

History of Physics Division Fachverband Geschichte der Physik (GP)

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19th Symposium of the History of Physics Division “Communicating Physics in History” Communicating Physics through its History”

Writing papers, gauging instruments, teaching at school or chatting over coffee: these are just a few ways in which physical knowledge is communicated, and many more exist today or have existed in the past. In the last decades research in the history, sociology and didactics of the sciences has investigated the communication of scientific knowledge, underscoring the relevance for the development of existing fields, the emergence of new ones and the shaping of scientists' identities and communities. These reflections also apply to the past and present of the physical sciences and the contributions to the conference are invited to reflect all aspects of this diversity.

We understand here “communicating physics” in a broad sense, encompassing formal and informal communications among physicists, teaching at university and school level and public outreach. Beyond that, it also includes the transfer, appropriation and assimilation of knowledge between different cultures, such as interdisciplinary cooperation between physicists and scientists from other disciplines or knowledge transfer in colonial contexts or within processes of globalization.

Furthermore we want to address also another perspective of communication in physics: Communicating Physics through its History. We want to ask how the history of physics is used in the communication of physics today: The communication of physics through its history in formal education as well as through mass media, museums, archives and at public sites.

Overview of Invited Talks and Sessions (Lecture hall GP-H7)

Plenary Talk by Allison Marsh

PV IV	Wed	9:00– 9:45	Audimax	Teaching with Objects and Teaching with Video: The Challenges of Informal Education in Physics — ●ALLISON MARSH
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Invited Talks

GP 1.1	Mon	13:30–14:00	GP-H7	The development of The Lorentz Lab: bringing the scientific history of Teylers Museum to life with working replicas — ●TRIENKE VAN DER SPEK
GP 1.2	Mon	14:00–14:30	GP-H7	Physics in Information Comics — ●HEIKE ELISABETH JUENGST
GP 1.3	Mon	14:30–15:00	GP-H7	Jenseits gewohnter Pfade: Ausstellungen neu denken — ●CHRISTIAN SICHAU

Invited Talks of the joint symposium The Nature of Science (SYNS)

See SYNS for the full program of the symposium.

SYNS 1.1	Tue	14:00–14:30	Audimax	The Role of Nature of Science Education for Science Media Literacy — •DIETMAR HÖTTECKE
SYNS 1.2	Tue	14:30–15:00	Audimax	What kinds of identities are deemed in/our of place in physics? — •LUCY AVRAAMIDOU
SYNS 1.3	Tue	15:00–15:30	Audimax	Some thoughts on the status of theoretical physics — •DANIEL HARLOW

Sessions

GP 1.1–1.3	Mon	13:30–15:00	GP-H7	Communicating Physics and its History (joint session GP/DD)
GP 2.1–2.3	Mon	15:30–16:30	GP-H7	History and Teaching
GP 3.1–3.2	Mon	17:00–17:40	GP-H7	Physics and Media
GP 4	Mon	18:00–19:00	GP-MV	Meeting of Early Career Scholars
GP 5.1–5.5	Tue	10:30–12:30	GP-H7	Physics and the Museum
GP 6.1–6.3	Tue	16:15–17:15	GP-H7	Physicists as Popularisators
GP 7	Tue	17:45–19:45	GP-MV	Annual General Meeting
GP 8.1–8.3	Wed	10:30–11:30	GP-H7	Physics and Instruments
GP 9.1–9.4	Wed	15:40–17:00	GP-H7	History of Physics
GP 10.1–10.1	Wed	18:00–18:20	GP-H7	Physics and Culture

Annual General Meeting of the History of Physics Division

Tuesday, March 22, 2022 17:45–19:45 GP-MV

Come Together for Early Career Scholars

Monday, March 21, 2022 18:00–19:00 GP-MV

Ansprechpartnerin: Julia Bloemer (j.bloemer@deutsches-museum.de)

GP 1: Communicating Physics and its History (joint session GP/DD)

Chair: Christian Forstner

Time: Monday 13:30–15:00

Location: GP-H7

Invited Talk

GP 1.1 Mon 13:30 GP-H7

The development of The Lorentz Lab: bringing the scientific history of Teylers Museum to life with working replicas — ●TRIENKE VAN DER SPEK — Teylers Museum, Haarlem, The Netherlands

In 2017 Teylers Museum opened The Lorentz Lab, a new extension to the permanent presentation of the museum. The Lorentz Lab is specifically dedicated to revive the institute's scientific past as a research institute and laboratory. The scientific instrument collection has long been a silent witness of this past, as are the old laboratory buildings. The Lorentz Lab brings the unique origins of this heritage into life in a carefully recreated historical setting of Teylers' Physics Laboratory.

