Scientific Instrument Commission

SIC Symposium Athens, 19 – 23 September 2022

BOOK OF ABSTRACTS

MONDAY, 19 September

9.30 – 10.00 Opening Ceremony

10.00 – 10.30

What shall we keep? In memory of Peter Maria Schuster

Denis Weaire

School of Physics, Trinity College, University of Dublin

Abstract

The passing of Peter Schuster provokes thoughts on the role of the "professional" and "amateur" in our subject, and how it can be best pursued in these changing times. In particular, are science museums outdated? And, when the attic is cleared, what shall we keep? My own involvement has been accidental or incidental, so this is a view from "from the sidelines" and from various angles. The examples chosen are mainly located in Ireland, which has a surprising wealth of surviving instrumentation.

An extended personal tribute to Schuster, prepared for an online History of Physics conference, is available via the link https://youtu.be/fZamHnhn4Io, courtesy of the Institute of Physics.

Denis Weaire is a former President of the European Physical Society and was the last of the old-style Professors of Natural and Experimental Philosophy at Trinity. There he felt haunted by the ghost of his predecessor Fitzgerald, which led him into an interest in the history of physics.

10.30 – 11.00 Coffee Break

11.00 – 13.00

Session 1 (plenary)

Session in Tribute to Paolo Brenni

Introduction and Chair:

Mara Miniati, Emeritus Curator of the Museo Galileo, Florence

Telegraphs, bridges and velocipedes: Scientific instrument-makers in 19th-century Veneto region

Fanny Marcon

University of Padua

Keywords: Scientific instrument-makers, transmission of scientific practices and knowledge, Veneto region, 19th century

Abstract

When I approached the world of scientific instruments studies, the first publications by Paolo Brenni I had the opportunity to read were his series of papers on French scientific instrument-makers. The reading of these articles was crucial to stimulate my interest in these figures, who are often considered to be of secondary importance in the history of science.

In my PhD thesis, which dealt with the circulation of scientific knowledge in the Veneto region in the 19th century, one of the chapters thus focused on makers. I showed how they played an important role in the transmission of scientific practices and knowledge through the research and teaching instruments they made for the local university and observatory, as well as for the high schools and academies of the region. They were also frequent participants in industry awards, events that greatly contributed to the dissemination of scientific and technological knowledge.

In my talk, I will briefly present my work and show how Paolo Brenni's suggestions were fundamental in order to fully understand these figures and their role, to outline their living conditions and to contextualise them in a broader context.

Fanny Marcon is Curator of the Museo Bernardi and Scattered Scientific Collections, University of Padua.

To teach, experiment and show:

The apparatuses of the Cabinet of Physics of the University of Bologna

Eugenio Bertozzi and Laura Rigotti

University of Bologna, Department of Physics and Astronomy

Keywords: Cabinet of Physics of the University of Bologna, Physics instruments

Abstract

In the last years, Paolo Brenni visited several times the University of Bologna, whose collections thrilled his expertise. In 2020, when the University decided to celebrate Augusto Righi, leading Italian physicist between the 19th and 20th century, Paolo pulled in a small group of researchers and students, stimulating their interest in Righi's sophisticated apparatuses for electromagnetic waves, which were studied, restored and exhibited on that occasion.

Since then, however, it became clear that the most relevant part of the collection was constituted by the devices of what had been "the Cabinet of Physics of the University of Bologna", whose instruments lay well-preserved but dispersed. When, in 2021, we had the opportunity of studying and restoring these instruments, and we had the possibility of organizing a specific exhibition, this appeared as a happy follow-up.

In this presentation we will discuss the central part that Paolo Brenni played in the understanding of these instruments, the critical remarks he made, the numerous checks he required, the joint use of historical sources, like books, and modern tools, like videos. Paolo's explanations and suggestions have been fundamental to understand how much the dimensions of teaching, experimenting and displaying were intertwined in a physics cabinet, and to grasp how the idea of variety was embedded in 19th-century instrument-making.

Eugenio Bertozzi is assistant professor in the history of physics and curator of the historical collection of physics instruments of the University of Bologna. His interests include the history of experimental practices and instruments and historical perspectives on the popularization and teaching of physics.

Laura Rigotti was born in Ravenna, studied physics at the University of Bologna and received a Master Degree (24/03/2022) in Physics with a thesis concerning the study of nineteenth-century instruments from the Collection of Physics Instruments of the University Museum Network of the University of Bologna.

In the Laboratory of History of Physics: Re-working Historical Experiments

Roland Wittje

Indian institute of Technology Madras

Keywords: Re-working experiments, Oldenburg group, electromagnetism

Abstract

I met Paolo for the first time at a conference in Regensburg in 1997 when he surprised me with the way he engaged with my research on re-doing the early experiments of Heinrich Hertz on the propagation of electric force leading to electromagnetic waves. Over the years, he became a close friend and mentor. Unlike most historians of science, Paolo did not only know about historical instruments but had personal knowledge of how to operate them and to conduct experiments. His deep and at the same time broad knowledge was highly valued among the Oldenburg group from where I graduated, which developed re-working experiments as a method in writing history of science.

Paolo and I have shared a strong interest in the Hertz experiments and related electromagnetic research and communication technologies prior to the advent of the vacuum tube. In my presentation, I will draw on hydromechanical models of electricity and magnetism, and on our work on re-creating the singing and speaking arc experiments. Beyond the didactic value of re-creating these lecture demonstrations, I want to discuss what they can teach us as historians of science about the understanding of electromagnetic phenomena and technologies at the time.

Roland Wittje is Associate Professor in History of Science and Technology at the Indian institute of Technology Madras.

"Better than New?": Paolo Brenni and the restoration of Scientific Instruments

Anna Giatti

Fondazione Scienza e Tecnica, Florence

Keywords: Restoration, conservation, scientific instruments.

Abstract

I met Paolo Brenni for the first time in September 1985. I was very young, so was he, but he knew everything, or at least that was what I thought when he introduced me into the world of the collection of the scientific instruments belonging to the Cabinet of Physics at the historical Istituto Tecnico of Florence. The best part was the restoration-workshop; that was the reason why I was there. It wasn't a sort of surgical room as modern restoration-workshops are nowadays, it was more similar to a suggestive alchemical laboratory.

In Italy, there is a well-established tradition regarding the restoration of artwork, with noble examples and important theoretical references. Florence, in particular, has played a special role

in the evolution of practices and methodology, due to the 1966 catastrophic flood and the consequent and challenging rescue of the Florentine cultural heritage. If this is true for the artistic, archaeological and architectural heritage, the situation for scientific instruments remained not so developed. Only a combination of different conditions made the situation exceptionally favorable to obtain a rigorous, effective and remarkable workshop. One of the conditions in the above-mentioned workshop, the most important, was Paolo's presence.

In this presentation I will report the experience, the subsequent outputs and the efforts to export the acquired knowledge.

Anna Giatti is the curator of the Cabinet of Physics at the Fondazione Scienza e Tecnica in Florence, and restorer of historical scientific instruments. Her interests include investigation on the materials of the scientific instruments, history of scientific experimental practices, preventive conservation, cataloguing, and popularization of scientific culture.

General discussion, remembering Paolo's contributions to scientific instrument studies

13.00 – 14.30 Lunch

14.30 – 16.30

Session 2 (parallel)

20th Century & Contemporary Instruments

Chair:

Tacye Phillipson, National Museums Scotland

The exoticism of biomagnetism and the related scientific recording equipment

Adam Adamopoulos

Medical Physics Laboratory, Department of Medicine,
Democritus University of Thrace, Alexandroupolis

Keywords: Bioelectromagnetism, medical applications of biomagnetism, SQUID technology

Abstract

This paper reviews theories and conceptions on magnetism and in the following on biomagnetism, i.e., the magnetic activity generated by living organisms and the magnetic fields that are emitted. The effort to develop scientific instruments for the detection and recording of biomagnetic fields is also reviewed. A special reference is made to Superconducting Quantum Interference Devices (SQUID) for biomagnetic signal recording and the development of special chambers for electromagnetic, acoustic and anti-vibration shielding in order to reduce as much as possible external interference (noise) during this procedure. In addition, the fields of

application of biomagnetism during the last four decades are reviewed with emphasis on the fields of medical diagnosis. Finally, the latest developments in the development of scientific biomagnetic signal recording instruments are presented. Through this review, a comment is attempted on the evolution of scientific equipment in biomedical research.

Adam Adamopoulos studied Physics and holds a Ph.D. on Medical Physics and a second Ph.D. on Computational Intelligence and Artificial Life. Among his research interests are medical applications of Biomagnetism, Computational Intelligence, Artificial Life, Nonlinear Systems and Chaos.

Immaterial practices and their material cultures: Inside Stephen Hawking's Office

Juan-Andres Leon

Science Museum, London

Keywords: Theoretical physics, physical spaces of research, materiality and immateriality, socio-political networks, distributed cognition, museological reconstructions

Abstract

Theoretical physics presents a formidable challenge for museums: the practice is far removed from everyday visitors' experience; and more fundamentally, theoretical scientists challenge our expectations of what should be the targets for preserving, collecting and displaying as material culture of science.

Up to the 1970s, paper traces were the hopeful workaround, fixing some of the theoreticians' 'inner' workings, through their written interactions, and if luckier, back-of-envelope scribblings indicative of private thoughts. However, as the world moves beyond digital calculation and communication, towards digitally-based "thinking"; what will be left for us to collect, 'figure out' and interpret in museums?

In short, what is, and what will remain, in its fundamental essence, the material culture of even the most immaterial of practices?

We are facing this challenge at the Science Museum with Stephen Hawking's Office, a space where scientific work was conducted in the early 21st century. Its contents and arrangement remind us of the highly networked, collective nature of contemporary theoretical work. It highlights how, while many material tools and instruments have migrated to the digital domain, this migration reinforces those aspects that remain anchored to physical places and face-to-face interaction. Are there 'magical places' that facilitate human endeavors, such as collective creative work, to flourish? Such potential places, their contents, and what is missing from them, are all ripe for exploration.

And as Hélène Mialet best describes, Stephen Hawking's physical limitations only highlight, perhaps forebode, processes experienced by all scientists, and increasingly, 21st century workers in general.

Juan-Andres Leon is the curator of Stephen Hawking's office, and recently co-wrote a book on the history of 20th century astrophysics in Germany. His work highlights scientific traditions and their support networks across disciplines, and scales: from the intimately private, through, the socio-political and environmental, even to the cosmic realm.

Reception and Use of Neurocomputers in Turkey

Kevser Rukiye Karabuğa Hatipoğlu

İstanbul Medeniyet Universty

Keywords: Neurocomputer, Artificial neural networks, Artificial neural networks in Turkey

Abstract

Artificial neural networks imitate the working principle of the brain by modelling the way the human brain performs functions. It is a system that aims to gain abilities such as learning, generalizing, categorizing and remembering. Neurocomputers, which operate with the integration of artificial neural networks into computers, are used in fields such as aviation, defence, automation, finance, medicine, character and handwriting recognition. First neurocomputer, 'Mark I Perceptron', was developed by Frank Rosenblatt, Charles Wightman, and their friends at the Cornell Aeronautics Laboratory in 1957-58. Although it had only a single system, it could perform separate operations from information sets. Over the years, neuro computers were developed with two main purposes: general and special. While general purpose neurocomputers are based on the neural network model that will appeal to the general audience; special purpose neural computers consist of specially equipped neural networks.

Reception of neurocomputers with artificial neural networks in Turkey occurred in the 1990. Although in a short period, its application areas immediately widened. From calculating foreign exchange rates in finance to radar systems in the defence industry and to finding oil deposits, many efficient examples can be observed. The aim of this paper is to give a brief account of the first uses of neurocomputers in Turkey, then provide a summary of its wide reception in many areas including its use by government and private enterprises.

Kevser Rukiye Karabuğa Hatipoğlu is a graduate student at İstanbul Medeniyet University, writing a thesis on application examples of artificial intelligence. She is doing research on artificial intelligence, artificial neural networks, transfer of neural connections to computer systems.

Made in Greece. Greek manufacturers of scientific instruments for teaching physics in the 20th century

Panagiotis Lazos

National and Kapodistrian University of Athens

Keywords: Scientific Instrument Makers, Instruments for education, Greece

Abstract

Several decades before the founding of the Greek state in 1830, many Greek schools of the Ottoman Empire had collections of scientific instruments for teaching physics and chemistry, purchased by local communities or donated by wealthy merchants. However, the situation changed in the newly formed Greek state, which was facing serious economic and social problems. The purchase of scientific instruments for education was not a matter of urgency, and it was not until around 1880 that a few gymnasiums acquired the necessary equipment, usually made by French manufacturers like E. Ducretet. The situation did not change at the beginning of the 20th century and only from the 1920s there is an improvement as several schools acquired equipment, this time of German origin. This change led in the interwar period to a, albeit slow, attempt to start making scientific instruments for education in Greece, sometimes by companies that also imported relevant equipment. The effort culminated after World War II with the establishment of the Ministry of Education's Factory for Teaching Instruments, which until its closure in 1990, equipped numerous primary and secondary schools with quality instruments and devices. This paper presents in broad terms the evolution of equipment for teaching physics in Greek schools during the 20th century and focuses on companies that manufactured scientific instruments until around 1970, especially in the Factory of the Ministry of Education.

Panagiotis Lazos is a physics teacher in secondary education and the head of the 4th Laboratory Center of Natural Sciences of Athens. He is also a PhD student in the National and Kapodistrian University of Athens. His main research interest is history of scientific instruments of the 19th century in Greek education.

14.30 – 16.30

Session 3 (parallel)

18th and 19th Century Instruments

Chair:

David Pantalony, Canada Science and Technology Museum

The Role of Technical Drawings and Models in the Promotion of the Steam Engine

Panagiotis Poulopoulos

Deutsches Museum, Munich

Keywords: Steam engine, technical drawings, models, technological transfer

Abstract

Although they are not scientific instruments per se, technical drawings and three-dimensional models are valuable tools for developing and communicating science and technology. Yet, their importance as witnesses of technical, economic and sociocultural history has often been overlooked. Focusing on the example of James Watt and his contemporaries, this paper will examine the role of technical drawings and models in the promotion of the steam engine during the late eighteenth and early nineteenth centuries. Based on the study of artefacts and archives housed in the Deutsches Museum and other collections, the paper will further investigate the transfer of steam technology from Britain to continental Europe, discussing aspects of patent diffusion, marketing and industrial espionage in the background of early industrialisation.

Panagiotis Poulopoulos is research associate in the department of Technology at the Deutsches Museum, Munich. He is currently working on the new exhibition 'Energy' with a focus on steam engines. His research interests include the history of instruments of music and science as well as interactions between technology and culture.

Novel objects for new needs: European watches for the Ottoman markets (18th-19th c.)

Artemis Yagou

Deutsches Museum, Munich

Keywords: Horology, Watches, Museums, Consumption, Ottoman Empire

Abstract

During the long eighteenth century, watches were the most complex artefacts of their time, with the exception of scientific instruments (Kelly and Ó Gráda, 2016). Given that scientific instruments were meant for scientists, scholars and other elite groups, watches were the most complex artefacts used by the wider public. At the same time, the boundaries between scientific instruments and watches were fuzzy, as the latter often incorporated advanced features.

A special category of watches during the long eighteenth century were those produced in Europe for the markets of the Ottoman Empire, which then occupied a vast area including most of Southeastern Europe, Asia Minor, the Middle East and North Africa.

The paper will discuss this rather under-researched category of objects by highlighting in particular two watches, both currently kept by museums in Germany: an upmarket version that incorporates a lunar calendar and a more ordinary pocket watch for middle- to low-income buyers.

Such watches belonged to new types of artefacts that emerged in the eighteenth century: both practical and fashionable, and certainly highly desired. Their use was intertwined with emerging forms of mobility and novel ways of working, learning and communicating. Among other things, watches exemplified for many users an informal, intimate and exciting connection to technology and science.

Artemis Yagou, PhD, is an Athens-born historian of design and technology. She is Research Associate at the Research Institute of the Deutsches Museum (Munich). Her main interests are design history, the cultural history of technology, museums, horology, construction toys, and Greek material culture (18th – 21st c.). Her personal website is www.yagou.gr

An "opportunely modified" Fairbanks Scale: On Peirce and Jastrow's (1885) Instrument to Measure Sensation

Claudia Cristalli

Indiana University, Bloomington, Indiana

Abstract

The emergence of psychology as a science is conventionally dated to 1879, the year when Wundt opened a first official laboratory in Leipzig. This historiographical choice reinforces the connection between experiment and scientific psychology and makes an inquiry into nineteenth century psychological apparatus relevant for understanding psychology's self-image as well as its ambitions. While research into some of Wundt's instruments provided interesting connections with astronomy (Robinson 2001, p. 164), psychological apparatus also enabled practitioners to pursue a reflexive investigation of psychology's own laws. Such is the case of Charles S. Peirce and Joseph Jastrow's 1885 experiment "On the Small Differences of Sensation," where the authors turned a postal scale into a tool to test the Weber and Fechner's psychophysical law, and in particular the notion of "threshold" of perception. Through a historical reconstruction of the instrument (and of the experiment), I was able to tap into the gestural knowledge (Sibum 1995; 2020) produced by the experiment and better understand its methodology. Of note, "brass and glass" instruments (Tweney 2003) and statistical tools were very well integrated in this experimental setting, which has been noted retrospectively as a first instance of randomization and blinding (Hacking 1988). This paper however does not tell a story of heroes and precursors, but rather shows how the study of instruments in early experimental psychology contributes to a "complementary science" (Chang 1999; 2004) of experimental psychology, which will lead to a better understanding of scientific practice and scientific theories alike.

