibrium thermodynamics that has individual pioneers fighting the old paradigms and boundaries of their disciplines, bringing about a new scientific revolution. This narrative has also been used by the Bielefeld Universitätsschwerpunkt Wissenschaftsforschung in 1990/91 for their history of self-organization.

In my master's thesis I am contrasting this narrative twofold: One, with an analysis of semi-structured oral history interviews conducted with the keynote speakers at the 2017 Dynamics Days Conference in Szeged, Hungary. Drawing on Peter Galison's *trading zone*, I am focusing on how they place themselves and their (past) colleagues within or outside their affiliated discipline, and how they present the communication with members of other disciplines. Two, I will analyze the framing and the disciplinary reduction processes (*pidginization*), as a specific problem – the Belousov-Zhabotinsky reaction – is presented in nonlinear dynamics and non-equilibrium thermodynamics textbooks for different audiences. With this approach I aim at contributing to answer how the field has maintained its fluid state until the present.

60 min. lunch break

GP 11: The tools of physical theory

Zeit: Mittwoch 14:00–16:30 Raum: HS 9

GP 11.1 Mi 14:00 HS 9

The Fresnel wave surface in the 1820s and 1830s: physical tool or object of mathematical study? — •Marta Jordi Taltavull — Johannes Gutenberg Universität Mainz

In 1821 Augustin Fresnel proposed that the propagation of light through biaxial crystals could be described by a special kind of surface, which is nowadays called the Fresnel wave surface. Biaxial crystals had posed a very challenging problem for optics ever since the 17th century, for light passing through them did not follow the ordinary laws of light propagation. The Fresnel surface became a tool to describe and understand better this anomalous behavior.

Yet Fresnel wave surface did not just remain a tool. Mathematicians and natural philosophers, in particular James MacCullagh, William R. Hamilton and Julius Plücker, turned their attention to the Fresnel surface as an object of mathematical study in the 1830s. They embedded it into more general mathematical theories, such as inversive geometry, and analyzed its properties as a mathematical surface. Relying on such properties, Hamilton even predicted a new optical phenomenon, conical refraction. Later, the Fresnel surface became just one instantiation of a special class of a more general kind of mathematical surfaces called quartics.

Thus the Fresnel wave surface had acquired a life on its own beyond biaxial crystals, having changed from tool in physics to object of study in mathematics, while mediating between both physical and mathematical cultures.

GP 11.2 Mi 14:30 HS 9

The Correspondence Principle as a Research Tool: Rethinking the Old Quantum Theory — •Martin Jähnert — TU Berlin

In a classical assessment, Max Jammer described the old quantum theory as a "lamentable hodgepodge of hypothesis, principles, theorems and computational recipes." This conglomeration of theoretical tools, he diagnosed, constituted a conceptually flawed mix of classical and quantum concepts and was therefore intrinsically doomed to failure. Decades have gone by, in which the philosophy and history of science developed a much more balanced take on the role of theoretical tools in physics, yet Jammer's assessment and the associated narrative of a crisis of the old quantum theory remains largely intact.

In this talk, I will reexamine multiple approaches within the old quantum theory, which operated with a set of loosely interconnected tools while building on a shared conception of quantum systems. I will show how the transfer of these theoretical tools into new empirical domains, their integration into existing theoretical representations and their implementation changed the tools themselves. This transformation through implementation, I will argue, played a central role in the emergence of quantum mechanics and provides the basis for reassessing the old quantum theory and its development.

GP 11.3 Mi 15:00 HS 9

'The new conception of the postulates:' The Bohr-Kramers-Slater reformulation of the (old) quantum theory — •Daniel J Mitchell — Institüt für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen, Sommerfeldstr. 16, 52074 Aachen

The so-called Bohr-Kramers-Slater (BKS) quantum theory remains the subject of conflicting interpretations among historians owing in part to the confusing ontological status of the 'virtual oscillators' (VOs) and 'virtual radiation' (VR) that it introduced. Are these just metaphors—semantic tools, if you will—for describing existing theoretical practice, or do they signify an alternative model to the state-transition picture of the atom? If so, should it be interpreted realistically, or merely as a classical tool for constructing phenomenological relationships between quantum-theoretical quantities? What is it about BKS that made, and continues to make, it so intractable? One reason is a failure to follow up on the main actors' pronouncements about their own work. Another is a narrow focus upon the theoretical content of the ambiguous joint BKS paper of early 1924 rather than its (albeit short-lived) development into 1925. Drawing partly upon recent scholarship on dispersion theory and the correspondence principle, I reconceptualize BKS as an extension and reformulation of Bohr's postulates of quantum theory. I then go on, in the context of the specific prohibition of causal space-time pictures, to characterise the several distinct senses in which the VR and VOs served as tools for articulating these postulates. This perspective, I argue, better represents how Bohr, Kramers, and Slater themselves perceived and pursued 'BKS.'

GP 11.4 Mi 15:30 HS 9

A History of Kirchhoff's Law of Thermal Emission — •Pierre-Marie Robitaille[1] and Stephen Crothers[2] — [1]The Ohio State University, Columbus, OH — [2]Tasmania, Australia

In 1859, Gustav Kirchhoff advanced his Law of Thermal Emission stating that within any arbitrary opaque cavity, in thermal equilibrium, the radiation will always be black, or normal, dependent only on temperature and frequency, while being independent of the nature of the wall. Kirchhoff's proposed this law based solely on theoretical arguments and without experimental proof. Yet, since that time, no theoretical proof of Kirchhoff's law has survived, as Hilbert highlighted at the beginning of the 20th century. Furthermore, this now includes the proof advanced by Max Planck himself [1]. At the same time, no experimental proof of Kirchhoff's law exists. This is because, perfectly reflecting cavities are designed to be resonant. Quality factors for laser cavities have now achieved values of 10^{11}. Conversely, unlike rigid perfect reflectors, actual black bodies are able to do work, transforming any incident energy (either as photons or heat) into normal radiation manifesting the equilibrium temperature. Perfect reflectors can never achieve such a feat (unable to emit) and are in fact, completely uncoupled from the radiation field. In this talk, the history of black body radiation will be reviewed beginning with work preceding Kirchhoff until present. It will be demonstrated that Kirchhoff's Law is indeed false and that universality does not exist. The consequences for modern physics will also be discussed. [1] P.-M. Robitaille and S. Crothers, Progress in Physics, v. 11, p.120-132, (2015).

30 min. coffee break

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.