Here working replica's, theatrical support and a tailor made educational program allow different groups of visitors to participate in science directly and engage with the activities and scientists that shaped Teylers Museum and its collections. The program The Lorentz Formula is dedicated to the general museum visitor, and Einstein was here in a high-level physics program, designed to provoke questions that fit in with educational requirements and with links to the school curriculum.

This lecture will discuss the development of the Lorentz Lab and the central role of working replicas therein. It will address its challenges, original goals, experiences and insights - both from the general public and the educational programs' point of view.

Invited Talk

GP 1.2 Mon 14:00 GP-H7

Physics in Information Comics — ●HEIKE ELISABETH JUENGST — FHWS Würzburg

Information comics are comics designed primarily for knowledge trans-

fer. They can be funny or serious, long or short, and can be found all over the world. And, of course, they can cover any topic.

However, information comics about physics are not very common. "The Physics of Superheroes" by Kakalios is justly popular but does not deal with information comics at all. Chemistry, on the other hand, is a popular topic for information comics.

The reason for this imbalance is a mystery and cannot be solved in this presentation. Information comics presenting topics from physics will be shown and the audience will be encouraged to produce their own information comics for teaching purposes (and for fun).

Invited Talk

GP 1.3 Mon 14:30 GP-H7

Jenseits gewohnter Pfade: Ausstellungen neu denken — ●CHRISTIAN SICHAU — experimenta gGmbH, Heilbronn

Lange Zeit galten Science Center als Ausstellungsorte, in denen über die Darstellung natürlicher Phänomene Begeisterung für Naturwissenschaft und Technik geweckt werden sollte. Obwohl hinsichtlich der Besucherzahlen recht erfolgreich, wurde ihr Ansatz immer wieder als unzureichend kritisiert. Science Center würden kein adäquates Verständnis der Natur der Naturwissenschaften vermitteln, ihnen mangle es an kritischer Reflektion und an einer ernsthafter Auseinandersetzung mit der Wissenschaft und ihrer Geschichte. Bei dieser gelegentlich scharf und polemisch vorgetragenen Kritik wird häufig übersehen, dass es seit vielen Jahren und auf internationaler Ebene zahlreiche neue Ansätze gibt. So wird immer mehr und intensiver in der Science Center-Szene diskutiert, wie das öffentliche Verständnis für und über Wissenschaft vermittelt und gestärkt werden kann. Hierbei kann gerade die Stärke der Science Center - das Erreichen einer sehr breiten Öffentlichkeit mit niedrigschwelligem Angeboten - ein wichtiger Pluspunkt werden. Am Beispiel der experimenta soll aufgezeigt werden, dass hier neue - und vielleicht sehr wirksame - Narrative entstehen können.

GP 2: History and Teaching

Chair: Arianna Borrelli

Time: Monday 15:30–16:30

Location: GP-H7

GP 2.1 Mon 15:30 GP-H7

Transformations: On the relation between research experiments and teaching demonstrations — ●PETER HEERING — Europa-Universität Flensburg

Some experiments from the history of physics were so relevant that they were not only included in textbooks, but also found their way into (university) physics education as teaching demonstrations. The instruments developed for this purpose can be found in a number of museum collections, whereby frequently hardly any differentiation is made between teaching devices and research instruments. However, a somewhat closer analysis of the instruments and the practice associated with them makes it clear that significant differences can be found here. In the context of this paper, I am going to discuss some aspects of such demonstration devices that prove relevant precisely in distinguishing them from the corresponding experimental instruments and the practices associated with them.