Claudia Cristalli is a post-doc researcher in the Department of History and Philosophy of Science and Medicine in Bloomington, Indiana. She works on Charles S. Peirce and 19th C experimental psychology and on notions such as control, analysis and synthesis. Methodological questions and reconstructing historical experiments first spurred her interest for scientific instruments.

Miracle material? The disputes between inventors, investors and instrument makers on Magnalium around 1900

Johannes-Geert Hagmann

Deutsches Museum, Munich

Keywords: Materials, invention, commerce

Abstract

In 1898, Ludwig Mach (1868-1951) – eldest son of the famed physicist and philosopher Ernst Mach (1838-1916) – obtained a German patent comprising alloys of magnesium and aluminium. The new light material coined "Magnalium" was initially seen as a promising candidate for replacing brass and mirror coatings in instrument production, and it was even more broadly considered for aviation and naval construction. The public discussion of this miracle material, whose properties yet had to be rigorously tested and which remained unavailable in larger quantities, created not only a scientific debate. Behind closed door, a patent lawsuit with Carl Zeiss Jena and numerous legal disputes between investors seeking rapid commercial exploitation of the patents internationally quickly unfolded. This contribution analyses the course of these early events from the Mach Papers added by instrument literature. It is argued the motivations and mechanisms governing the disputes are identical to other 'tech hype' failures in more recent history.

Johannes-Geert Hagmann is head of the curatorial department AII-Technology at the Deutsches Museum. His research interests cover the history of physics and scientific instruments in the 19th and 20th century with emphasis on optics.

16.30 – 17.00 Coffee Break

17.00 – 19.00

Session 4 (parallel)

New Methods and New Interpretations

Chair:

Evangelia Chordaki, Hellenic Open University

Yin and Yang and Scientific Instruments

Ad Maas

Rijksmuseum Boerhaave

Keywords: Historiography and theory of scientific instruments

Abstract

In this presentation I aim to analyze how historians regard scientific instruments. I will argue that two ideal-typical approaches can be distinguished, that are contrasting and at the same time complementary. The first approach is to consider the place of the instrument in a 'taxonomy' of related instruments. Thus a microscope can be typified by describing to what kind of (sub)class of microscopes it belongs, and - in relation to this classification - what makes it special, perhaps even unique. The second approach can be called 'biographical', and focuses not on discrete characteristics of the instrument, but on a specific story connected to it. A Van Leeuwenhoek microscope, then, taxonomically is (say) an early single lens microscope, with some unique qualities, and biographically represents the story of a Delft wine rower who astonished the learned world by making unparalleled observations with it.

My second objective is to address the specific challenges posed to historians by recent scientific heritage. The taxonomic approach has helped to shape the historiography of scientific instruments in particular for the period before 1850-1900. For more recent times the taxonomic approach has proved to be less useful, because of, among other things, changes in material culture (bulk production of instruments, set ups consisting of generic parts et cetera). The study of recent heritage consequently largely depends on the biographical approach. I will end by starting a discussion of how to deploy the biographical approach in a more structured way.

Ad Maas is curator of Rijksmuseum Boerhaave, Leiden, the Netherlands

"Materialized Theories":
Computational models as scientific instruments for humanities research

Floor Koeleman

University of Lausanne

Keywords: Phenomenotechnique, digitalization, formal modeling, visual culture, theoretical reflection

Abstract

This paper will paint a picture of a possible future of scientific instrument studies. In recent years, instruments for research have often taken on a digital rather than an analogue form. This development calls for a rethinking of what exactly scientific instruments are. According to Bachelard (1934), they can be understood as "materialized theories." Such an interpretation makes it possible to expand our definition of the sciences to include the humanities. Particularly

in the field of digital humanities, it is now common practice to model the phenomena studied through data and code (as noted by Piotrowski), although mostly implicit. Uncovering such models reveals the theoretical notions embedded and underlying the resulting computational analyses. My work on the website constcamer.art will serve as an example to illustrate, on the one hand, how the seventeenth-century phenomenon of constcamer paintings can be modeled more explicitly. On the other hand, it will highlight how such a website functions as a scientific instrument in the study of this art historical subject. By considering computational models as scientific instruments for humanities research, the process of knowledge production can be better understood. But is the scholarly community prepared to move in this direction and bring such instrumentation under the umbrella of scientific instruments? This open-ended question intends to provoke thought and discussion.

Floor Koeleman is an art historian and expert in digital humanities. She currently is a postdoctoral researcher at the University of Lausanne within the project "Towards Computational Historiographical Modeling: Corpora and Concepts." Her main research interests are the history and philosophy of art, science and instrumentation.

Instrument studies taking a philosophical turn?

Jan Tapdrup

Hauchs Physiske Cabinet and Department of Mathematical Sciences, University of Copenhagen

Keywords: Instrument studies, Philosophy of Science, Experiment, Philosophy of Science

Abstract

In general, the history of science has been influenced by sociologists and instrument studies to divert from or diversify the one-eyed theory focus and purely book-based approach. Similarly, instrument studies have been broadened from the analysis of singular instruments in the local context to general studies which clearly shows that the study of instruments enlightens the general history of science and indeed shows that we cannot fully understand its development without studying instruments.

I intend to address the issue of how theories are connected to instruments and the experimental situation. Gaston Bachelard argues with (Pierre Duhem) that "Les instruments ne sont que des théories matérialisées", in the sense that the creation and use of scientific instruments rely on a set of theoretical assumptions.

In this paper, I will examine this claim by looking at debates during the chemical revolution relating to the composition of water and the gasometer. Indeed, I will argue that the proponents of the new chemical theories and the followers of the phlogiston theory alike interpreted the results of experiments with the gasometer in their favour. I will specifically do so by looking at the experiments conducted, and conclusions drawn by A.W. Hauch in relation to other contemporary researchers. In this way, I intend to challenge Bachelard's claim and demonstrate how instrument studies can enlighten debates this debate. I thus propose that instrument studies can not only enlighten the history of science but can also enlighten the philosophy of science.

Jan Tapdrup has studied the history of science and technology at the Universities of Oxford and Aarhus. He has worked as a curator and museum director, is now centre administrator at Copenhagen Centre of Geometry and Topology at the University of Copenhagen and a Research Associate at Hauchs Physiske Cabinet.

17.00 – 19.00

Session 5 (parallel)

18th to 20th Century Instruments (part 1)

Chair:

Joshua Nall, University of Cambridge

About the Replication of the Stern-Gerlach Experiment

Wolfgang Engels

HistEx GmbH, Oldenburg

Keywords: Molecular beam, atomic magnetic moment, inhomogeneous magnetic field, Bohr magneton

Abstract

The atomic model presented in 1916 by the physicists Niels Bohr and Arnold Sommerfeld suggested that the angular momentum of atoms must be quantised. The spin could therefore not assume arbitrary angles, but only specific, discrete angles, which contradicted classical physics and was not proven experimentally for a long time. In the night of 7th to 8th February 1922, Otto Stern and Walther Gerlach succeeded in experimentally detecting the directional quantisation in the Alte Physik (Robert-Mayer-Straße) in Frankfurt am Main. Using the molecular beam method developed by Stern, they generated a beam of silver atoms which they guided through an inhomogeneous magnetic field onto a glass plate. If the angular momentum of these atoms is not quantised, then the atoms should deposit uniformly on the glass plate after their flight through the inhomogeneous magnetic field, but two separate areas of quantitatively equal silver deposition appeared. The version of the apparatus with which the "Richtungsquantelung" could be visualised for the first time was reconstructed according to written sources and the experiment was conducted again. All material sources of this apparatus as well as the original precipitation plates were destroyed during an air raid in WWII.

Wolfgang Engels is chief executive officer of HistEx GmbH, Oldenburg. He took studies in engineering, physics, and history of science (TU of Hannover and U of Oldenburg). He is a research associate at physics department (physics education and history of physics and

philosophy of science, University of Oldenburg). His main research fields are history and instruments of science, re-enactment of historical experiments, construction and engineering.

Lost for words: The challenge of verbalising observations in Young's experiments on diffraction and interference

Michelle Mercier

Europa-Universität Flensburg

Keywords: Thomas Young, replication method, communicating experimental observations

Abstract

At the beginning of the 19th century, Thomas Young carried out extensive experimental work on diffraction and optical interference. The basic principles of the experiments are well known today, but the experiments performed by Young are not: His descriptions leave many questions unanswered and are difficult to understand, especially with regard to the results of his experiments.

As part of my PhD project, Young's experiments on diffraction and optical interference were analyzed by using the replication method. However, what and how could be seen in the context of his time, is not easy to 'understand' at all – I first had to learn how to see. Experimental activities and observations had also to be documented and communicated. But what is decisive or noteworthy was also not easy to define, to record or to communicate 'vividly' - I was lost for words.

Experiences made (experimentally) in observing as well as documenting and communicating what is seen will be described in this talk. The meaning of the experiences made for the understanding of Young's descriptions of the experiments will be discussed in conclusion.

Michelle Mercier studied mathematics and physics at the Europa-Universität Flensburg. Now she is working as a postgraduate at the Europa-Universität Flensburg in the section of physics, its didactics and its history. In her PhD project, she is analyzing Thomas Young's experiments on diffraction and interference (1802-1807).

Replicating Henry Peter Brougham experiments on diffraction from 1796

Mar Rivera Colomer

Institut Interuniversitari López Piñero - Universitat d'Alacant

Keywords: Henry Peter Brougham, replication method, experiments on diffraction

Abstract

Henry Peter Brougham can be described as a gentleman of science in England at the beginning of the 19th century. Today, he is best known for advocating the abolition of slavery and his educational reforms. He is less known for his public attacks against contemporary natural philosophers such as Thomas Young and William Herschel. Almost unknown, even today, are his experimental works on physical optics he carried out at the end of the 18th century. These experiments are of particular interest as Brougham still is characterised as scientifically incompetent in the context of his criticism of Young and the undulatory theory of light.

In order to develop a better understanding of Brougham's scientific practice, some experiments were analysed by using the replication method. I will focus on the experiments on diffraction published by Brougham in 1796 – these are particularly interesting as they could provide some clues about the subsequent criticism of Young's work. I will describe some experiences and I will as well discuss the meaning of these experiences for the understanding of Brougham's scientific practice.

Mar Rivera Colomer studied physics at the Universitat de Barcelona and Teacher Training in Mathematics at the Universidad de La Laguna. She finished her Master in History of Science and Scientific Communication at Institut Interuniversitari López-Piñero (IILP) where she has worked with material culture and scientific commemorations. At the moment she is working as a postgraduate at Europa-Universität Flensburg in the section of physics, its teaching methods and its history, analysing the early diffraction experiments and observations made by Henry Peter Brougham.

From delectation to science

Flashlights on the development of continental microscopes pre 1930

Timo Mappes

Deutsches Optisches Museum (D.O.M.) and Friedrich-Schiller-University Jena

Keywords: Microscope, resolution, aperture, production numbers

Abstract

The microscope has been and still is the most important instrument for life sciences and medicine. On the one hand, it is the key tool enabling the observation and thus the understanding of the structural, physiological, and chemical relationships at the cellular level. On the other hand, it allows us to ask a wealth of new questions. In the natural and

engineering sciences, the different methods of microscopic imaging are crucial to study the structure and interaction of matter.

This presentation outlines the historical development of instrumental practice in microscopy from the beginnings in the 17th to the early 20th century. The focus for the selection from this equally fascinating and overwhelmingly rich history is on technical progress in the German-speaking countries. In the form of flashlights on key technologies, the contribution made by the implementation of the inventions will be discussed. The aim of improving the instruments was always to enlarge the structures revealed by the microscope even more and, above all, to perceive them in more detail. The improvement of resolving power over time by increasing the aperture will be highlighted. The exponential growth of the number of sales of microscopes from the leading manufacturers in the second half of the 19th century will be illustrated.

Timo Mappes is professor for the history of physics with a major in science communication at University Jena, Germany. He serves as founding director of Deutsches Optisches Museum (D.O.M.). With his team he is creating a highly interactive museum. His research interests are German made microscopes 1800 – 1950.

20.00 Reception (Buffet) at the Atrium of the NHRF

TUESDAY, 20 September

09.30 – 11.00

Session 6 (parallel)

Scientific Instruments and Women (Part 1)

Organizers:

Janet Laidla, University of Tartu

Louise Devoy, Royal Museums Greenwich

The inclusion of women in history generally and the history of science in particular has risen over the past half-century. In addition to scholarly studies (and sometimes instead of) many popular books on women in science appear in the bookshops and on the bestseller lists, on our cinema and TV screens. This year's overall theme of the past, present, and future of scientific instrument studies is an excellent opportunity to make a survey on the topic of women and the study of scientific instruments. Our proposed session presents both general observations and more specific case studies on this topic. The general papers deal with the problems of identifying the role of women and locating relevant sources in the history of scientific instruments (Clifton, Laidla); others consider the general ways in which women used scientific

instruments in their research (Kidwell). Specific case studies by Devoy and Miniati will introduce a range of stories that show how women in science have used scientific instruments as research tools, as the inspiration for writing educational texts, and as the basis of museum collections that continue to influence our work today. Our session will close with a paper on how scientific instruments are represented in visual materials designed to encourage girls' participation in STEM, an important factor that may inspire women's greater participation and representation within future scientific research.

Chair:

Louise Devoy, Royal Museums Greenwich

Makers, Owners and Users: Questions on Cataloguing and Attribution

Janet Laidla

University of Tartu

Keywords: Astronomical instruments, gender, curating

Abstract

Today, as most scientific instrument collections are moving into online catalogues, it is relevant to think about the question of gender representation in catalogues. For example, the custom to use women assistants and computers at astronomical observatories since the end of the 19th century is well documented, but how well is their handling of the photographic plates and instruments they used in their work represented in documentation concerning these instruments?

In the introductory paper to the session, I will argue that it is possible to increase the representation of women in online catalogues of scientific instruments, and even more widely in the scientific collections by paying more attention to adding data on 'Users' to the items when this is known. This, in turn, will help to highlight the role women have played in the history of science. I will also venture a mini case study to see how difficult it would be to ascertain with some certainty, which instruments used by women at the Tartu Observatory before World War Two.

Janet Laidla works as a lecturer of Estonian history at the University of Tartu Institute of History and Archaeology. She has a PhD in history with interest in early modern and modern history of culture and science, object-based learning and gender history.

Hidden from History? Unearthing information about women instrument makers from the 17th to the 19th centuries

Gloria Christine Clifton

Curator Emeritus, Royal Museums Greenwich

Keywords: Scientific-instrument making, women makers

Abstract

It is difficult to identify women working in the scientific instrument trades or to know how many there were. There are passing references in historical sources to women being involved in instrument-making in the past, but they are few and far between. The best known examples are Sarah Dollond, who married Jesse Ramsden, and who, according to a letter written by Jean Hyacinthe De Magellan in 1775, worked on Ramsden's first dividing engine, and Mary Senex, the globe maker, whose letter to the Royal Society in 1749 was published in their Transactions. Trade directories from the later eighteenth and nineteenth centuries occasionally list women under the headings for mathematical instrument makers, opticians and related trades. This paper will seek to examine what other sources can be consulted and brought together to form a fuller picture of the numbers of women working in the scientific instrument trades and the ways in which they were involved.

Gloria Clifton published the Directory of British Scientific Instrument Makers, c. 1550 – 1851 and continues to research makers and to add material to the database of makers, extending to 1914. A research collaboration between Greenwich, the Universities of Cambridge and Sussex, and National Museums of Scotland, hopes eventually to make this publicly accessible.

Women and Mathematical Instruments in the United States: Buyers, Designers, Makers, Users, and Curators

Peggy Kidwell

National Museum of American History, Smithsonian Institution

Keywords: Mathematical instruments, women in mathematics and mathematics education

Abstract

Looking at objects that survive in collections, particularly collections at the National Museum of American History, reveals several roles women have played in the making and distribution of mathematical instruments in the United States. First, especially from the nineteenth century, they bought and used instruments as educators, particularly though not exclusively at the elementary level. Second, they designed new devices – from three-dimensional string models for university students to devices for teaching preschoolers. Third, they sometimes "made" instruments –as owners of instrument firms, as workers assembling parts, and as students in the classroom. With the expansion of office work (and the availability of more lucrative jobs

for men), women were hired to do calculations, working as users of a wide variety machines and then electronic computers. Finally, particularly from the mid-twentieth century, women have been hired to curate museum collections of mathematical (as well as scientific and medical) instruments.

Of course men – and women outside the United States – have handled instruments as buyers, designers, makers, users, and curators. The stories of American women who have played these roles sheds light on the changing position of women, and on the place of mathematical instruments, in one culture. It also suggests a raft of useful questions one can raise more generally about instruments and those associated with them.