GP 2.2 Mon 15:50 GP-H7

Bringing some light into the dark and some darkness into light: Young's double-slit experiment (1807) — ●MICHELLE MERCIER — Europa-Universität Flensburg

In 1807, Thomas Young published the description of an experiment that is nowadays canonized as Young's double-slit experiment. Today, the basic principle of the experiment is well-known, however, the experiment performed by Young is not. And if one goes back to the initial description, his text is difficult to understand and leaves several questions unanswered both in respect to the details of the apparatus he used and the exact observations in his experiment.

As part of my PhD project, Young's double-slit experiment is analyzed by using the replication method. In this talk, I will describe the

experiences made (experimentally) and focus in particular on the difficulties in observing as well as documenting and communicating what is seen. The meaning of the experiences made for the understanding of Young's description of the experiment will be discussed in conclusion.

GP 2.3 Mon 16:10 GP-H7

Garavito's work in Colombia on the theory of light aberration: some didactic reflections for the teaching of physics — ●LISBETH ALVARADO-GUZMAN^{1,2}, ISABEL MALAQUIAS², and ROBERTO NARDI¹ — ¹São Paulo State University (Unesp), School of Sciences, Bauru, Brazil — ²University of Aveiro (UA), Dep. Physics, CIDTFF, Aveiro, Portugal

This article aims to recognize some elements about the scientific research developed in Colombia at the beginning of the 20th century and the communication with the international scientific community of the time. Julio Garavito Armero's (1865-1920) original article on the theory of light aberration (1912) is taken as a paradigmatic example and with didactic interest. He was the first professor of mathematics (Arboleda, 2021), graduated as an engineer, also director of the Astronomical Observatory in Colombia (1893-1919). From the original article, the problem Garavito addresses was the one proposed by the astronomer David Gill (1843-1914) in 1896: if one may consider as exact the generally accepted theory of aberration. Garavito concluded that the annual aberration constant was correct and considered incorrect Huygens' interpretation of the superposition of waves effect, using the analogy of water waves (Lleras, 1915). To conclude, the problem addressed by Garavito can have a special interest in the teaching of Physics and Astronomy context from: 1) the analysis of the phenomenon of aberration of light as an argument in favor of Earth's motion; 2) questions on the nature of science connected with the communication by and between researchers.

GP 3: Physics and Media

Chair: Christian Forstner

Time: Monday 17:00–17:40

Location: GP-H7

GP 3.1 Mon 17:00 GP-H7

From the Preprint Information Exchange to "Computopia": the development of preprint culture in High Energy Physics — ●ARIANNA BORRELLI — Leuphana University Lüneburg, Universitätsallee 1, 21335 Lüneburg

The term "preprint" has recently become known also among the general public as indicating research papers which are circulated in digital form, but have not (yet) gone through the peer review process. In particular, debates in the biomedical sciences on whether and how far such results should play a role in the management of the pandemics have found large resonance in the media. A look back at the history of printed and digital preprints shows that such discussions are not new and often found a different outcome in the biomedical field, where preprints were long discouraged if not forbidden, and in physics, where preprints became an increasingly important means of academic communication already in the late 20th century.

High-energy physicists were path-breaking in this development and it has been suggested that they traditionally had a more open approach to the diffusion of knowledge than life scientists. Is this really the case? I will offer a brief overview of the growth of preprint culture in physics from the 1960s and its eventual move to the digital sphere, which physicist David Mermin in 1991 hailed as "Computopia." Comparing these developments with those in other academic fields, I will ask about the historical factors which may help explain the differences and similarities.

GP 3.2 Mon 17:20 GP-H7

Poggendorffs Briefe an seinen Verleger Barth: Eine neue Quelle zu den Annalen der Physik und Chemie — ●MICHAEL BARTH — Nordstraße 7 31249 Hohenhameln

J.C.Poggendorff war von 1824 bis 1876 Herausgeber der Annalen der Physik und Chemie, der mit Abstand bedeutendsten Fachpublikation im 19. Jahrhundert im deutschen Sprachraum. Die 147 Briefe, die er im Zeitraum von 1824 - 1859 an J.A.Barth, Verleger der Annalen, schickte, wurden mir vor längerer Zeit überraschend zugänglich gemacht. Für den Zeitraum 1830 bis 1845 habe ich davon 51 Briefe transkribiert und in meiner Dissertation publiziert. Sie dienen mir vor allem zur möglichst exakten Datierung der Annalen, um die Rezeption von Faradays Arbeiten im deutschen Sprachraum genau zu verfolgen.

Diese bislang nach meinem Wissen nicht publizierte Quelle hat aber noch erheblich mehr Potential. Sie liefert für mehrere Dekaden detaillierten Einblick in den alltäglichen Ablauf von Poggendorffs Herausgebertätigkeit, den konkreten Druck- und Publikationsprozess, Finanzfragen, technische Probleme, Einschätzungen von Kollegen, Animositäten, privaten Erlebnissen, Reisen usw. usw., dies auch für Poggendorffs bekanntes Biographisch-literarisches Handwörterbuch. Alles Informationen, die interessant für die unterschiedlichste Nutzung in der wissenschaftshistorischen Forschung sein können.

Im Vortrag werde ich diese Quelle vorstellen und ihr Potential diskutieren. Dabei werde ich auch kurz auf sehr interessante Passagen der Korrespondenz zwischen Poggendorff und Schönbein eingehen, die in den bisherigen Publikationen fortgelassen wurden.

GP 4: Meeting of Early Career Scholars

Chair: Julia Blömer

Time: Monday 18:00–19:00

Location: GP-MV

Virtual Come Together**GP 5: Physics and the Museum**

Chair: Michelle Mercier

Time: Tuesday 10:30–12:30

Location: GP-H7

GP 5.1 Tue 10:30 GP-H7

Physik erleben durch "Ein naturkundliches Spiel-System". Hugo Kükelhaus und die deutsche (Vor-)Geschichte des Science Centers — ●ARNE SCHIRRMACHER — Humboldt-Universität zu Berlin

Mehr und mehr haben die Science Center die Vermittlung von Naturwissenschaften und damit insbesondere von physikalischen Phänomenen übernommen, häufig noch bevor Schule oder Museum dies tun. Während die Vermittlung über historische Arefakte in Museen eine europäische Errungenschaft war und etwa in Paris, München oder London Modellcharakter bekam, entstand die heutige Form des Science Centers Ende der 1960er Jahre in Nordamerika. In meinem Vortrag möchte ich mit Hugo Kükelhaus einen unkonventionellen deutschen Weg zur Vermittlung von physikalischen Phänomenen vorstellen, die dieser seit einem Besuch im Deutschen Museum im Juli 1965 entwickelte und mit Unterstützung von Otto Hahn und der Max-Planck-Gesellschaft realisierte, u.a. für die Weltausstellung 1967 in Montreal. Das Projekt eines "Phänodrom" scheiterte indes. Lagen die Probleme bei der deutschen Entwicklung zu einem Science Center in Kükelhaus' Biographie oder in dem Wandel der deutschen Wissenschaftskultur?

GP 5.2 Tue 10:50 GP-H7

Von Fehlergrenzen und Straßenbahnen: Die Experimente von Alice Golsen zum Strahlungsdruck des Lichts — ●JOHANNES-GEERT HAGMANN — Deutsches Museum, München, Deutschland

Laserkühlung, Optischen Pinzetten, Sonnensegel: für eine Vielzahl von physikalischen Konzepten und Anwendungen kommt der durch die

elektromagnetische Strahlung vermittelte Druck zum Tragen. Die Geschichte der Entdeckung und Messung des Strahlungsdrucks wird gelegentlich auf die Arbeiten von Pjotr Nikolajewitsch Lebedew (1886-1912), Ernest Fox Nichols (1869-1924) und Gordon Ferrie Hull (1870-1956) reduziert. Der vorliegende Beitrag ordnet die Arbeiten der Physikerin Alice Golsen (1889-1940), die in Frankfurt gemeinsam mit Walther Gerlach (1889-1979) forschte, in diese Untersuchungen ein. Die damit verbundene Rekonstruktion der Biografie Golsens ist Teil der Vorbereitungen zur geplanten Ausstellung *Licht und Materie* im Deutschen Museum.