Peggy Kidwell is the Curator of Mathematics at NMAH. Her research interests include history of mathematics, history of computing, and women in technical areas.

09.30 – 11.00

Session 7 (parallel)

Bringing Historical Scientific Instruments and Learners Together: Personal Stories, Educational Activities, and Visions for the Future (part 1)

Organizer:

Elizabeth Cavicchi, Edgerton Center, MIT

Chair:

Frédérique Plantevin, Université de Brest

Experiencing the Unknown: Historical instruments as education for me and students

Elizabeth Cavicchi

Edgerton Center, MIT

Keywords: Physics education, induction coil, exploratory learning, experimenting

Abstract

As a physics student and then teacher, I was unaware of historical scientific instruments. It was the same for experimenting – school labs never put learners into the unknown! This presentation relates from my encounters with historical instruments: as a doctoral student in education, in recreating instruments, and in my gradual integration of instruments into educational activities in classroom, collections and beyond. Paolo Brenni and the SIC are "instrumental" in this journey. A first moment arose when, sitting on Harvard Science Center's basement floor cramped between shelves crammed with instruments, I was sketching induction

coils with colored pencils. Induction coils figured experimentally and historically in my dissertation's narratives where experimenting is the way of learning for students, myself and historical investigators. Suddenly, an illustrious international scholar came over, expressing genuine interest in me, as a student, my access to instruments, and my experiments. This was Paolo Brenni! Then I lacked connection to others having those interests. SIC meetings introduced me to instruments' diverse stories, astonishing collections, and community. I sensed educational possibilities within SIC's shared fascination for instruments and Paolo's boundless questioning! Seeking to create experiences where students are actually in the unknown, I began introducing historical instruments into classroom activities. These teaching experiments are tentative, iterative and evolving. Viewing authentic instruments in galleries, students improvise their interpretations. While observing, students' wondering about historical methods gives rise to experimenting. The astrolabe provokes students' multi-layered responses, even on zoom. How will students and I evolve these instrument-mediated experiences into new, future contexts?

Elizabeth Cavicchi interweaves science, history, instruments, art and social justice in her teaching at MIT's Edgerton Center. Together with Peter Heering, she coedited SIC's volume 9, Historical Scientific Instruments in Contemporary Education, 2022, where SIC community members relate diverse educational projects. Among students and internationally, Dr Cavicchi encourages exploratory education.

A fruitful encounter: When students interact with historical scientific instruments

Panagiotis Lazos, Constantina Stefanidou and Constantine Skordoulis

National and Kapodistrian University of Athens

Keywords: Maraslean Teaching Center, Historical Scientific Instruments, Education

Abstract

Until 1984 the education of the primary school teachers in Greece was taking place in the Pedagogical Academies, the most important of which was the Maraslean Teaching Center. The Center has a long history which starts from 1876 and now it is a part of the infrastructure of the Department of Primary Education of the University of Athens.

The Maraslean Teaching Center already in the late 1880s had a fairly rich collection of scientific instruments, mainly of French manufacturers, such as E. Ducretet for the teaching of natural sciences. The collection was further enriched with instruments of the German company PHYWE shortly before the start of WW II.

In recent years, an effort has been made to highlight the collection. An important part of this effort is the interaction of students of the pedagogical department, but also students of secondary education, with selected scientific instruments in the context of educational activities, such as recording the objects of the collection, creating a video on specific scientific instruments to communicate with the general public or the writing of a script for an escape room with the main theme of some scientific instruments.

The present work focuses mainly on students' engagement with the historical scientific instruments and not on instruments themselves. Such engagement highlights the educational value of a university collection of historical scientific instruments, and especially the institutional role those devices had in educating previous generations of teachers. In this context, students' interest, enthusiasm and intent for research are emerged.

Panagiotis Lazos is a physics teacher in secondary education and the head of the 4th Laboratory Center of Natural Sciences of Athens. He is also a PhD student in the National and Kapodistrian University of Athens. His main research interest is history of scientific instruments of the 19th century in Greek education.

Constantina Stefanidou has a position in the Department of Primary Education, National and Kapodistrian University of Athens as Laboratory Teaching Staff in Science Education. Her research and publications are on didactics of science, focusing on historical and philosophical perspectives as well as conceptual difficulties and their relation to model-based teaching and learning and informal science education. She is a member of the European Science Education Research Association (ESERA) and the International History Philosophy and Science Teaching (IHPST) Group.

Constantine (Kostas) Skordoulis is Professor of Epistemology and Didactical Methodology of Physics in the Department of Primary Education, National and Kapodistrian University of Athens. He has studied Natural Sciences at the University of Kent at Canterbury, UK, and worked as a visiting researcher at the Universities of Oxford and Groningen. He is an Effective Member of the International Academy of History of Science and has served as the Secretary of the Interdivisional Teaching Commission of the International Union of History and Philosophy of Science (2007–2017). His research interests include History of Science and Science Education from a critical perspective.

Creating a science-museum. A school-project on Ancient Greek Technology

Flora Paparou

Secondary Education Science Teacher, PhD

Keywords: Ancient Greek Technology, scientific instrument reconstructions, science communication

Abstract

This paper describes an educational process taking place at the science laboratory of the 1st Senior High School of Vrilissia, Athens, during the period 2020-2022. The process resulted in the creation of an exhibition related to Ancient Greek Technology. It was part of the Greek team's contribution to the Erasmus+ KA229 school-cooperation: "The European scholars' network".

During 2020-2021, we mostly met on-line due to covid19. We virtually explored Kostas Kotsanas' Museum of Ancient Greek Technology. The students focused their research on selected items of this museum, such as elevating machines, time measurement devices, hydraulic mechanisms and automats, cryptography and telecommunication systems,

mathematical toys and musical instruments. During the schoolyear 2021-2022, the students reconstructed many of these technological objects. The difficulty in the effective assembling of the gears in order to make the machines operate; the ingenuity characterizing the ancient Greek automatic hydraulic systems and their demanding sealing techniques; the theoretical knowledge incorporated in the different types of clocks were among the topics that aroused the students' curiosity.

Apart from these scientific and technological questions the creation of our museum also included a science communication task. The students were asked to think about the 'museum idea' and approach their reconstructions as cultural objects as well. They found ways to present their reconstructions to the international student-audience of the Erasmus+ project both in situ and virtually. They used short talks, games and theatrical sketches. They also created a *padlet* digital platform incorporating all different phases of their two-year-long work.

Flora Paparou is currently working as a science teacher in secondary education, Greece. She holds a PhD (University of Athens) in the use of historical scientific instruments in education. Her research focuses on the material culture of science as well as on the integration of the history of science in science teaching.

11.00 – 12.30

Poster Session

Chair:

Richard Kremer, Dartmouth College

Hypothetical Instruments in the Clouds for Ottoman Scholars to Understand the Formation of the Rainbow

Sena Aydin

Istanbul Medeniyet University

Keywords: Rainbow, Optics, Mirrors, Ottoman Science.

Abstract

This study is about the story of the rainbow and halo in the Ottoman classical period, which is tried to be explained through hypothetical mirrors or glass spheres assumed in the clouds. Examining the debates on rainbow, halo and color in Ottoman science shows the contribution of different schools of science. The interest in optics, more specifically in visual perception and the nature of color in Ottoman science, led to the writing of many independent treatises that tried to explain the rainbow and halo. When these treatises are examined, it is noticed that the rainbow and halo debates are a subset of a larger discussion, and that there are discussions about light in numerous works, whether in the context of the rainbow and halo or in the context of different scientific schools of theology, illuminationism and peripateticism.

Sena Aydin graduated from Boğaziçi University, Faculty of Arts and Sciences, Department of Physics in 2011. She completed her master's degree in Boğaziçi University, Faculty of Arts and Sciences, Physics, in 2015 with the subject of "The Introduction of Modern Optics to Ottoman Science". Her doctoral study at Istanbul Medeniyet University, Faculty of Arts and Humanities, Department of Philosophy is on the discussion of rainbow and halo, which is a geometric-optical problem set in Ottoman Science. She has been working as a research assistant at the Department of History of Science at Istanbul Medeniyet University, since February 2020. Since July 2020, she is the assistant editor of Nazariyat, Islamic Philosophy and Science History Research Journal. Her areas of interest include Ottoman history of physics and Ottoman optics.

Portable Quadrants in the Islamic World and the West: A Cataloging Attempt

Enes Tepe

Europa Universität Flensburg

Keywords: Portable quadrants, Timekeeping, Almucantars Quadrant, Astrolabic Quadrant, Cataloguing

Abstract

Portable quadrants (*rubʿ al-dāʾira*'s) belong to a class of scientific instruments that were used for terrestrial and celestial practices for a millennium. They used to have different features when they were designed as time reckoning tools. Some of these features are latitude-dependent and universal hour markings, trigonometrical grids and astrolabic elements.
In a previous project, the surviving samples of the quadrants from the online collections of museums and auctions were catalogued, and their images were examined in order to compare the role of portable quadrants in the Islamic World and the West during the classical period. For this aim, a database of 259 portable quadrants is compiled and the instruments are classified in terms of technical elements and geography. In the catalogue, the instruments within each category are enlisted chronologically. Their material, production date, producer's signature, contemporary location, and inventory numbers are specified.

As a result of this cataloguing attempt, I identified two of the most well-established quadrants in the Islamic World and the Western Europe. In a follow-up project, I am going to analyze the practice with these two quadrants in regards with replication method.

In this talk, the process and reasons behind cataloguing a class of historical scientific instruments will be shared.

After **Enes Tepe** graduated from METU Physics in Ankara, Turkey, he got his MA from History and Philosophy of Science program of Medeniyet University in Istanbul, Turkey. His main research interest is history of astronomy and cosmology. During the lecture-period, he was focusing on theoretical aspect of this subject. Then, he focused on the role of instruments during the classical period. For his MA thesis, he researched on portable quadrants, which led him towards his PhD project which is analysis of the practice with two of these instruments.

500 Years of A Tradition: User Manuals of Rubʿ al-Mujayyab

Merve Sandalli

Istanbul Medeniyet University

Keywords: Ottoman astronomy, astronomical instruments, sine quadrant, rubʿ al-mujayyab

Abstract

The quadrant is a successful replacement of astrolabes for easier practical applications. It was originally perfected in the 13th and 14th centuries by Mamluk astronomers in Egypt and Syria. Ottomans adopted its use from the second half of the 15th century. The quadrants, rubu tahtası in Ottoman Turkish (for 'wooden quadrant'), contains two different instruments: 'an astrolabe quadrant' on one face and a 'sine quadrant' on the other. Since the use of these instruments are different, the manuals prepared for their use are almost always prepared separately. Due to its relatively hard-to-use features, sine quadrants attracted more attention, specifically in Ottoman astronomy. Between the 15th and 20th centuries, dozens of user manuals for sine quadrants were compiled and copied extensively. In fact, the sine quadrant user manuals are the most copied treatises in the Ottoman astronomical literature with more than three hundred extant copies. Despite the abundance of original treatises, the content and structure of these user manuals seem to be following a strict tradition. In this poster, I will give one example from every century between the 15th and 20th centuries and show how this tradition continued. I will also discuss the cause of this continuity and argue the potential reasons.

Merve Sandallı was born in 1993. After having completed elementary, secondary and high school in İstanbul, started her undergraduate at Istanbul University, Faculty of Letters, Department History of Science in 2012. After having her bachelor's degree in 2016, attend MA programme at Istanbul Medeniyet University, Department History and Philosophy of Science in 2019. Her graduate studies are focused on history of astronomy, cosmology and astronomical instruments

The Museum of Physiology "Georgios Kotzias"

Flora Zarani, Panagiotis Lazos, Panagiotis Lembessis, Polyxeni Gaitanari, Panagoula Angelogianni and Anastassios Philippou

National and Kapodistrian University of Athens

Keywords: Museum, Experimental Physiology, Historical Instruments, Kotzias archives

Abstract

The Museum of Physiology "Georgios Kotzias" belongs to the National and Kapodistrian University of Athens (NKUA), it was established in 2020 and is accommodated in the Department of Physiology, Medical School, NKUA. It serves educational and research purposes, supporting the development of basic and applied biomedical research. The Museum

houses a wide selection of historical instruments of Physiology (more than 200 instruments and scientific accessories) and the historical archive of Georgios Kotzias, a famous physician, neurophysiologist who won the American Lasker Price, the highest honor in medicine, in 1969.

The Museum's mission is to meet the teaching and research needs of the Faculty of Medicine, to cooperate in any form with other museums, research centers and academic institutions, to participate in educational and research programmes that contribute to the dissemination of scientific knowledge and experience, to organize scientific lectures, workshops, seminars, conferences and other scientific events and to transmit academically cultivated knowledge to the wider society.

All the historical instruments of the Museum come from the "Laboratory of Experimental Physiology - Physiologeion" that was founded by Rigas Nikolaidis, Prof. of Physiology, in 1883.

The Museum's collection includes items, among others, that someone could see in an experimental physiology laboratory in the early 20th century, such as kymographs, myographs, induction coils, galvanometers, rheotoms, Helmholtz's resonators and models of sense organs.

The instruments come from a variety of well-known European manufacturers, such as E. Zimmermann (Leipzig), Wilh. Petzold (Leipzig), Baird & Tatlock (UK), C.F. Palmer (UK), Secretan (Paris), Johann Kruscich (Prague) and L. Castagna (Vienna).

Flora Zarani is Biologist, Laboratory and Teaching Staff, Laboratory of Physiology, Medical School, National and Kapodistrian University of Athens, Greece. Her scientific interest is in Cellular Physiology and she is interested in promoting physical activity in adolescence. She has designed educational programs approved by the Ministry of Education for Primary and Secondary Education.

Panagiotis Lazos is a physics teacher in secondary education and the head of the 4th Laboratory Center of Natural Sciences of Athens. He is also a PhD student in the National and Kapodistrian University of Athens. His main research interest is history of scientific instruments of the 19th century in Greek education.

Panagiotis Lembessis, BSc, PhD is a molecular biologist at the Department of Physiology of the School of Medicine of the University of Athens. He is co-author of 58 publications in international journals. His work concerns the pathophysiology of intestinal cells, the molecular biology of Marfan syndrome and Grebe-type chondrodysplasia, and molecular diagnosis of metastatic cancers.

Polyxeni Gaitanari, PhD, works at the Medical School of the University of Athens as a Special Teaching Staff. She is responsible for the administrative planning and management of the Postgraduate Program "Molecular & Applied Physiology" as well as for the organization of scientific meetings and workshops of the Physiology Laboratory.

Panagoula Angelogianni, MD, PhD, Associate Professor of Physiology, Dept. of Physiology, School of Medicine, National and Kapodistrian University of Athens, Athens, Greece. The scientific work covers various aspects of Neuroendocrine Physiology with special interest in the endogenous opioid system and its implication in the mechanisms of drug addiction.

Anastassios Philippou, PhD, Associate Professor of Physiology - Exercise Physiology, School of Medicine, National and Kapodistrian University of Athens, Greece, Director of the Museum of Physiology "Georgios Kotzias". His scientific work covers a wide field in the physiology of exercise and skeletal muscle, for which he has received international and Greek awards.

The curious story of a forgotten instrument:

The magnetoscope at the Mineralogical Museum of Naples (Italy)

Carmela Petti[1], Piergiulio Cappelletti[1,2], Annamaria Pellino[2]

[1]Centro Musei delle Scienze Naturali e Fisiche, Napoli, Italy
[2]Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse, DiSTAR, Napoli, Italy;

Keywords: Mineralogical instruments, museum, magnetoscope

Abstract

The historic mineralogical instruments collection of Real Museo Mineralogico, University of Naples Federico II, contains many items directly connected to the figure of one of its most important Director Arcangelo Scacchi (1810 – 1893) and to his studies and researches. Singular is the presence in the museum's instruments collection of a device, the magnetoscope, a physics instrument used to detect the presence of magnetism in the rocks. In 1852 studying some lavas from Mt. Vulture, a Pleistocene volcano in the Apennine chain (Basilicata region, Southern Italy) Scacchi discovered that they affected the magnetic compass so he deduced that the lavas must have an internal magnetization.

After two years, in 1854 to continue his research, he commissioned the construction of a magnetoscope, similar to that Macedonio Melloni had built in Parma in 1825 and successfully in Naples in 1853. The instrument was made by Saverio Gargiulo a Neapolitan "machinist" that had already built other instruments for Melloni. The device is formed by a brass cylinder containing a glass container with an upper graduated plate. The cylinder is closed at the bottom by a circular wood base with three brass pins. The instrument was forgotten for many years. Recently new extensive research focused on documents and ancient catalogues of the Museum carried out to increase with new data (suppliers, acquisition methods, price) the catalogue of the instruments collection, led to rediscover the curious story of the magnetoscope.

This is a very fascinating instrument not only for its historical and scientific value but mainly for multitude of meanings that it encloses and the "stories" that it can tell.

Carmela Petti is curator of the Real Museo Mineralogico of the University of Naples FEDERICO II. Her research interests focus on mineralogy, history of collections and scientific heritage. She is author and co-author of over 40 scientific publications, most of them hosted in international ISI and peer-reviewed journals.