GP 5.3 Tue 11:10 GP-H7

Elsa Garmires kohärente Kunst: Eine interaktive Laserinstallation als didaktisches Ausstellungselement — ●ECKHARD WALLIS — Deutsches Museum, München, Deutschland

Das Ausstellungsprojekt „Licht und Materie“ am Deutschen Museum verfolgt das Ziel, die Quantenphysik des Lichts auch Besucherinnen und Besuchern zugänglich zu machen, die keine ausgeprägte Affinität zur Physik mitbringen. Ein Beispiel für einen historischen Zugang zur Thematik sind die Arbeiten der Laserpionierin Elsa Garmire (geb. 1939). Neben ihrer physikalischen Arbeit am Caltech war Garmire ab den späten 1960er Jahren auch an den ersten experimentellen Kunstprojekten mit Laserlicht beteiligt. Inspiriert von Garmires Projekten ist für die Ausstellung eine interaktive Laser-Installation geplant, die die Besucherinnen und Besuchern zu physikalischen und historischen Erkundungen einladen soll. In diesem Beitrag gehe ich der Frage nach, welche Lerneffekte wir durch die historische Perspektive erwarten.

Coffee Break

GP 5.4 Tue 11:50 GP-H7

Label: Fallacy. Communicating Nature of Science in a Museum Exhibit — ●JULIA BLOEMER — Deutsches Museum, Munich, Germany

Physics often seems to be incomprehensible and divorced from reality. High-specialized instruments rarely help to bridge the gap in science communication. The interferometer built by Georg Joos in 1930 is one example. It is a person-high steal construct with four arms and a complex mirror construction inside. Meant to measure the hypothetic aether and to answer the question about a medium for light propagation, it is the end of a long line of different interferometer experiments since the 1880s with larger and larger instruments. Finally, special relativity theory replaced any need for a luminiferous aether and the hypothesis was abandoned. Why should anybody care about an old and gigantic historical instrument connected with an outdated theory? In the past, the Joos-interferometer served as a museum object to transport several different messages: to explain the theory of relativity and its history or to emphasize the high-standard of the German optical industry in the 1930s. This talk presents a different perspective. Especially instruments can tell stories about nature of science aspects, about the way physicists ask and answer questions. In this case, which role does fallacy play? How can repetition stabilize knowledge? In times of science skepticism, this is as important as never before.

GP 5.5 Tue 12:10 GP-H7

GP 6: Physicists as Popularisators

Chair: Julia Blömer

Time: Tuesday 16:15–17:15

Location: GP-H7

GP 6.1 Tue 16:15 GP-H7

The role of aesthetics in science communication: History and histories in Werner Heisenberg's popular writings — ●ELENA SCHAA — Trinity College Dublin, Dublin, Ireland

In 1969, Werner Heisenberg published his memoir *Der Teil und das Ganze. Gespräche im Umkreis der Atomphysik*. Driven by the motivation to empower the lay audience to engage in the "philosophical, ethical, and political discussions" arising from modern physics, he sets out to share his recollections of the development of modern physics.

Departing from a close examination of Heisenberg's bestseller, the paper discusses how Heisenberg used history and historization to communicate physics beyond the scientific community while taking on a double role as a spectator and a narrator of the history of physics. The paper analysis first, the different ways history becomes relevant Heisenberg's narratives. Secondly, focusing on the form of his popular writings, the paper highlights the interference of science and religion, specifically the Romantic aesthetics of immediate experience of nature and knowledge production. Ultimately, I situate Heisenberg's communication of physics in the wider context of the German *Bildungsbürgertum* together with the masculine ideal of academic authority within which his popularisation of modern physics becomes effective.

GP 6.2 Tue 16:35 GP-H7

Writing History as a Way to Teach Physics: Edmund T. Whittaker's two editions of the A History of the Theories of Ether and Electricity, 1910 and 1951-3. — ●JAUME NAVARRO — University of the Basque Country, Spain

At the end of his career as a physicist and mathematician, Edmund T. Whittaker (1873-1956) decided to prepare a second, much enlarged version of his by then classic 1910 book *A History of the Theories of Ether and Electricity*. While the first edition had received nothing but praise, the second, two-volume edition had mixed reviews, especially due to its treatment of Einstein's role in the development of special relativity. In a recent paper I have analysed the reasons behind his moderate portrayal of Einstein in the history of twentieth century physics (Navarro 2021). Yet, much has to be studied about the role

Mont Blanc, the laboratory of 18th century Geneva scientists — ●STÉPHANE FISCHER — Musée d'histoire des sciences de Genève, 128, rue de Lausanne, 1202 Genève

At the end of the 18th century, through a combination of political, social and cultural circumstances, Geneva became the scientific capital of the Alps. In less than fifty years, several of the city's scientists embarked on a scientific exploration of the Savoyard Pre-Alps and the Mont Blanc Massif, 60 km away. The mountain became a veritable open-air laboratory where various measurements were taken: altitude, air or water boiling temperatures, topographical surveys, purity of the atmosphere, composition of the gases in the atmosphere at altitude, etc. This quest culminated in the summer of 1788 with the ascent of Mont Blanc by the Genevan naturalist Horace-Bénédict de Saussure.

The Museum of the History of Science is devoting its next temporary exhibition to this scientific epic. The heart of this exhibition is made up of instruments from the collections, in this case the instruments from the Saussure collection kept at the Museum. The exhibition is an ideal medium for tracing a storyline, a narrative that allows the context in which these instruments were invented and manufactured at the time. A great deal of attention is paid to the functioning of these instruments. Alongside the old barometers, two modern replicas of mercury barometers taken this summer to heights of more than 3000m for altitude measurements will be presented. Various interactive experiments offer visitors the opportunity to learn the basics of barometric levelling, surveying and slope inclination in a playful way.

both editions played in the teaching of physics to generations of physicists, historians of physics and physics aficionados. In this paper I intend to track the implicit agendas of Whittaker in the two editions of his book and the ways they were received. I shall argue that *A History of the Theories of Ether and Electricity* had an historiographical vision on how to use history to teach the contents of physics, to shape a discipline at a time of profound transformations and to portray physics as a collective and non-teleological enterprise. The highly unexplored correspondence with his son, the also mathematician John Whittaker, helps us give this more complex picture of the *A History of the Theories of Ether and Electricity*.

GP 6.3 Tue 16:55 GP-H7

Spacetime as popularised by Arthur S. Eddington — ●FLORIAN LAGUENS — IPC-Facultés Libres, 70 avenue Denfert-Rochereau, 75014 Paris, France

Arthur S. Eddington (1882-1944) certainly was the world's most famous astronomer during the interwar period. For thirty years he was the director of Cambridge Observatory and a Fellow of Trinity College. He also plunged into philosophy while discovering Einstein's general relativity in 1916. From then on, he developed some personal thoughts about physics, its methods and its limits. Along with widely acclaimed scientific treatises, Eddington published some controversial books such as *The Nature of the Physical World* (1928), *Relativity Theory of Protons and Electrons* (1936) and *The Philosophy of Physical Science* (1939). In particular, *The Nature of the Physical World* is still considered a masterpiece regarding the popularisation of general relativity theory and quantum mechanics. Indeed, spacetime is discussed at length in several chapters. This paper intends to highlight, thanks to key passages of Eddington's works, his very conception of popularisation. It then allows to exemplify its role in helping both students and colleagues coping with the relativity major conceptual changes. Finally, Eddington's attitude towards popularisation reveals his way of considering the relationship between physics and mathematics. All in all, as he replies to some critics, his aim is to "convey exact thought in inexact language" (*New Pathways in Science*, 1935).

GP 7: Annual General Meeting

Time: Tuesday 17:45–19:45

Location: GP-MV

Annual General Meeting

GP 8: Physics and Instruments

Chair: Johannes-Geert Hagmann

Time: Wednesday 10:30–11:30

Location: GP-H7

GP 8.1 Wed 10:30 GP-H7

The Communication of Object-Bound Knowledge in Networks of Lead-Users — ●CHRISTIAN FORSTNER — Ernst-Haeckel-Haus, Friedrich-Schiller-University, Jena, Germany

Research technologies circulate between different fields of society and are continuously adapted to new contexts in a process of dis- and re-embedding. But how is the tacit knowledge that is tied to their practical use made explicit? Does it reveal itself to the user? What strategies were taken by the instrument makers to make tacit knowledge accessible to the user? In my talk I will discuss a historical example of communicating physical practices. Therefore I analyze the optical measurement instruments of the Carl Zeiss Company, in particular analytical interferometers, to show how a network of lead users was created and how practical knowledge circulated in this network.