The observation instruments in the 1769 transit of Venus in the peninsula of Baja California

Maribel Moreno Ochoa

DIE-CINVESTAV, Mexico

Keywords: Transit of Venus, observation, medition and scientific instruments

Abstract

The observation of the transit of Venus over the solar disk in the Baja California Peninsula in New Spain in 1769 was made to collect measurements for the calculation of the solar parallax in order to obtain data to know the distance of the Sun to the Earth, but also for more practical purposes such as navigation, cartography, the conquest of new territories and the confirmation of the shape of the planet.

The people who participated in the observation of the transit were the novo-Hispanic Velázquez de León, the French astronomer Chappe d'Auteroche, and the naval lieutenants Vicente de Doz and Salvador de Medina. But they were not the only ones participating in this Spanish-French expedition. There were other characters that historiography has omitted and left hidden. This is the case of the instruments themselves and of the French engineer and geographer Michel Pauly, who also made observations.

Instrumental astronomical observations imply practices that depend on subjects, institutions, territories, worldviews and different societies, as well as on the prestige, authority, hierarchies and even the legitimacy of what is observed and what is measured.

Maribel Moreno Ochoa has a bachelor's degree in Applied Mathematics, with a master's in Mathematics Education. She is completing a PhD in history of science and education as a fellow of the Departamento de Investigaciones Educativas (DIE) CINESTAV. Her main research interests are scientific travel, scientific instruments, and scientific practices.

Determining time at the Neuchâtel Observatory: Mastering the personal equation (1858-1960)

Julien Gressot

University of Neuchâtel – Institut d'histoire (IH) & Laboratoire temps-fréquence (LTF)

Keywords: Neuchâtel Observatory, Time Determination, Operating Chain, Scientific Instruments, Time Automatization

Abstract

The Neuchâtel Observatory was founded in 1858 with the main objective of supporting the watch industry by certifying watch products and transmitting the time to the production sites. For this reason, obtaining an extremely accurate reference data is of great importance to the

Observatory. This scientific establishment will do its utmost to remain at the forefront of this specific field in order to provide a high-performance time service.

The Observatory is constantly looking for ways to enhance its process, acquiring new scientific instruments and experimenting new methods in order to improve the quality of the data produced and seeking to master sources of error. In this small institution, which cannot afford to hire a large staff, the elimination of the personal equation, the influence of the human factor, on the production of time data represents a guiding thread of the period under consideration.

To make the history of the time determination at the Observatory from its material culture allows to note the evolution of the institution, to see the daily practice being modified, to seize the organizational changes within the establishment which accompanies the modifications of the missions and the use of new technologies more powerful in term of precision. To represent these aspects, the concept of Operating Chain is mobilized, showing three representative periods of the Observatory's evolution, with the period of setting up in 1858-1861, the period of renewal of the institution at the beginning of the 20th century, and then the period which integrates new technologies such as quartz and the Photographic Zenith Tube since the middle of the 20th century.

Julien Gressot is a PhD student at the University of Neuchâtel. He is studying the history of the Neuchâtel Observatory through its material culture in order to analyze the functioning of the time service between the 19th and 20th centuries. He is particularly interested in the scientific instruments, the actors and the spatial configuration in order to understand the process of time production.

Objects of the Past: The Future Starts in the present

Preventive Conservation Practices for the Scientific Heritage in Italy

Maria Rosalia Carotenuto, Ileana Chinnici and Manuela Coniglio:

Keywords: Preventive conservation, scientific collections, scientific instruments, astronomical observatory, Museum

Abstract

Italy has a considerable scientific and technological heritage, sometimes unrecorded, spread throughout its territory. The process that led to its official recognition as cultural heritage has been historically complex and, to some extent, still in progress. At present, the cultural value of the historical scientific instruments is still often underestimated. Training, debate and research on these collections need to be developed, as well as suitable and sustainable conservation practices.

Today, preventive conservation is at the frontier of international research in the field of collections management. It includes all indirect measures aimed at avoiding and minimizing future deterioration of the objects, by acting on their environment, without interfering with their materials or structures.

Maria Rosalia Carotenuto is a graduated conservator. Since 2018, she has been collaborating with INAF-Palermo Astronomical Observatory for the development of a preventive conservation project for the scientific collections kept in the Specola museum with the aim of planning timely solutions and sustainable long-term strategies through a risk management approach.

10 years of researching instruments in the proceedings of the University of Tartu Museum

Lea Leppik

University of Tartu Museum

Keywords: Research on historical instruments

Abstract

When the idea to establish a museum at the University of Tartu appeared in the 1960s, antiquities began to be collected from the university's buildings and laboratories. Enthusiasts were physicists, chemists and astronomers. Collecting was often initiated by repairs or removals, and had to be done quickly to save assets for history. This means that things were not always described and not always properly accounted for. Unfortunately, this is how descriptions such as "detail of an unknown item" appeared in the inventory lists. There has been no special field of study in Tartu dealing with instruments and the history of science, and the staff of the museum did not manage to delve into various topics among other things. 1989 one catalog of the oldest physical instruments was published, the other part remained in the manuscript.

From 2010, a section dedicated to museum collections was started in the publications of the UT Museum to provide an opportunity to publish articles on objects. Once the place and opportunity had been created, research began to appear, it has continued to this day, and the range of topics has gratifyingly expanded: review articles on historical laboratory glass and laboratory porcelain, special studies on old scales, rare Arabian celestial globe, telescopic mirrors. It also allows to improve the quality of descriptions in databases. Of course, there are still topics that have not been covered by researchers, but the situation is more hopeful than 10-15 years ago.

Lea Leppik, PhD, is historian, dealing with the history of the University of Tartu and Tartu observatory. She has been from 2004 chief redactor of the proceedings of the UT Museum (Tartu Ülikooli ajaloo küsimusi).

Cryptic Connections? Arca Steganographica and Cryptology in the Islamic World

Afra Akyol

İstanbul Medeniyet Universty

Keywords: Cryptology, Works of Muslim Cryptologists, Arca Steganographica, Encipherment, Athanasius Kircher

Abstract

Confidentiality of information was an important part of communication for both administrations and individuals throughout history. From rulers to traders, many attempted to create their own secretive message delivery systems. This is the base of what we know as cryptology. In the 9th-century Baghdad, Abu Yūsuf Yaʿqūb ibn Isḥāq al-Kindī wrote the oldest extant book on this topic. He introduced several types of encipherment and algorithms for cryptanalysis using his own method of frequency analysis. Consequently, cryptology has remained a subject of interest among scholars for centuries. In the 13th and 14th centuries, ʿAfīf al-Dīn ʿAlī ibn ʿAdlān, Ibrāhīm ibn Dunaynir, and Tāc al-Dīn ibn al-Durayhim were part of a tradition that advanced the cryptanalysis by introducing dozens of new methods. Coincidentally, interest in cryptanalysis in the West began to materialize in the 14th century. If there are any causation between the works of Muslim cryptologists and the western scholars, it is needed to be further examined. Works of one scholar, namely Athanasius Kircher -a 17th century German polymath-strikes a resemblance. As part of his efforts to find a universal language, he designed several devices including one called "Arca Steganographica". This poster will discuss similarities between the fundamental knowledge on cryptology produced in the Islamic world and the principles behind the invention and use of this device. Are there any unreferred connections? Or were the principals discovered independently?

Afra Akyol graduated in Information Systems and Technologies in 2016, currently she is a graduate student in History and Philosophy of Science at Medeniyet University in Istanbul and studying on her thesis related to topic of cryptologic treatises written in the Islamic World especially in the 13th and 14th centuries. Her main research area is cryptology.

19th century set of platinum vessels for experimentation in fluorine and hydrogen fluoride

Małgorzata Taborska

Jagiellonian University Museum, Jagiellonian University, Krakow, Poland

Keywords: Platinium apparatus, fluorine, hydrogen fluoride, Karol Olszewski, Tadeusz Estreicher

Abstract

The Cracow scientists Zygmunt Wróblewski (1845-1888) and Karol Olszewski (1846-1915) made a mark in the history of cryogenic research i.a. in 1883 with their groundbreaking

liquefaction of air, that is permanent gases: oxygen, nitrogen, and carbon dioxide. Olszewski arranged a low-temperature laboratory in the Department of Chemistry of the Jagiellonian University with the experimental apparatus of his own design. From 1890 on, he was the supervisor of the JU First Department of Chemistry—specialising in inorganic chemistry—further developing the low-temperature laboratory. He focused his efforts on liquefaction and solidification of various substances, as well as on the research of their physicochemical properties under low temperatures. Furthermore, he determined the gas constants (critical temperature, critical pressure, boiling and solidification points), including hydrogen halides. Olszewski's assistant was Tadeusz Estreicher (1871-1952), from 1919 the supervisor of the First Department of Chemistry, who also worked on hydrogen halides. During that period, he invented the graphical technique of glass etching—fluorine etching, which was later used by the most prominent Cracow artists of the modernist period. The platinum vessel setting was purchased for the First Department of Chemistry in 1896 for the purpose of researching fluorine and hydrogen fluoride. It was composed of several apparatuses for extraction, purification and distillation of fluorine and its compounds. It was likely used by Olszewski and it is confirmed that Estreicher used it at the end of the 19th and the beginning of the 20th century. This is an occasion to present the experimental setting and the experiments it was used for.

Malgorzata Taborska, PhD, biologist and surveyor, is curator at the Jagiellonian University Museum in Krakow (since 2006), and supervisor of the collection of scientific instruments. She is author of exhibitions, catalogues and articles on the construction, history and development of scientific instruments, such as an exhibition of Polish-language globes (2006), history of geography (2016, 2018, 2019), scientific laboratory instruments (2014), and a catalogue of sundial collection (2020).

The heritage of science in Polish museum collections – research results

Ewe Wyka

The Institute for the History of Science. Polish Academy of Sciences in Warsaw / the Jagiellonian University Museum in Krakow

Keywords: Scientific instruments in Poland, museum scientific collections

Abstract

As part of the research project "National inventory of historical scientific instruments", financed by the National Science Center, Poland (project no 2017/25 / B / HS3 / 01829), Polish museums were searched for historical scientific instruments. The acquired information, as records of selected instruments, was entered into a database developed for this purpose. The following criteria for selecting objects for the database were adopted: age, scientific value, historical value, and aesthetic value. The created database (currently still being completed) will be publicly available for viewing. In principle, the database will be a source for research on the history of science in Poland, the development of scientific instruments, and their manufacture.

On the basis of the research and visits to museums, an image of the material heritage of science in Polish museum collections has emerged. Significant collections of historical scientific instruments are found in only a few museums. These are mainly academic institutions. Art

museums have a few collections of instruments. The objects preserved in these museums were often part of larger donations. Several specialized collections, such as metrology or sundials, deserve attention.

Queries made it possible to estimate the number of devices made by Polish manufacturers, generally in the 19th and early 20th centuries. The optic and surveying instruments of the Warsaw company "Gustaw Gerlach" were the most numerous. The poster will discuss the current state of research on historical instruments in Poland and the results.

Ewa Wyka is a historian of science, associate professor of the Institute for the History of Science Polish Academy of Sciences in Warsaw, and curator of the Jagiellonian University Museum in Krakow. Area of research interests: history of mathematical and natural sciences, the evolution of scientific instruments, aristocratic and academic scientific collections, making of scientific instruments, museology of science and technology, popularization of science.

Scientific instruments for experiments never done?

Scientific instruments and physics teaching in 20th century Greece, a fictional reality

George N. Vlahakis

Hellenic Open University

Abstract

Educational scientific instruments have been acquired for teaching purposes in Greek schools since the late 18th century. After the establishment of the Greek independent state in the mid-19th century education and all its parameters became naturally a duty of the government and especially of the Ministry of Education. In this respect, physics and chemistry decided to be taught not only through textbooks but using also experiments for making these disciplines more understandable and more attractive to the students. For this reason, scientific instruments were not only imported by other countries but were also built in Greek small factories. This paper discusses the history of the creation of educational laboratories in the Greek schools, the instruments usually existing in these laboratories, if finally they were used and in what extent for improving science teaching. A final remark will be given for the fate of many of these instruments, which was not the ideal one.

George N. Vlahakis is Associate Professor of History of Science and Philosophy at the Hellenic Open University. He is director of the M.Sc. Program "Science Communication" and the M.A. Program "Philosophy and Arts". He is also president of the Commission on Science and Literature, DHST/IUHPS. He has published articles and books on history of science with a focus in 18th-20th c. South-eastern Europe.

12.30 – 14.00

Session 8 (parallel)

Scientific Instruments and Women (Part 2)

Chair:

Janet Laidla, University of Tartu

Annie Maunder: Using instruments and photography to extend a constrained career

Louise Devoy

Royal Museums Greenwich

Keywords: Women astronomers, photoheliograph, solar photography

Abstract

Annie Maunder (née Scott Dill Russell) (1868–1947) was one of five women recruited by the Royal Observatory in the early 1890s to work as 'lady computers'. In this paper I will demonstrate how Annie's individual career was defined and shaped by her access and adaptation of instruments.

Annie started work at the Observatory in September 1891 and within a year she had been assigned to work alongside E. Walter Maunder in the Heliographic Department. Annie was trained to use one of the Dallmeyer photoheliographs so that, weather-permitting, she could create a daily record of sunspot activity. When Annie subsequently married Walter Maunder in late 1895, she had to resign from the Observatory according to the rules and social conventions of the period, but it was her experience and proficiency in using instruments that helped sustain her astronomical career as an 'obligatory amateur'.

Within a year, she had been awarded a fellowship by her former college to create a wide-angle camera. She adapted this instrument and combined it with telescopes borrowed from Greenwich to capture wide-angle images of coronal streamers, as seen from India during the total solar eclipse of 22 January 1898. The images were enthusiastically received by the astronomical community and cemented her status as an accomplished astronomer and photographer. Although Annie's later research focused on sunspot analysis and investigating the origins of the constellations, her early career access to Observatory instruments helped sustain her reputation and contribution to astronomy for the next forty years.

Louise Devoy is Senior Curator of the Royal Observatory, Greenwich, and is interested in the history of the site's buildings, instruments and people.

A "feminine touch" in the history of scientific instruments in Italy: Maria Luisa Bonelli Righini

Mara Miniati

Museo Galileo, Firenze

Keywords: History of science, women and science, scientific instruments, Florence

Abstract

In 1966, the flood put Florence and the tragedy of cultural institutes and museums in the spotlight. The photo of the Museum of the History of Science and its director went around the world. Maria Luisa Bonelli was able to transform destruction into an opportunity: scholars and specialists became habitual visitors of the museum, and the instruments became worthy of attention. This presentation aims to illustrate the work and the personality of Maria Luisa Bonelli, both scientific and human. She established relationships with Italian and foreign institutions, popularizing the Museum and its collections with numerous popular publications. At the same time, she increased the cataloging and publications entrusted to scholars or written directly by her. She opened the museum to all those who could be of help and stimulus. The award of the Sarton Medal in 1979 recognized Bonelli and the role she held in the field of the history of science, and the role her instruments played as protagonists in this discipline.

Mara Miniati is Emeritus Curator of the Museo Galileo-Istituto e Museo di Storia della Scienza. She has been its vice-director, and editor-in-chief of "Nuncius". She has authored almost 200 publications and attended to reorganising the Museum (1986, 1991). She cooperated with national and international institutions. In 1993 she received the prestigious Paul Bunge Prize.

12.30 – 14.00

Session 9 (parallel)

Bringing Historical Scientific Instruments and Learners Together: Personal Stories, Educational Activities, and Visions for the Future (part 2)

Chair:

Frédérique Plantevin, Université de Brest

Rediscovering scientific instruments. The case of the 1st Elementary School of Athens

Chryssanthi Pikoula

1st Elementary School of Athens

Keywords: Primary education, Scientific instruments

Abstract

The 1st Elementary School of Athens is located in Pagrati, a short distance from the historic center of the city. It is one of the oldest schools in the country. Initially, the building housed the stables of King Otto (1833). In 1923 it was used to temporarily house refugees from Asia Minor. The current school building was inaugurated in 1933. Today the school has approximately 200 students, most of whom belong to immigrant families who have settled in Athens within the recent decades. Our 6th-grade class consists of 13 students coming from six different countries: Albania, Algeria, Georgia, Sudan, Syria and Greece.

At the beginning of the school year 2021-2022, we looked for material to be used in the teaching of Natural Sciences on the school premises. We were surprised to discover dozens of scientific instruments made during the 20th century. Apparently, these instruments had been rarely used in the past while no information about them was available.

The instruments were gathered in our classroom, carefully cleaned, photographed one by one and identified. Our initial surprise quickly transformed into unbridled excitement. Since then, our students have been searching for information regarding these instruments trying to restore them at the same time. The students' personal engagement in using and learning about scientific instruments helped them enrich their cognitive horizons.

Finding, highlighting and utilizing these forgotten scientific instruments, became an occasion of joy and knowledge for our class. Undoubtedly, their presence in the classroom and the students' daily engagement with them encourages their appeal for exploratory learning activities and renews their school experience.