GP 8.2 Wed 10:50 GP-H7

Analysis of Portable Quadrants from Different Cultures — ●ENES TEPE — Europa-Universität Flensburg, Auf dem Campus 1, 24943 Flensburg

Portable quadrants (*rub^cal-dā²īras*) are instruments that were used for purposes such as astronomical observations, timekeeping, navigation, surveying, maritime, ballistics, and mathematical calculations for more than a Millennium. In a previous study (my MA thesis), the role of this class of instruments in classical astronomy was analyzed within the context of a comparison between the Islamic World and the Western Europe. For this purpose, information of surviving instruments that can be found through the online catalogues of museums and auctions were examined. Therefore, it has been shown that the

astronomical portable quadrant traditions in Mamluk, Maghreb, Iran, Ottoman Syria, Ottoman, Continental Europe, Italy and England can be distinguished and studied in detail. In my current project, two of the most well-established portable quadrants, one from the Islamic World and the other from the West, are chosen in order to analyze the respective practice with the replication method. One of them is a quadrant of almucantars (*rub^cal-muqantarāt*) for Damascus by Zayn al-Dīn [Shams al-Dīn] Abū ʿAbd Allāh Muḥammad ibn Aḥmad ibn ʿAbd al-Raḥīm al-Mizzī (d. 1349). The other one is a Sutton-type large quadrant by Henricus Sutton Londini (d. 1665) for London. In this talk, the prominence of these two instruments will be discussed and their general features of them will be shared.

GP 8.3 Wed 11:10 GP-H7

Binocular or stereoscopic telemeters? Two countries, two concepts — ●ANDREAS JUNK — Europa-Universität Flensburg

The development of rangefinders in Europe towards the end of the 19th century seems to have been a competition between the British company Barr&Stroud and their German counterparts Carl Zeiss Jena. These companies used different approaches for their so-called telemeters whilst the instruments looked very much alike.

Barr & Stroud preferred a binocular approach for a coincidence rangefinder, Zeiss in turn designed a stereoscopic rangefinder. Whilst the preliminary test results indicated, that the stereoscopic approach would produce better results, Barr & Stroud insisted, that these results could only be produced by users, who did not have certain physiological handicaps. In my paper, I want to line out the (dis)advantages of the instruments as well as the respective motivation and conditions for their construction.

GP 9: History of Physics

Chair: Peter Heering

Time: Wednesday 15:40–17:00

Location: GP-H7

GP 9.1 Wed 15:40 GP-H7

M. I. Kaganow und die Elektronentheorie der Metalle — ●PETER BUSSEMER¹ und VLADIMIR RZHEVSKI² — ¹Cooperative University Gera-Eisenach — ²Lomonosov-University Moscow

Moisej I. Kaganow (1921-2019) war einer der letzten Repräsentanten der sowjetischen Schule der Festkörpertheorie, begründet in Charkow um 1930 von Lew Landau und dort bis 1970 fortgeführt von Ilja M. Lifschitz (1917-1982), danach in Moskau. Unter dessen Leitung war Kaganow wesentlich an modernen Entwicklungen beteiligt: Quantenmechanik von Elektronen mit beliebigem Dispersionsgesetz, Topologie der Fermi-Flächen (Fermiologie) mit der Möglichkeit offener Elektronenbahnen, Oszillationen thermodynamischer Größen im Magnetfeld, HF-Eigenschaften-veröffentlicht in Deutsch 1975 in "Elektronentheorie der Metalle" mit Lifschitz und Asbel. Seine Untersuchungen zu den Lifschitzschen topologischen Phasenübergängen 2 1/2-ter Ordnung sind ein früher Vorgriff auf die aktuellen Anwendungen der Topologie bei Phasenübergängen. Kaganow war ein brillanter Hochschullehrer: Von 1970-1994 bildete er an der Moskauer Universität mehrere Studentengenerationen aus. Ebenso ein engagierter Wissenschaftsvermittler, verfasste er zahlreiche populäre Einführungen in die Quanten- und Festkörperphysik mit Übersetzungen in Deutsch, Englisch und Polnisch. Enge Kontakte pflegte er zur DDR und Polen: Dr.h.c. TU Wroclaw 1988. Nach 1994 lebte er als jüdischer Emigrant in den USA.

GP 9.2 Wed 16:00 GP-H7

JOHN HERSCHEL, NOT ONLY AN ASTRONOMER, IN THE FOOTSTEPS OF FATHER AND AUNT — ●HARALD GROPP — VIGN, Heidelberg, Germany

150 years ago, on May 11, 1871 John Herschel died in Hawkhurst, Kent. He is mainly known as an astronomer but also contributed to math-

ematics, chemistry, philosophy of science and related fields. Together with the astronomical couple, his aunt Caroline (1750-1848) and his father William (1738-1822), John(1792-1871) covers a period of more than 130 years of astronomical research. Caroline is probably the least known of them. She not only assisted her male colleague (brother) William, but was paid a salary for her work.

In this paper the cooperation of 3 astronomers will be discussed, between William and Caroline directly, but also independently, between William and John by John following in his father*s footsteps. Letters between John in England (and South Africa) and his aunt Caroline back in Germany played a main role in the last period. They were edited by John*s wife, *Mrs. John Herschel* (1810- 1884) and tell interesting details about the *collective work*

GP 9.3 Wed 16:20 GP-H7

“Reducing physics to pure mathematics”: Johann I Bernoulli on Brook Taylor’s taut string problem — ●IULIA MIHAI — Ghent University (Belgium)

The vibrating string problem is outstanding in the history of eighteenth-century mathematical physics. This paper focuses on the conception of the continuous string that was dominant for three decades before the use of partial differential equations at the end of the 1740s. Scholars have emphasized the novel mathematical techniques in Johann I Bernoulli’s reappraisal (1732) of Brook Taylor’s initial investigation (1713), but the standard view has it that the conception of the string with which they work remains unchanged. By contrast, this paper argues that how the string is conceived evolves due to the conceptual changes brought about by Bernoulli’s scientific practice. Whereas Taylor approaches the string (also) by drawing analogies with other mechanical objects on the basis of shared (physical and geometrical)

properties, Bernoulli steers clear of physical analogies in investigating the string's properties. Moreover, Bernoulli's extensive use of algebraic symbolism enables innovative notational interventions which result in a more robust handling of both physical and geometrical quantities; this goes beyond the fact that Bernoulli uses the differential calculus and Taylor the fluxional calculus. Ultimately, it is Bernoulli's methodology of "reducing physics to pure mathematics" which is behind the evolving conception of the string.

GP 9.4 Wed 16:40 GP-H7

Black Hole Imaging and Framings of the Observer — ●EMILIE SKULBERG — Institute of Physics, University of Amsterdam

Based on the study of an extensive collection of visual representations of black holes from 1970 to the present, I trace the history of visual and textual framings of the observer in the context of black hole imaging. I argue that the framing of the observer changed significantly in this period. Some peer-reviewed papers containing early visual representa-

tions of the immediate surroundings of black holes had brief references to telescopic observation. More commonly, such images were framed as part of thought experiments of what an observer (appearing in thought experiments as a hypothetical human being) would see or photograph if equipped with a camera directed at a black hole. The observer here became a point of view in a visual sense as images showed what an observer "saw" or "photographed". Towards the new millennium, visualizations from simulations began to form part of arguments that observing the shadow of a black hole would in fact be possible. Rather than an observer with a camera in thought experiments, visualizations showed how a specific celestial object believed to be a black hole might look if observed from Earth using Very Long Baseline Interferometry. This method, in which data from observations by multiple telescopes placed far apart are combined, was what would later enable the Event Horizon Telescope Collaboration to produce images such as the first observation of the shadow of a black hole. At the same time, virtual reality now offers the immersive and embodied experience of seemingly being an observer approaching a black hole.

GP 10: Physics and Culture

Chair: Peter Heering

Time: Wednesday 18:00–18:20

Location: GP-H7

GP 10.1 Wed 18:00 GP-H7

European and American Research Traditions in the 20th Century — ●ALEXANDER UNZICKER — Pestalozzi-Gymnasium München

While the European research tradition, in the spirit of natural philos-

ophy, was focused on the fundamental laws of nature and pursued the question of 'what holds the world together at its innermost folds', in the US, a technologically oriented culture dominated, with a desire to realize large, visionary projects, such as the atomic bomb and landing on the moon. It is argued that this change in scientific culture is still visible in contemporary physics.