Chryssanthi Pikoula is a graduate of the Pedagogical Academy of Larissa and of the Pedagogical Department of Primary Education of the National and Kapodistrian University of Athens. She has been working as a Primary Education teacher for the last 31 years. She currently teaches at the 1st Elementary School of Athens. She seeks to provide her students with the opportunity to experience the phenomena they research so that they have a deeper understanding of the concepts of the Natural Sciences.

PATSTEC mission in Britany:
Safeguard and conservation of contemporary scientific heritage

Julie Priser

Université de Rennes 1

Keywords: Contemporary scientific instruments, PATSTEC, heritage conservation

Abstract

At the beginning of the 21st century, it's necessary to save 20th century historical instrument heritage. Tomorrow, it will constitute one of the tools to revisit knowledge, techniques and innovations of the second half of the 20th century.

The University of Rennes 1 is engaged in a national program, initiated by the Conservatoire National des Arts et Métier- Mission PICST, which aims to save the scientific and technical contemporary heritage and lead the PATSTEC mission for the Britany.

The Brittany PATSTEC mission has a constant exchange and discussion towards its partners, particularly on what constitutes and will constitute the scientific heritage (instruments, memory, creation process, documents, etc.). With this experience, the PATSTEC mission develops a formal heritage approach.

With the partners' awareness for the scientific and technical heritage and networks work, the PATSTEC mission in Brittany was contacted in 2016 by the physical measurement center of the Institute of Chemical Sciences of Rennes to assess the SQUID (Superconducting Quantum Interference Device).

The SQUID is a variable temperature superconducting magnetometer. Used from the 1980s to 2000 at the University of Rennes 1, this equipment measures the magnetic properties of small samples and calculates their magnetic susceptibility. During this period, superconductivity was a major research theme on a local, national and international levels. The SQUID's installation arises from the discovery of the Chevrel phases on 1971. It's the only equipment in western France. At an international level, Brian David Josephson was awarded the Nobel prize in Physics in 1973 for his prediction of the Josephson effect and Karl Müller and Johannes Bednorz won the Nobel Prize in Physics for their discovery of high-temperature superconductivity in ceramics in 1987.

In this historical and scientific context, what criteria must be validated for the scientific instrument to become an object of heritage

- Is it only physical criteria such as weight, size or materials used?
- Is it only non-physical criteria, such as scientific or historical or aesthetic interest, living memory? etc.
- Both? what relative significance?

Currently, the SQUID integrates a valorization project, entitled "Parcours des instruments scientifiques".

Through this technical expertise, we will discuss our "reasoned approach" heritage supported by the PATSTEC mission and essential idea to initiate the beginning of a reflection on heritage's safeguard of today and tomorrow.

Julie Priser is collection assistant since 2014 at Rennes 1 University and specialized in scientific instruments from 19th century to nowadays. PATSTEC mission coordinator Britany, France (PATSTEC - PATrimoine Scientifique et TEchnique contemporain).

Scientific instruments studies within the framework of the inventory of French astronomical heritage: Evolution and critical assessment

Jean Davoigneau

Ministry of Culture, Paris, France

Françoise Le Guet Tully

Honorary Astronomer (Observatoire de la Côte d'Azur)

Keywords: Astronomical heritage, astronomical instruments, observatories, inventory, conservation, protection, heritage documentation

Abstract

In the mid 1990s, following an alarmist audit produced on behalf of the French Ministry of Research on the state of conservation of archives and obsolete instruments in institutional observatories, an agreement was signed with the Ministry of Culture to inventory the instrumental heritage of astronomical sites. Pursued for around 10 years by the two authors – with the wise advice of Paolo Brenni and Anthony Turner–, this illustrated and documented inventory led in some instances the supervisory authorities to take protective measures for the instruments and/or their shelters. It also prompted us to write short studies on iconic or non-iconic astronomical instruments.

We will briefly recall how the purpose of these studies has evolved over the last thirty years: from the study of a single instrument (i) to that of a series of instruments of the same type built on different French astronomical sites, (ii) to that of instruments produced by the same maker, in France and in countries belonging to its sphere of influence, (iii) to the evolution of shelters for the same instrument over time, and (iv) to the 3D reconstruction of all the previous states of an emblematic instrument.

We shall then assess the results achieved through these studies with regard to the protection, preservation and future of the instruments concerned. Finally, we shall question the difficulty of sharing the knowledge that we have produced for almost thirty years beyond the community of specialists, in particular with the authorities in charge of these instruments.

Jean Davoigneau is a historian with a scientific background, works for the Mission Inventaire général du patrimoine culturel at the French Ministry of Culture, where he is the specialist in scientific and technical heritage.

Françoise Le Guet Tully is Honorary Astronomer (Observatoire de la Côte d'Azur).

14.00 – 15.30 Lunch

15.30 – 17.30

Session 10 (parallel)

Ottoman and Arabic Instruments from the 13th to the 18th century

Chair:

George Vlahakis, Hellenic Open University

New perspectives on the History of Ottoman astronomy: Portable astronomical instruments and Calendars (16th – 18th centuries)

Gaye Danışan

Department of History of Science at Istanbul University

Keywords: Ottoman, portable astronomical instruments, calendars, 16th – 18th centuries

Abstract

The majority of applied astronomical works in the Ottoman scientific literature are not intended to be a complete theoretical exposition, but they allow us to trace the practical aspects of Ottoman astronomical tradition. Manuals on portable astronomical instruments, including their description and the use, are one of them. The number of surviving manuals on astrolabes and quadrants in Ottoman literature gives the impression that these instruments were by far the most commonly used for determining the time in the Ottoman territory. However, the other side of the coin is that these manuals do not reflect all parts of Ottoman tradition as following examples: There are manuals on daire-i muaddil and zat'ül-kürsi, although less popular than the other three. Besides, it is possible to encounter anonymous Ottoman treatises, which include descriptions and sketches on various sundials or give information on nautical astronomical instruments. Ottoman calendars are also another valuable source for obtaining information on portable astronomical instruments. For example, a 16th-century corpus of calendars includes a drawing about dividing the ecliptic into its twelve zodiac signs intended to use when projecting on rub'-ı mukantarat. Cross staff is mentioned in the term "palastirilya" in an anonymous Ottoman perpetual calendar, which was prepared for the latitude of Algeria from the 18th century. Moreover, it is possible to encounter volvelles in the Ottoman calendars. Taking into account all of these issues, this paper aims to discuss possibilities for new methods and approaches to Ottoman sources for portable astronomical instruments.

Gaye Danışan is an assistant professor, at the Department of History of Science at Istanbul University. Her research interests are mainly in calendars, portable astronomical instruments, Ottoman volvelles, astronomy, astrology and astrometeorology especially among Ottoman navigators in the 16th century. Her research focus on a project entitled "A comparative study on theoretical and practical aspects of scientific activity in the Ottoman Empire: annual and perpetual calendars (1550-1710)", funded by the TUBITAK.

Curious Case of a 15th-Century Treatise on the Spherical Astrolabe

Taha Yasin Arslan

Istanbul Medeniyet University

Keywords: Astronomical instruments, spherical astrolabe, Libros del saber de astronomía, Ottoman astronomy

Abstract

The spherical astrolabe is one of the earliest inventions in astronomy in the Islamic world. Unfortunately, only one example survives from a relatively late period. Textual sources, however, are less scarce. Numerous treatises were compiled on the construction and/or use of the instrument between the 9th and 15th centuries. One of these treatises stands out the most. It is an unsigned work copied in Istanbul in the late 15th century by ʿUmar al-Dimashqī, who was also an astronomer and instrument maker. One of the reasons this treatise arouses curiosity is its description of the instrument. Breaking away from the tradition in the Islamic world, the unknown author introduces an astrolabe that is very much like the one described in Libros del saber de astronomía (Books of wisdom of astronomy), a compendium prepared by the order of Alfonso X of the Kingdom of Castile in the 13th century. This and several other pieces of information in the treatise makes it hard to define its place in the literature. This paper will provide these unusual details and offer a comparative account on descriptions of the spherical astrolabe within extant texts from the Islamic world. It is hoped that this might generate enough curiosity to revise the approach to the existing literature on spherical astrolabes.

Taha Yasin Arslan is an assistant professor in the Department of the History of Science in Istanbul Medeniyet University. The main focus of his research is astronomical instrumentation in the Islamic world between the 13th – 16th centuries. As part of his academic studies, he creates virtual and physical reproductions of instruments.

Rediscovering Marrākushī:
A Comparative Analysis of the Treatise 'On the Use of Celestial Globes'

Beyzanur Topçuoğlu

Istanbul Medeniyet University

Keywords: Celestial Globes, Marrākushī, Qusṭā ibn Lūqā, Timekeeping, Astronomical Instrumentation

Abstract

One of the most influential books on astronomical instrumentation in the Islamic world was Jāmiʿ al-mabādiʾ wa-ʾl-ghāyāt fī ʿilm al-mīqāt (Compendium of the Principles and Objectives in the Knowledge of Timekeeping) compiled by Abū ʿAlī al-Ḥasan ibn ʿAlī al-Marrākushī, a Mamluk astronomer who lived in 13th century Cairo. It was the source book for all operations in the knowledge of timekeeping for centuries. The compendium contains four books of which

each respectively deals with mathematical principles required for timekeeping calculations, construction of astronomical instruments, use of astronomical instruments, and a questionnaire for testing the reader. In the third book, there is a 90-chapter treatise on the use of celestial globes. In the beginning, Marrākushī states that he benefited from five works of his predecessors, namely Hero of Alexandria (1st century CE), Philo of Byzantium (3rd century BCE), Theon of Alexandria (4th century CE), Eutocius of Ascalon (6th century CE), and Qusṭā ibn Lūqā (9th century CE). Furthermore, he singles out Qusṭā ibn Lūqā's work being the most useful of them. Detailed study of Marrākushī's work reveals that he used Qusṭa's work extensively. This presentation will briefly present the information in the treatise and try to reveal how much of it comes from Qusṭā's work and how much of it is of Marrākushī's original contribution.

Beyzanur Topçuoğlu was born in 1996. She completed her undergraduate degree in Arabic Literature and Language at Istanbul University in 2020. After graduation she began her MA program in History and Philosophy of Science at Istanbul Medeniyet University. Her studies are focused on astronomy, astronomical instruments and timekeeping.

15.30 – 17.30

Session 11 (parallel)

18th to 20th Century Instruments (part 2)

Chair:

Kostas Tampakis, National Hellenic Research Foundation

Scientific Instruments at the Frontier

Olov Amelin

Jamtli Foundation, Öresund

Keywords: 18th century, meteorology, astronomy, land surveying, networks, transit of Venus

Abstract

In the 1782 spring issue of the transactions of the Royal Academy of Sciences an article is published about "…the extremely low temperatures that was noted in the county of Jämtland on the first of January, 1782". The author was Johan Törnsten, extraordinary engineer and land surveyor, living in the small village of Brunflo. The temperatures he reports are indeed extreme. For several hours the thermometer shows around -50 Centigrades, but all of a sudden it drops down to -82(!)

Törnsten initiates a discussion about how mercury and glass is affected by long periods of extreme weather. The professor of physics, Johan Carl Wilcke wrote a comment and discussed

the matter. Törnsten was honored with a silver coin from the academy and, maybe more important, two new thermometers.

Törnstens first encounter with the county of Jämtland took place in June 1769. The Swedish astronomer and secretary of the academy, Pehr Wilhelm Wargentin got information about a land surveyor also trained in astronomy, living in the northern part of the country and asked/ordered him to travel to Jämtland and observe the transit of Venus, using instruments of his own construction, but equipped with lenses sent by Wargentin.

My paper will follow Törnstens work, both with the instruments and how he managed to build and transport them more than 200 km through a sparsly populated area of the north in a few days. He became part of a network of informants that Wargentin organized in order to get observations about astronomy and meteorology from the most remote parts of Sweden.

Olov Amelin has been studying scientific instrument making in 18th century Sweden and wrote his PhD thesis about the instrument maker Daniel Ekstrom in 1999. He is director of the Jamtli Foundation in Östersund, which runs one of Sweden's largest county museums and several other museums and heritage sites in the region of Jämtland Härjedalen.

The role of the Russian diplomatic representatives in London in acquiring navigational instruments for Russian navigators in the beginning of the 19th century

Feliks Gornischeff

Estonian Maritime Museum

Keywords: Navigational instruments, diplomacy, Russian exploration, British instrument makers

Abstract

This presentation intends to examine the role of Russian diplomatic representatives in London, more precisely ambassadors Semyon Vorontsov (until 1806) and Christoph Heinrich von Lieven (between 1812–1834) in the process of acquiring navigational instruments for Russian expeditions in the first half of the 19th century. Even though it is roughly known which instruments Russian voyages carried, it is still unclear who and how exactly ordered the instruments from well-known makers such as Troughton, Dollond, Arnold, Barraud or Massey.

Adam Johann von Krusenstern's First Russian circumnavigation in 1803–1806 set an example of the use of British instruments. Other Russian voyages, such as Otto von Kotzebue's in 1815–1818 and 1823–1826, Fabian Gottlieb von Bellingshausen's in 1819–1821 or Vasily Golovnin's in 1807–1809 and 1817–1819, used British instruments on board the ships. A great number of these were acquired in England, where regular stops were made.

The Russian embassy in London were to become an important link between explorers and instrument makers. The Ministry of Navy usually sent information in advance what to order or buy in London, but the leaders of the expeditions stopped in England themselves to complete the purchases. This allows us to argue that without the Russian diplomatic representatives in England, the preparation of the expeditions would have been much more complicated.

This presentation would add new information to the connections between the British instrument makers and Russian navigators, drawing information from different Russian, Estonian and British archives.

Feliks Gornischeff is a researcher at the Estonian Maritime Museum focusing on the Russian exploration in the first half of the 19th century. The focus is the life and work of Adam Johann von Krusenstern, the first Russian circumnavigator, concentrating on the scientific aspects of his career, but also international networks.

Discoverer and Methodologist:
Alfred O. C. Nier and the Mid-20th Century Instrumental Revolution in Geochemistry

George Borg

National Science Foundation and Science History Institute

Keywords: Alfred Nier, geochemistry, instrumentation, mass spectrometry

Abstract

During the mid-20th century, geochemistry—one of the core Earth sciences—underwent a spectacular transformation as a result of the introduction of high-tech instruments. In this process, mass spectrometry became the workhorse analytical technique in isotope geochemistry. The theme of this essay is the dynamic relationship between discoveries of isotope systems and the variations in their relative abundances, on the one hand—discoveries that became the foundation of isotope geology—and the development of mass spectrometry, on the other. This relationship is illustrated by the career of physicist and instrument-builder Alfred O. C. Nier, who was based at the University of Minnesota in Minneapolis. Nier's 60-degree-sector mass spectrometer design of 1940 endowed the instrument with powerful new capabilities, as well as facilitated its adoption outside the nuclear physics community. In the course of developing and applying the instrument, Nier also made important discoveries about the relative abundances of isotopes that paved the way for geochemical research on the deep past. My thesis is that Nier's early career, spanning the 1930s and '40s, illustrates a certain dynamic relationship between science and instrumentation, in which instrument development and scientific discovery co-evolved synergistically. This pattern of research spread beyond Nier—who largely moved on from this research after the 1940s—to develop into a research tradition, initially based at the University of Chicago's Institute for Nuclear Studies and then spreading to other institutions, notably Caltech and the University of California, San Diego. This tradition made crucial contributions to historical geology, including paleoclimate, solar system history, and the tectonics revolution.

George Borg is a post-doc based in Philadelphia. His research is at the intersection of the histories and philosophies of science and technology. His current project concerns the 20th century history of geochemistry, a core Earth science. He is studying the role of technology in turning geochemistry into a science capable of studying the deep past.

The Eiffel Tower method: radiotelegraphy, observatories and time signals

Sabina Luz and Moema Vergara

UNIRIO and MAST, Rio de Janeiro

Keywords: Radiotelegraphy, Observatories, Instrument makers

Abstract

An International Conference for the establishment of an "universal" hour took place in 1912 in Paris by the initiative of the Bureau des Longitudes. The creation of the Bureau International de l'Heure was one of its consequences. Since 1910 the collaboration between général Ferrié, responsible for communication by wireless telegraphy and Benjamin Baillaud, the director of the Parisian Observatory with its hour service, made the time signals from the Eiffel tower to be received not only in Europe and North Africa but also at the North part of the Atlantic. Hour emissions by radiotelegraphy and longitude calculations were starting at that time a long history that has been neglected by the historiography until recent times. In Brazil, the director of the National Observatory, Henrique Morize, was following with great interest the decisions and resolutions of the International Hour Conference. With the objective of being part of this international time signals network, Morize decided to acquire some instruments made by the French fabricant Leroy and Cie which were "the most indicated" for the task since they were used in Paris. Some years later, Morize could say that the Brazilian Observatory was using the same method as the Eiffel tour for time signal transmissions. Instrument makers, instrument circulation, international conferences and international networks: the aim of this paper is to reflect on the collaboration between instrument makers and the observatories from a perspective that includes different countries, continents and contexts.

Sabina Luz is a Historian of Sciences and PhD Student in Brazil, and interested in observatories, networks, instruments of time and international scientific organizations.

17.30 Departure to the National Observatory of Athens

Tuesday Evening: Early Career Scholars' Dinner

WEDNESDAY, 21 September

09.30 – 11.30

Session 12 (parallel)

Visualization of Instruments – Instruments in Film (part 1)

Organizers:

Michael Korey, Mathematisch-Physikalischer Salon and Staatliche Kunstsammlungen Dresden

Samuel Gessner, Centro Interuniversitário de História das Ciências e da Tecnologia, Lisbon

The four decades of the SIC's existence have seen a flowering of technologies for visualizing instruments and their use. This session aims to illustrate and analyze a variety of approaches at the nexus of instruments and film, broadly conceived. Contributions addressing demonstrations of instruments in use, their animation for purposes of education and outreach, as well as imaging techniques as used in research are all welcome. As we look ahead, can we take stock of the pros and cons of using digital means to treat analogue instruments, and vice-versa?

Chair:

Michael Korey, Staatliche Kunstsammlungen Dresden

How to translate scientific contents into digital language: The experience of the Museo Galileo

Jacopo Tonini

Museo Galileo - Istituto e Museo di Storia della Scienza

Keywords: Digital communication, video, 3D, app, web, augmented reality, history of science, scientific instruments

Abstract

The Museo Galileo of Florence has an in-house Multimedia Laboratory, founded in the early 1990s with the task of 3D modelling and animating the instruments of the museum collection, of explaining how they are made, and showing how they work. Following the fast evolution of technologies, in subsequent years the Lab extended its activities to include, for example, the Web, cd-interactive applications, apps for mobile devices, augmented reality, and video projections.

Being part of the Museum means that the staff of Multimedia Laboratory works continuously in close contact with curators, ensuring an excellent translation of contents into a digital language.

In this session we will talk about the workflow we follow to transform the results of scientific investigations into digital applications addressed to the general public: sharing the contents with curators, discussing time and budget with the Direction, evaluating the best media to be used, writing the storyboards, collecting or producing images and other visual documentation, as well as developing and testing the products.

We will also talk about the pros and cons for a museum having an in-house Multimedia Laboratory: with respect to costs, the quality of results, development time, and the updating of technological expertise.

Finally, we will try to gauge what we should expect in the next years from the development of new digital technologies and new software frameworks, in relation to the desires of museums to communicate and interpret their collections. One overriding premise for us is that applications must be content-driven and public-oriented, not technology-centered.

Jacopo Tonini has been Head of the Multimedia Laboratory of Museo Galileo since 2004. Fields of interest: digital technology for museum education, especially regarding old scientific instruments; projecting and implementing digital communication in temporary exhibitions of history of science.

Light, camera, action – Making of the history of science film: "Les magiciens de la lumière" (Wizards of Light)

Christine Azémar

Mios, France

Pierre Lauginie

GHDSO, Université Paris-Saclay

Alain Sarfati

LAC, Université Paris-Saclay

Keywords: Light, film, history, fiction

Abstract

Our film "Les magiciens de la lumière" (Wizards of Light, 2009) relates, in a fictional form and with professional actors, the measurements of the speed of light from Galileo to Léon Foucault (ca 1600 -1865). See: https://www.canal-u.tv/80035. We propose to discuss several aspects of the making of the film, including:

• Choice of topic: History presents material for a very nice story, one spanning from 17th to 19th century and including Galileo and the moons of Jupiter, the discovery of the finitude of the speed of light (Römer, Bradley), as well as Fizeau and Foucault's "terrestrial" measurements. But in the end, how much of the film is "true" and how much is "invented"?

• Logistical challenges: if a shooting did not go perfectly, we couldn't simply re-do it again the next morning (for many reasons: location restrictions, availability of actors, money). How to work around such strong constraints?

• Special features of our scientific/technical language: How could we get professional actors, who were very skilled in reciting nicely balanced literary texts, especially poems, to deal with our scientific scripts?

• Role of women: What role should and could women play in a film focused on the history of the speed of light?

• Scholarship vs pedagogy: What part do the technical explanations play? How deep can these be? Can the audience acquire a deeper technical understanding of the material through the film?

While addressing these challenges, the film offered us the chance to feature original instruments, including: Fizeau's toothed wheel and its Drummond light source, Foucault's spinning mirror (a marvel of mechanics) driven by organ bellows, Froment's clock and its so-called "chronometric wheel" (in fact a stroboscope), while also depicting the "zig-zag" light path, an essential detail of the experimental set up never shown in textbooks.

Christine Azémar is a former film editor and co-director (with Serge Guyon †) at the audiovisual department of Orsay (SCAVO), University Paris-Sud. Some typical productions were: "Les magiciens de la lumière", "Marie Curie, la chimie de l'impondérable", "Du gaz d'éclairage aux sulfamides", "Virgo, objectif 10-21".

Pierre Lauginie, the presenter, is a former lecturer and researcher in physics and scientific co-author of the film with Alain Sarfati, has developed an experimental approach to History of science teaching, based on adaptations of historical experiments. His present interests are on history of instruments and popularization of science.

Alain Sarfati, Professor of Physics at the University Paris-Saclay and researcher at the Aimé Cotton lab (LAC), was the head of the SCAVO at the time of our film, and more recently last president of University Paris-Sud (now part of University Paris-Saclay).

Tangible transcendental curves:

The video "Exponential ex machina – A quest from history to action"

Frédérique Plantevin and Pietro Milici

Université de Brest (Université de Bretagne Occidentale)

Keywords: Visual, tangible and sensitive mathematics, historical geometrical machines, Poleni, tractional motion, inverse tangent problem, reconstruction.

Abstract

In the late 17th century, an important issue was to legitimize transcendental curves geometrically. In the early 18th century, Giovanni Poleni significantly contributed to this problem. Indeed, he designed and realized two geometrical instruments to precisely trace the tractrix and logarithmic curves in a continuous way. Although these devices appear in some

old catalogs of the Padua physics museum, they are no longer present. For this reason, we decided to reconstruct them and, in the summer of 2021, we achieved this goal. After almost three centuries, such machines are now back in action! Making a movie seemed the best way to share this result.

The movie had to include several aspects of these machines: the historical context, the steps toward their reconstruction, as well as how and why they trace the desired curves. Explaining how these machines draw the curves from the underlying geometrical definitions is strongly related to pedagogical aims, especially for the logarithmic or exponential ones. Indeed, these instrumental constructions provide an attractive, concrete, "white box"- perspective: such an approach is very different from both the usual theoretical definitions and also conventional, didactically-oriented computer constructions.

For all these purposes it was not sufficient simply to film the machine in action: viewers have to be guided to understand what they are seeing. In this talk, we will present a selection of visual solutions that we adopted to pursue our goals.

Frédérique Plantevin is lecturer in mathematics at the University of Brest – France, member of the LMBA. She founded the Cabinet of Curiosity in the Faculty of Science where the collection of outdated scientific instruments is housed. She is involved in its enhancement. She is member of the international project EuroPoleni.

Pietro Milici has a Ph.D. in mathematics (Palermo) and epistemology (Sorbonne), and is a researcher at the University of Insubria. His main research interests deal with mathematical machines from historical, philosophical, and educational perspectives. He founded Machines4Math, a university spin-off for tangible educational materials.

Ancient Greek science through the lens of surviving objects and modern scientific research

Jane Desborough

Science Museum, London

Keywords: Ancient Greeks, scientific instruments, modern science, museum exhibitions

Abstract

This paper takes a case-study approach to consider how the recent exhibition Ancient Greeks: Science and Wisdom attempted to convey some key themes in Ancient Greek science by combining the display of original ancient objects with representations of contemporary science research through film.

It will look at the challenges posed by the lack of surviving 'science' objects and indeed of the original words of the key people. The latter raising questions about who those people actually were and whose words we rely on today when trying to come closer to how the Ancient Greeks undertook their investigations into the workings of the natural world.

It will give examples of how these challenges were overcome by the identification of ancient objects which may in other contexts be considered to be 'art objects' rather than 'science objects', but whose production, decoration or use were influenced by science ideas of the time. It will introduce the three modern scientific research projects that were represented in the exhibition through film. Each of which used scientific techniques and recreation to discover more about the Ancient Greek world - allowing us to appreciate and wonder over the speed of their merchant ships, the sound of their music and the complexity of their geared mechanisms.

It will conclude by sharing some examples of visitor feedback and considering what questions this case study raises about how we can convey Ancient Greek science in museums in the future.

Jane Desborough (PhD) is Keeper of Science Collections at the Science Museum in London. She was Lead Curator of the Ancient Greeks: Science and Wisdom exhibition. Recent publications include The Changing Face of Early Modern Time, 1550-1770 (Palgrave); The Role of Women in the Science City (co-authored with Dr Gloria Clifton, Science Museum e-journal).

09.30 – 11.30

Session 13 (parallel)

Scientific Instrument Studies – Decolonised (part 1)

Organizers:

Silke Ackermann, History of Science Museum, Oxford University

Jahnavi Phalkey, Science Gallery Bengaluru

Helmuth Trischler, Deutsches Museum, Munich

One of the key drivers of change in the museum sector in recent years has been the deep engagement with decolonisation. With its theme of The Past, Present, and Future of Scientific Instrument Studies, this year's SIC meeting in Athens provides an ideal opportunity for reflection and critical thinking on past practice and future possibility for our sector:

• How can scientific instrument collections be decolonised?

• What questions and approaches work in different circumstances?

• Is there already experience that can be shared within the SIC community?

• What can we learn from art galleries, social history museums, anthropological and ethnographic collections, and natural history museums that have all responded with initiatives to interrogate their own collections and develop new exhibitions and projects?

This themed session aims to explore these questions. Topics may include, but are not limited to:

• Provenance – the circumstances and sources of acquisition

• Language and images – the way in which artefacts, their producers and users are being described, depicted and referred to

• Materials – the colonial and extractive origins of raw materials and products (for example, mahogany or rubber)

• Contemporary collecting – new initiatives to expand the reach and representation of scientific instrument collections

• Exhibitions – projects which have tackled decolonisation through display and co-curatorship

• Politics – political and nationalist agendas in the decolonisation debate

Chair:

Tba

Casting a Long Shadow: Calendars, Clocks and the Decolonisation of Pre-Modern Time

Silke Ackermann and Stephen Johnston

History of Science Museum, Oxford University

Keywords: Decolonisation, Pre-Modern, Time, Clocks, Sundials

Abstract

The History of Science Museum (HSM) at Oxford University is transforming. To mark our centenary, we have launched Vision 2024: an ambitious programme of refurbishment, reinterpretation and re-engagement underpinned by a new focus on inspiring curiosity, revealing beauty and highlighting ingenuity. Our mission explores the connections between people, science, art, and belief; gives voice to our collections; and shares the stories of science in Oxford.

Decolonising our collections and the way in which we interpret them is a crucial element of Vision 2024. This is a politically charged arena for a public institution: social media provokes a polarisation of debate, where charges of "wokeism" on one side confront accusations of apology for past and continuing colonial and imperial injustice. Our paper is therefore exploratory rather than definitive, encouraging conversation within our community which we hope will resonate with other museums.

We take one particularly important area of the HSM collection – the measurement of time – and ask how we can approach its objects with new questions. Using case studies ranging from the ancient Roman world to 19th-century India and the Ottoman empire, we examine calendars, clocks and sundials to see how they could be used to support imperial expansion or embody indigenous resistance. Does colonisation always entail the forced introduction of an alien time-system? Does de-colonisation in turn mean that indigenous time-systems – often representing intangible heritage – should be recovered and valued? How should these issues be presented in museum displays which respect a range of voices, including those previously unheard?

Silke Ackermann is the Director and **Stephen Johnston** is the Head of Research, Teaching and Collections at the History of Science Museum at Oxford University. Both take a strong interest in all elements of decolonising (history of) science collections.

Decolonising horological collections: Towards a more sympathetic terminology

Emily Akkermans

Royal Museums Greenwich

Keywords: Horology, terminology, sympathetic systems, decolonising collections

Abstract

The term 'master-and-slave' is endemic in horological literature, insomuch that it is often unquestionably applied to any system where clocks are electrically connected to one another. In technology and horology, 'slave' is used as a figurative description, or as an analogy, which removes it from its historical and social context and gives it a false sense of neutrality or objectivity. The accepted use of the terms is surprising considering how offensive it is. Some employees in various technical and engineering companies recognise this and have recently been taking steps to change these terms, and have introduced other, often far more accurate terms, to describe the relationships within their systems.

Royal Museums Greenwich holds many objects which have incorrectly come to be known as 'master' or 'slave' clocks, or 'Master-and-slave' systems. The term is applied to any system where a standard clock regulates additional dials or clocks through electrical contacts, even though the makers themselves used a different description. For example, George Airy described the Shepherd system as a sympathetic system, consisting of a 'Normal' or 'Motor Clock' connected to 'Sympathetic Dials'. Alexander Bain spoke of 'Affiliated' or 'Companion' dials. Frank Hope-Jones of the Synchronome Company used the term 'Electric Impulse Dials', as did many other companies.

Whilst most European countries used diverse terms to describe such systems, it was the Scottish Astronomer David Gill who first used the term whilst stationed at the Cape Observatory. This context is key to understanding the historic links to slavery, and that the term cannot be considered neutral. This paper reviews the origins of the term in horology and its subsequent development within the discipline.

Emily Akkermans is Curator of Time at Royal Museums Greenwich where she cares for the museum's timekeeping collections. Her background is in practical horology and metals conservation. Her research interests are maritime history, horology, scientific instruments, and the history of science and technology.

Flashpoint and fulcrum: A university instrument collection in the context of DEAI

Alexi Baker

Yale Peabody Museum

Keywords: Museums, Decolonisation, DEAI, Teaching, Universities, Exhibitions

Abstract

The Division of History of Science and Technology [HST] at Yale University's Peabody Museum has a nationally important collection of approximately 15,000 artifacts. The collection originally grew out of Yale's own historical instruments, and it mostly consists of objects which were made in Europe or North America within the past 500 years.

It is an amazing collection – but it is regionally, culturally, and temporally specific. It is furthermore situated within the contexts of a privileged university which was originally founded in 1701, and of a natural history museum which was founded in 1866. Yale and its pursuit of "science" were associated with British imperial and later American nationalist activities and networks. These included a variety of prejudiced institutions and actions from the oppression, persecution, and enslavement of Black and indigenous people to scientific racism. Both Yale and the Peabody Museum are currently working to better understand and respond to their own histories and to make improvements across the board in relation to Diversity, Equity, Accessibility and Inclusion [DEAI].

How can an instrument collection like ours best contribute to DEAI- or decolonization-related change in the museum and university contexts? At this transformative time, the HST collection has sometimes been perceived or represented as a potential flashpoint and at other times as a fulcrum for pioneering and enacting DEAI reform. I will explore the different ways in which we are working to further this mission across all of our collection-based activities – and would be happy to receive feedback and ideas.

Alexi Baker operates the Division of History of Science and Technology at Yale Peabody Museum. She completed an M.Sc. and D.Phil. in History of Science at Oxford, researching London's early modern instrument trade. She was a post-doc at Cambridge on the Board of Longitude Project (2010-2013) and at CRASSH (2013-2015).

Decolonised labels

Mathilde Daussy-Renaudin

History of Science Museum, Oxford University

Keywords: Labels

Abstract

In the ongoing debate about decolonisation in museums, scientific instrument collections raise particular issues. These instruments are the products of intricate webs of needs, meanings, and

realities in their first context(s) of creation, and use. In museums, however, they are frequently used as a prism to convey ideas of 'progress', illustrate the 'Golden Age' of a civilisation, and act as a comparison point.

The language and chosen words to describe the instruments form another web of meaning, revealing a distorted vision catering for a particular audience. This is especially the case when Western museums hold collections coming from other cultures. The Western frame uses a specific set of values to think about science, from Early-Modern considerations on the Middle Ages through to Enlightenment categories and the colonialist discourse of the hierarchy of the civilisations.

In this paper, I look closely at the language and categories that are used to define the scientific instruments displayed in the labels of Western museums.

In the context of my PhD research in the Oxford History of Science Museum, and after a study visit in the Museum für Islamische Kunst in Berlin, I am working on glossaries and historiographic definitions of key terms used in the descriptions of scientific instruments that are made available to visitors. My particular interest is in asking: What does it mean to describe an object as Islamic? What is 'Islamic Science'? From where does this term come, and why is it still used in galleries?

Mathilde Daussy-Renaudin is a Collaborative Doctoral Partnership PhD Student at UCL and the University of Oxford History of Science Museum. She is investigating labels for the collections of astronomical objects, her working title is: "Science in the service of Religion? A museum study."

11.30 – 12.00 Coffee Break

12.00 – 14.00

Session 14 (parallel)

Visualization of Instruments – Instruments in Film (part 2)

Chair:

Samuel Gessner, University of Lisbon

BEHIND THE STARS

An app to teach basic astronomy through interactive early-modern instruments

Frederik Nehm

Mathematisch-Physikalischer Salon, Staatliche Kunstsammlungen Dresden

Keywords: Astronomy, historical instruments, education

Abstract

For centuries, mathematical instruments such as nocturnals, sundials, and globes served not only to solve specific astronomical problems, but also to visualize and understand the movement of the heavens. Banished now behind the glass of a museum display case, however, they often teach us very little. Over the past 18 months, we have reanimated four instruments from the Mathematisch-Physikalischer Salon in Dresden for the interactive app Behind the Stars. Users anywhere can now hold a nocturnal to the Pole Star to find the time, learn step-by-step how to use a horizontal sundial as a calendar, and much more – all with a smartphone or tablet applied to the sky at their current location. In so doing, they learn to interpret and predict the heavens via an observer-centered celestial sphere.

This talk summarizes the approach, expectations, challenges, surprises, testing, and reception of this project, in particular:

• how we navigated the occasional "clash" between historic instruments and (conventional) modern perspectives,

• which parts of the instruments we chose to simplify or idealize for better understanding,

• how reanimating the objects generated new insights for the museum itself.

Frederik Nehm is a physicist, part of the scientific staff as well as the museum's education team at the Mathematisch-Physikalischer Salon in Dresden. He got his PhD from the TU Dresden in 2016. Current research interests are early modern astronomical instruments and other historical mathematical instruments.

Geared to the Planets:

The Digital Re-Animation of a War-Damaged Renaissance Equatorium

Michael Korey

Mathematisch-Physikalischer Salon, Staatliche Kunstsammlungen Dresden

Keywords: Equatoria, geared mechanisms, planetary theory

Abstract

Ptolemy's late-antique theory to predict the motion of the planets was received and refined over many centuries by successive generations of mathematicians and astronomers writing in

Greek, Arabic, and Latin, for whom the theoretical models largely served for the computation of tables to predict planetary positions. At least since the eleventh century, a class of specialized, analogue mathematical instruments known as equatoria emerged alongside these tables. They consisted of rotatable graduated disks and radially turned arms or threads, with which planetary positions could readily be found. Such instruments offered both a visual representation of Ptolemy's geometric models and a means for the approximate calculation of the planets' positions. Certain of these instruments used metal gears to realize interconnected components of the desired motion.

Next to nothing of these early geared mechanisms survives – the far-earlier Antikythera Mechanism in Athens being a remarkable exception – so that rediscovery or re-analysis of each such instrument is a cause for interest. Such a geared equatorium made of brass, with a simultaneous display of the "true" position of all seven of the classical planets in the zodiac, was sent to the Saxon court by the Coburg mathematician Nikolaus Valerius in 1564. After it was caught up in the bombing of Dresden in 1945, it survives only as a disfigured, burnt fragment, but even before WWII it was never subject to a comprehensive analysis. The talk describes the many steps undertaken in the attempt to use digital means to analyze and reconstruct what this equatorium once did – and did not – show.

Michael Korey is senior curator at the Mathematisch-Physikalischer Salon in Dresden. Current research projects include a census of the world's oldest surviving refracting telescopes (with Marvin Bolt) and a comparative analysis of Renaissance planetary clocks (with Samuel Gesser, Karsten Gaulke, and Michael Beck).

Squaring the Circles:
Digital 3D modelling and website documentation of Lisbon's earliest slide rule

Samuel Gessner[1], Paula Redweik[2] and Susana Reis[2]

[1]CIUHCT and [2]DEGGE (FCUL), Faculdade de Ciênciase, Universidade de Lisboa

Keywords: Visualization, 3D modelling, audience engagement

Abstract

How can instrument studies benefit from recent progress in 3D modelling and a faster internet? What does the experience of producing an online model of an instrument reveal about the challenges of these new tools? What desires for future projects does this new perspective trigger?

This paper reports on a three-month project to create a 3D model of a very rare type of an early slide rule. The instrument used as a reference for the model is currently held at the MUHNAC University Museum in Lisbon. It is a logarithmic computational device invented by William Oughtred around 1630, named Circles of Proportion. Despite sharing functional principles with the later common linear slide rules, the Circles' multiple features set it apart.

We present the project's workflow and report on the cross-institutional collaboration involving an instrument historian from CIUHCT, museum staff of MUHNAC and engineers of DEGGE. The paper highlights various questions arising all along the process when defining the target

audience and the objectives, choosing the technology, texting and illustrating, conducting user tests and iteratively improving the presentation.

Documenting complex objects as 3D models with associated information undeniably surpasses the possibilities of traditional print publications. The novel medium of presentation, however, puts challenges to the developers and does not automatically guarantee a more efficient engagement with the objects. We will discuss some of these challenges, while also showing how exploring the 3D model has resulted in some discoveries and raised new historical questions. In conclusion, with the lessons learnt, the paper outlines objectives of a future project.

Samuel Gessner is an historian of science, assistant researcher at CIUCHT. His current project "Cultures of mathematics" focusses on medieval and Renaissance mathematical and astronomical instruments.

Paula Redweik is a geospatial engineer and teaches about photogrammetry and laser scanning, map production and 3D city modelling in the DEGGE (FCUL). She collaborated in multiple projects of cultural heritage preservation and dissemination.

Susana Reis is a biologist with a master's degree in Geographic Information Systems from DEGGE (FCUL) with a thesis in 3D modelling of the Tropical Botanical Garden of Lisbon.

Turning the Inside Out:

A Digital Scheme for the Three-Dimensional Representation of Early-Modern Clocks

Karsten Gaulke

Astronomisch-Physikalisches Kabinett, Kassel

Keywords:

Abstract

Currently, the technical analysis of historic clocks is mostly based on two-dimensional images. In the age of high-resolution cameras, it is no longer a problem to photograph the exterior of clocks in great detail. It becomes more difficult, however, when it comes to obtaining distortion-free images of clock dials in order to measure them as accurately as possible. The obstacles can be manifold. One example is distortion caused by the optical configuration of the lenses used.

The challenges increase when a detailed study and representation of the clock's movement is required to address a scientific question. First, researchers depend on the willingness of an accomplished clock conservator to remove the movement from its case and disassemble it, if necessary. The conservator's willingness, in turn, depends on the condition of the clock and his or her current workload. Often enough, important questions cannot be answered because of these stumbling blocks.

Based on the questions and experiences of the "Deus ex Machina" research project investigating the four surviving Renaissance planetary clocks that materialize true planetary motion, the Museumslandschaft Hessen Kassel is currently working with two Fraunhofer

Institutes on a grant proposal to the German Research Foundation (DFG). The goal of this proposal is to develop a "best-practice specification" for the three-dimensional, distortion-free representation of early modern clocks. At the heart of the project is the application and refinement of tomographic (CT) methods to allow researchers to smoothly zoom through a clock movement in a three-dimensional coordinate system. The scheme also aims to enable the segmentation of all individual parts in a format that allows precise measurements of angles and distances. The talk will present these ideas for discussion for the first time to the broad, international scholarly community

12.00 – 14.00

Session 15 (parallel)

Scientific Instrument Studies – Decolonised (part 2)

Chair:

Stephen Johnston, History of Science Museum, University of Oxford

Finding and Founding: Decolonising Astronomical Instruments of the Islamic World at the History of Science Museum

Federica Gigante

History of Science Museum, University of Oxford

Keywords: Decolonisation, Islamic, Collecting, Provenance

Abstract

This paper will discuss how to approach, communicate, and carry out the decolonisation of the History of Science Museum in Oxford through an investigation of the provenance of its collection, setting it in the context of other similar projects both in Oxford and elsewhere. The HSM holds the world's finest collection of scientific instruments from the Islamic world. Yet, their provenance, channels and mechanisms of acquisition are largely unknown and have never been investigated until now. As awareness on the responsibility of museums to account for their collections grows both within the wider public and the academic world, the HSM plans to embark on a research path into the provenance of its founding collection. This was assembled between the end of the 19th and the beginning of the 20th century by the museum founder Lewis Evans at a time when many objects left Islamic countries under colonial power. The HSM will be the first museum to attempt to decolonise a collection of scientific instruments in a panorama in which all such projects thus far have concentrated solely on art and ethnographic museums. This paper will address fundamental questions such as what can a museum find out about provenance. How can the research findings help in the efforts of decolonisation of the collection? How can we involve, and integrate the voices of, the people whose ancestors created these objects? And finally, how can and should we communicate and share the results of this process with the broader public and source communities?

Federica Gigante is the curator of the collection from the Islamic World at the History of Science Museum in Oxford.

Interrogating and visualising the colonial histories of scientific instrument collections

Rebekah Higgitt, Alex Butterworth, Duncan Hay and Sarah Middle

National Museums Scotland

Keywords: Digital Humanities, museum collections, data, colonial histories

Abstract

The role of scientific instruments in processes of colonisation, from exploring and defining colonial territories to controlling and exploiting them, are well known to historians but these associations often leave only scant traces in collection databases. Digital tools and models, such as those being developed in the Tools of Knowledge project, may, however, offer new ways of revealing and communicating these connections, making explicit, for researchers and museum audiences alike, the imperialist and power structures implicit within scientific instrument collections.

Working at scale across extant collections data, it is possible to quantify and visualise data points to reveal imperial and colonial connections. Such datasets include, often implicitly, evidence of colonial histories as, e.g. locations of use or acquisition, institutional or personal associations, or materials of colonial extraction. Additionally, data cleaning, modelling and augmentation, can help identify probable gaps in records, suggestive of an implication in colonial histories. Beyond this, digital analysis of text corpora may reveal otherwise overlooked associations between instrument types and people, activities, events and places.

Using selected objects as case studies, we will model a detailed series of connections and relationships that show the agency of people, objects and places within networks of imperial power or colonial experience. While such in-depth work is not yet possible at scale, our examples will provide a useful provocation, prompting reconsideration of instrument collections as part of the work of decolonising the museum.

Rebekah Higgitt, the presenter, is Principal Curator of Science at National Museums Scotland, having previously worked at the University of Kent and Royal Museums Greenwich. Her work has focused on the history of science, including the makers and users of instruments, in Britain from the 17th to 19th centuries.

Collecting for Everybody: Detoxing the Museum

Christel Schollaardt

Rijksmuseum Boerhaave

Keywords: Collecting decolonize tricky subjects

Abstract

Rijksmuseum Boerhaave is a national science museum in Leiden, the Netherlands. The collections comprise 400 years of scientific discovery in the natural and medical sciences. The museum was transformed and modernized in 2017 and was rewarded with the European Museum of the Year prize in 2019. During this transformation process the museum's staff took the opportunity to rethink the historical timelines and themes that were presented in the permanent expositions. Since then, we noticed that big issues as diversity, colonial history and how to deal with thorny issues in general were underexposed. This year, we will focus on developing programmes to fill the gaps: we have an intern looking into the tone of voice of our exhibition texts we try to adjust a few exhibits, we have a wonderful interactive which projects the muscles and veins from Vesalius' work on the human skin and it appeared not to work on dark skins! we look into the provenance of our collection: are there colonial connections? we diversify our stories, more focus on women scientists, the influence of the Arabic scientists, etc.

Christel Schollaardt is the Manager of Collections at Rijksmuseum Boerhaave. She studied library sciences and rolled into collection management many years ago. She has been working at Rijksmuseum Boerhaave for the last 1.5 year, and previous at Naturalis and Geldmuseum.

General Discussion

14.00 – 15.30 Lunch

15.30 – 17.30

Session 16 (parallel)

16th to 18th Century Astronomy

Chair: Efthymios Nicolaidis

The astronomical machine by Johannes Kepler

Daniele L. R. Marini

Dipartimento di Informatica, Università di Milano

Keywords: Kepler, Astronomical machine, Planetary

Abstract

While Kepler was still working in Graz during 1598, some letters to his mentor Michael Mästlin demonstrate his interest in astronomical clocks and machines.

The first letter, dated January 6th, 1598, contains a detailed description of a machine. In the second letter, written between June 1st and 11th 1598, Kepler starts with a brief review of clocks and machines of his time, then goes on to describe the requirements necessary for a useful mechanical instrument, based on the latest information of the day. In the Epitome Astronomiae Copernicanae (1618) he reiterates the importance and utility of astronomical and horological machines to divulgate the Copernican model of the Cosmo, to inform and assist scientists in their celestial calculations and hypotheses, even during periods of poor visibility in the night sky.

I will present a translation of Kepler's design and a hypothetical three-dimensional virtual reconstruction of his machine. This project reveals Kepler's ongoing research and understanding of the planets' cinematics, still bound to the homocentric spheres concept while the idea of orbita was maturing. At the same time Kepler's project reveals a reasoning on a clear description of retrograde motion of planets, fully developed later in his Astronomia Nova. His machine demonstrates the Copernican concept of the Sun and its planets as a unique system. He also wants to show how the planet moves from the viewpoint of an Earth based observer. He shows how to solve the basic mechanical problem of moving all the planets simultaneously with just one driving mechanism, which was impossible to accomplish with the Aristotelian theory of homocentric spheres.

Daniele L. R. Marini graduated in physics, since 1974 he has been professor of computer science at the University of Milano and Polytechnic of Milano. His research interest is on digital imaging, computer graphics and virtual reality. After the retirement he has been working on the application of imaging methods to astronomical photography, on clock and watch making and recently in the history of astronomical machines.

‘Goodness me, how badly you were deceived by this treacherous instrument!’: The Past, Present, and Future of the Telescope in the Correspondence of Johannes Hevelius and Elias von Löwen

Jarosław Włodarczyk

Institute for the History of Science, Polish Academy of Sciences

Keywords: Telescope, 17th century astronomy, Hevelius, Cunitia, von Löwen

Abstract

In this paper I intend to discuss the epistolary dispute as of 1650, involving Johannes Hevelius (1611–87) and two scholars based in Silesia i.e. Maria Cunitia (1610–64) and her husband, Elias von Löwen (c. 1602–61). Cunitia is widely acknowledged for her Urania Propitia (1650), an innovative adaptation of the mathematical astronomy of Kepler’s Rudolphine Tables. In turn von Löwen, a physician, authored astronomical calendars and ephemerids. They used the telescope in their observations already in the second decade of the 17th century. And yet, having received from Hevelius his Selenography, they would undermine in their letters the reliability of the telescope as an instrument used to examine the appearance of heavenly bodies, planets in particular. Hevelius however would defend the telescope, pointing to the merits of contemporary instruments and invoking a wider historical perspective and the prospects of the development of observational astronomy. I shall review the arguments invoked for and against the telescope in the letters from von Löwen to Hevelius and in the latter’s extensive reply. Based on their reports, I shall also cast some light on the methods of obtaining telescopes in Silesia in the 1620s.

Jarosław Włodarczyk is a professor at the Institute for the History of Science, Polish Academy of Sciences, Warsaw, Poland. He has published on e.g. the armillary astrolabe and the camera obscura and their use in ancient astronomy. He is currently taking part in a collaborative project on the correspondence of Hevelius.

The camera obscura: Practical uses and the geometrical location of the image, 1568-1711

Jip van Besouw

Vrije Universiteit Brussel

Keywords: Camera obscura, image location, geometrical optics, practice and theory

Abstract

The camera obscura was a staple of early modern natural philosophy. The instrument came to special prominence after it was improved by glass lenses. By the early 1600s, the camera was used for several different purposes in different fields of interest. One of the more obvious practical applications of the instrument, highlighted in print as early as 1568, was as a drawing

tool. Curiously, descriptions of how to set up a camera obscura for that practical purpose generally remained vague and left much to the material skills of the reader. Even more surprising, I will show that geometrical accounts of where the image projected in the camera obscura was located equally lacked precision until the very end of the seventeenth century. This point of a lack of theoretical understanding has largely been overlooked in existing scholarship.

In this talk, I will first discuss the most detailed early modern illustrations and textual descriptions of the practical use of the camera obscura. By comparing these with a number of key theoretical treatises on optical projection, I show that there is a strong connection between the setup of a camera obscura and the understanding of the location of the image after projection. By focusing on long-term developments in the operational understanding of the camera obscura, we get a fascinating story of the circulation of knowledge about the camera, a story in which a back and forth between material concerns and mathematical conceptualizations in seventeenth-century optics plays a central role.

Jip van Besouw is a Postdoctoral Fellow of the Research Foundation Flanders, based at the Vrije Universiteit Brussel. His research focuses on the development of experimental and mathematical practices in seventeenth and eighteenth-century natural philosophy, which he approaches from the perspective of material culture.

An Exceptional Planetarium from the 18th-century Austrian Netherlands Restored

Huib Zuidervaart

Huygens ING (KNAW-Royal Netherlands Academy of Arts and Sciences), Amsterdam

Keywords: Astronomy, Planetarium, 18th century, Austrian Netherlands

Abstract

In the eighteenth century it became fashionable to imitate the Copernican celestial movements in astronomical clocks or planetariums. However, a clockwork driven planetarium in which different world views were depicted, rotating simultaneously, has hardly been made. A rare attempt to do so – namely the construction of an astronomical clock with a Tychonic and a Copernican planetarium – was designed in 1771 by Jean Paulus (1710-1781), a Jesuit priest from the Austrian Netherlands. This cleric worked as a watchmaker at the Brussels court of Prince Charles of Lorraine, governor-general of the Austrian Netherlands. Paulus's untimely death, however, prevented the completion of this exceptional astronomical gearwork. The mathematician Michel Ghiesbreght (1741-1827), who bought the incomplete instrument at auction in 1781, tried to complete it. He succeeded only after great difficulties. Later, the planetarium fell into disrepair and after all sorts of wanderings, the instrument ended up in the collection of planetarium Zuylenburgh, The Netherlands.

The instrument is currently being restored to its former functionality by the skilled hands of ancient clocks restorer Piet de Ruiter, who, thanks to the original construction drawings preserved with the instrument, is able to reconstruct missing parts. Thanks to his efforts, a unique astronomical clock from the Southern Netherlandish will soon be able to function again,

as it was originally intended. In our presentation, a short history of the instrument will be presented and the recent – fairly far-reaching – restoration will be discussed.

Huib J. Zuidervaart (*1951) is a retired Senior Researcher at the Huygens Institute for the History of the Netherlands in Amsterdam. He served as Editor-in-chief of the Belgian-Dutch journal Studium for the History of Science, Medicine and Universities and as Co-editor of the book series History of Science and Scholarship of the Netherlands. His main field of research is the History of Early Modern Science and Astronomy, with a focus on the History of Scientific Instruments and Collections.

15.30 – 17.30

Session 17 (parallel)

Collecting and Exhibiting at the Museum

Chair:

Panagiotis Lazos, National and Kapodistrian University of Athens

Collecting scholarship

Tacye Phillipson

National Museums Scotland

Keywords: Collections, museum, documentation

Abstract

Developing collections is a form of scholarship. The decisions taken in acquiring objects for a collection, or disposing of them, reflect intellectual, professional and institutional interests, and collections form a resource for future scholars and professionals to draw upon. One prominent way in which past collecting is used is in choosing what to display in present exhibitions or online and how it is interpreted. In exhibition, current interests intersect with past scholarship – not only what has been collected, but how it has been documented, catalogued, researched or published already.

Just as written scholarship attracts variable interest and citations over time, collections development results in varied future use. National Museums Scotland has nearly 170 years of history of collecting scientific instruments and materials, for reasons and aims which have varied over the decades. Of the items currently on display some have been featured nearly constantly since they were acquired, some were collected specifically for their present show cases either as contemporary collecting or targeted collecting of older material, and others were selected for display from past collecting which had not previously been displayed. In common with many museums, only a small proportion of National Museums Scotland's scientific collections is on display, and it is drawn very unevenly from past collecting. In this paper I will

examine in more detail the material which has been selected for display and how this relates to the past scholarship involved in its acquisition and documentation. What proportion of objects on display were acquired specifically for display, where existing collections were lacking? What proportion are treasures, featured more often than not? And how many came from the more ordinary collecting, that forms the bulk of our collections?

Tacye Phillipson is Senior Curator of Science at National Museums Scotland, with particular expertise in the physical sciences and 20th and 21st century material.

Dowsing for Evidence. Controversial Topics in a Museum

Julia Bloemer

Deutsches Museum München

Keywords: Pseudoscience, demarcation problem, nature of science

Abstract

The object of interest looks unremarkable; it is just a wooden box with a magnetic needle inside. But actually, this is a very controversial exhibit: an automated “scientific” dowsing rod. It was developed in the early 20th century and its constructor even gained an imperial patent on it. It was meant to measure horizontal changes in the earth’s magnetic field and with this detect underground water streams. This apparatus was donated to the Deutsches Museum in 1912 and passed the time mostly unnoticed in the deposit. In connection with an exhibition on Albert Einstein in 2005, it served to illustrate the spirit of the time around Einstein’s work and the context of invisible rays and occultism. Aside from this, the existence of dowsing rods in the collections of the Deutsches Museum is rather hidden than addressed. Presenting objects with pseudoscientific aura in a museum exhibition and providing it thereby with a serious veneer is a subject of ongoing concern. This paper presents a different perspective. Objects like this dowsing rod can be used to explicitly communicate nature of science aspects. Especially in a time of flat earthers and climate change denial, there exists the wish for clear criteria how to differentiate between science and pseudoscience. Where is the demarcation and how can we recognize "real science"? It is difficult to come up with a list of distinctive marks of science. Instead, we can bare scientific methods and explain how scientific knowledge is generated. Objects like a dowsing rod can be a chance to explicitly cover controversial topics and show how science itself adjusts its boundaries repeatedly.

Julia Bloemer is research assistant at Deutsches Museum in Munich and currently develops an exhibition about Nature of Science. Her research focuses mainly on the history of science in the 18th century, the relationship between science and religion and the history of academic institutions.

Rethinking instruments for the National Air and Space Museum's new look at astronomical history

Samantha M. Thompson

National Air and Space Museum, Smithsonian Institution

Keywords: Material Culture, Exhibitions, Astronomical Instruments

Abstract

In September 2001, the Smithsonian's National Air and Space Museum (NASM) opened Explore the Universe, an exhibition featuring the Smithsonian's collection of astronomical artifacts. The exhibit, which chronicled a history of modern astronomy, led visitors through a narrative of advanced instrumentation, from the eye to the telescope, the addition of photography and spectroscopy, and into the digital age. In 2025, as part of the complete renovation of the National Mall Building, NASM will open Discovering Our Universe, its new exhibition of astronomy and its history. Rather than a technology-first framework, the exhibition development team chose to center the science, using the instruments to guide visitors through major changes in how we understand the universe, including a major expansion and refocus on multi-messenger astrophysics.

The transformation of the Museum has allowed us to rethink how we use astronomical instruments to tell a story, which instruments to include, what qualifies as an instrument, and what we hope visitors will gain by seeing an instrument on display. In this paper, I discuss why NASM chose to collect and display objects in the past and why those decisions may have changed. I will examine how changes in astronomical research have influenced what we collect and how we use scientific instruments on display to engage the public.

Samantha M. Thompson is Curator of Science and Technology at the National Air and Space Museum. She is a historian of science and technology whose work focuses on the history of twentieth and twenty-first century astronomy and space science. She is particularly interested in the development of astronomical instrumentation.

An Instrument and its Network: A 20th Century Helium-Neon-Frequency Standard

Eckhard Wallis

Deutsches Museum, Munich

Keywords: Frequency measurement, Laser, Quantum Optics, Museum

Abstract

Scientific instruments acquire their meaning through their integration into networks of support und communication. As far as 20th century precision instruments are considered, some striking examples are the integration of measurements into the abstract network of units and standards

or, on a more material level, the tangled clutter of signal- and power-carrying wires in contemporary laboratories.

In 2021, the Deutsches Museum acquired such a heavily network-dependent instrument: a methane-stabilized helium-neon frequency standard. Built around 1990 in Nowosibirsk in the Soviet Union, the instrument was used for precision measurements in hydrogen spectroscopy at the Max-Planck-Institut for Quantum Optics in Garching during the 1990s.

In this contribution, I intend to untangle the network connections branching from this early optical frequency standard and to analyze the local and not-so-local networks required to make this instrument work. I argue that a didactic presentation that addresses these networks may help museum audiences to get a better understanding of nature of science in quantum optics and frequency metrology.

Eckhard Wallis is a physicist and historian of physics, currently developing an exhibition on quantum optics and its history. Main interests: 20th century physics, quantum physics, time and frequency measurement.

17.30 Departure to the Kotsanas Museum of Ancient Greek Technologies

THURSDAY, 22 September

09.30 – 11.00

Session 18 (plenary)

SIC40: Reflecting on Four Decades of Symposia and the Development of Instrument Studies (part 1)

Although the activities look very different from our present practice, we can say that the first SIC Symposium was in 1981 in Bucharest, within the programme of an IUHPS Congress. In the first four papers of our session each of our speakers will characterise and assess what they consider to be the important developments in one of the subsequent decades and the consequences that have followed from them. They will not necessarily confine their reflections to the activities of the Commission.

Chair:

Sofia Talas, Università degli Studi di Padova

Introduction: Richard Kremer and Sara Schechner

1980s

Robert Anderson

Former President and CEO, Science History Institute, Philadelphia

Robert G. W. Anderson is Former President and CEO, Science History Institute, Philadelphia. He has been Director of the National Museums of Scotland from 1985 to 1992 and the British Museum from 1992 to 2002, and President of the Scientific Instrument Commission from 1982 to 1997.

1990s

Sara Schechner

Harvard University

Sara Schechner is David P. Wheatland Curator at the Collection of Historical Scientific Instruments at Harvard University.

2000s

Richard Kremer

Dartmouth College

Richard Kremer is Professor Emeritus of History, Dartmouth College

2010s

David Pantalony

Canada Science and Technology Museum, Ottawa

David Pantalony is Curator of Physical Sciences and Medicine, Canada Science and Technology Museum, Ottawa.

11.00 – 11.30 Coffee Break

11.30 – 14.00

Session 19 (plenary)
SIC40: Reflecting on Four Decades of Symposia and the Development of Instrument Studies (part 2)

Chair:

Marvin Bolt, Technische Universität Berlin

Historiography

Boris Jardine

Whipple Museum of the History of Science, University of Cambridge

Abstract

The period since 1981 has been a challenging and exciting one for the historiography of scientific instruments. A profound material turn in the history of science more generally has given a new significance to studies of instruments and their use in laboratories, in teaching and in research. Artisanal knowledge has become a popular theme, along with courtly science, institutions, and museums as sites of practice. On a different front, challenges to the prominence of historic instruments in displays have come from the rise of science centres. For these and other reasons, instrument historiography has been given a prominence it did not previously enjoy.

Boris Jardine is Research Associate at the Whipple Museum of the History of Science, University of Cambridge.

Catalogues

Alison Morrison-Low

National Museums Scotland, Edinburgh

Abstract

A great deal of very significant work has been done in cataloguing over the four decades, and there have been important publications, some in series, for example from Greenwich, Florence and Chicago. A number of different platforms for computerised catalogues have been introduced, together with their online offshoots. Attempts at standardisation have seen little success and the variety of formats and conventions seems greater than ever. The scholarly

museum catalogue was once regarded as the core curatorial achievement. Have we witnessed technical and scholarly decline or does expansion and variety signal renewed creative commitment?

Alison Morrison-Low is Research Associate at the National Museums Scotland, Edinburgh.

Exhibitions and Galleries

Trienke van der Spek

Teylers Museum, Haarlem

Abstract

The work of museum display, and of special exhibitions in particular, may be the activity where we are most influenced by trends and expectations from beyond our immediate discipline of instrumentation. What trends can we see over the four decades? Have we become more engaged with social issues in science, more committed to educational outcomes, more daring in moving away from 'straight' science towards controversial or esoteric areas? How have we been affected by engagement with professional designers, how by sponsorship, how by education and access issues, how by science centres? With new permanent galleries and even entire redisplays more is at stake for the museum, with greater expense and longer outcomes. There have been many projects and much to assess in what are our most prominent statements of our public mission.

Trienke van der Spek is Chief Science Curator at Teylers Museum, Haarlem.

Education

Jean-François Gauvin

Université Laval

Abstract

How has education involving instruments developed during the period under scrutiny? At university level, historic instruments are now used in teaching the history of science to students, and reconstructed instruments help students experience and problematize past laboratory cultures through 'reworked' historic experiments. School students are offered classes in museums, usually delivered by education staff rather than curators. Loaned object boxes can be sent to classrooms, and a museum may maintain a loan or a 'handling' collection, containing instruments they are willing to see damaged or even lost. What learning experiences are offered by these and other engagements with museums and their contents? What theories of learning and knowing underpin them? Are they the same as their classroom or lecture room equivalents?

Jean-François Gauvin is Chaire de leadership en enseignement en muséologie et mise en public; Director, Centre de recherche Cultures-Arts-Sociétés (CELAT), Université Laval, Québec.

National Trends

Sofia Talas

Università degli Studi di Padova

Abstract

SIC and its parent body IUHPST are fundamentally international organisations. A characteristic feature of the Symposia is that they have moved annually from one country to another, being open to invitations from any appropriate institution with the resources to organise the meeting. This paper will reflect on the range of work across different regions, countries and continents, with their variety of resources, ambitions and priorities. Have we been moving in similar or different directions? There is no ideal approach to our discipline but our international profile should help us to learn from each other.

Sofia Talas is Curator of the Museum of the History of Physics, Università degli Studi di Padova.

Closing remarks: Richard Kremer and Sara Schechner

14.00 – 15.30 Lunch

15.30 Departure to the National Archaeological Museum

FRIDAY, 23 September

09.30 – 11.30

Session 20 (parallel)

16th to 18th Century Instruments

Chair:

Boris Jardine, University of Cambridge

The Collected Tools of Elector August of Saxony: Modelling Saxon Work, Industry and Materials through Aesthetic Utility

Andrew Biedermann

University of Oxford, Faculty of History

Keywords: Tools, Instruments, Kunstkammer, Holy Roman Empire, Mechanical Arts, Patronage

Abstract

My research addresses Elector August of Saxony's (r. 1553-1586) Dresden-based collection of tools and how it expanded his understanding of Saxony's potential to harness nature through work and intellect. This study-focused Kunstkammer, or cabinet of curiosities, remains unique in its focus upon objects of science and technology, particularly its almost 10,000 tools (Werkzeuge), ranging from gardening utensils to surgical knives and mining implements.

August was a practical ruler and one who devoted much of his long reign to mapping his domain and cultivating lucrative mining, forestry and agricultural industries in Saxony. He was also a patron of alchemy who worked in gardens, turned fine pieces of ivory and executed his own surveying projects. It was through his hands and intellect, not only his hereditary status, therefore, that he participated in the tuning of the Saxon landscape and populace and made understanding the primary commodity of rulership.

August was active in an under-studied, yet crucial moment in early modernity, in which the liberal and mechanical arts took on new meanings, and privileged understanding could be attained through the aid of objects. Furthermore, as August concerned himself with the objects of lowly work, I endeavour to define the blurred notions of early modern princely occupation. This study unites the histories of science, technology and art, and assess how August's tools acted within a network of mediums through which he cultivated the knowledge required to rule.

Andrew Biedermann's bachelor's and master's degrees were completed in the history of art and have contributed to his primary interests in: the history of science and technology, the history of ingenuity, early modern material culture, court culture, the history of collecting, and German studies.

Magic Instruments against Superstition

Convin Splettsen

Goethe-Universität Frankfurt

Keywords: Natural magic, enlightenment, charlatanism, practice

Abstract

In 18th century Germany, Johann Christian Wiegleb, a chemist, wrote two books on natu- ral magic „Unterricht in der natürlichen Magie“ – in english it would translate „Lessons in Natural Magic“ – with the clear impetus to fight superstition and charlatans who claim to possess panaceas and to demonstrate their curative effects. In his books, the author aims at opening people’s eyes and at providing the reader with information and instructions to help him understand that there is no such thing as magic and magic cure, but all observati- ons are explainable by nature and are replicable by the reader.

This talk will focus on the theory and practice of the magic instruments as explained in Wiegleb’s books discussing the philosophy of what he calls ‘natural magic’ and showing how he uses instruments to fight superstition and to impart knowledge about nature. It will conclude with a short demonstration of a self-made model based on Wiegleb’s books accompanied by a summary of what he describes in the manual.

Convin Splettsen is writing his master thesis about Johann Christian Wiegleb’s natural magic during the elightenment. Besides that, he is a trained magician and is interested in instruments, material culture and theory.

Athanasius Kircher’s *Organum Mathematicum* – Part Two

Giorgio Strano

Museo Galileo, Firenze - Italy

Keywords: Athanasius Kircher, *Organum Mathematicum*

Abstract

The necessity to stay at home during the Covid19 pandemic, incidentally brought unprecedented occasions to concentrate on unusual mathematical problems. In 2020, I already expounded upon the *Organum mathematicum* devised by the Jesuit polymath Athanasius Kircher (1602-1680), and about one of its nine sections. This was the structure and use of the twenty-four tablets labelled “Steganography”: the art to write and decipher uncrackable secret messages. The complete scan of the recto and verso of all the 216 tablets included in the Florentine specimen of the *Organum*, preserved at the Museo Galileo, brought to interesting discoveries about: 1) The uneven relationship between Kircher’s original design of the *Organum*, Caspar Schott’s description of the same device, and the Florentine device itself; 2) The presence of date indicators – extraneous to both Kircher’s and Schott’s texts – which allow to fix the construction of the Florentine device at about the year, instead than as roughly “late

17th century – early 18th century"; 3) The identification of a couple of internal evidences confirming (independently from the direct examination of the other specimen) that the Florentine and the Praguese *Organums* have been made in parallel by the same maker.

Giorgio Strano, PhD in history of astronomy, is head of the collections at the Museo Galileo of Florence. He has published articles in international magazines, and has collaborated in the making of exhibitions on the history of science. He has been the general editor of *Scientific Instruments and Collections* (Brill).

Astrolabes and Astrology: Instrumental Transformations in 16th-Century Europe

Stephen Johnston

History of Science Museum, University of Oxford

Keywords: Astrolabes, Astrology, Practice, Regiomontanus

Abstract

Mathematical arts such as navigation and surveying developed instrumentally in at least two conflicting directions in the 16th century. Existing instruments were simplified to target the needs of craft practice; simultaneously, complex and sophisticated universal devices were proposed. This paper shows that astrology followed the same instrumental trajectory. It documents both the simplification of astrolabes for astrological use as well as their incorporation into elaborate and prestigious objects of patronage, indicating how closely astrology paralleled other areas of contemporary practical mathematics.

Astrolabes were also a vehicle for the transformation of astrological practice itself. Following the posthumous publication of his Tabulae directionum (1490), the name of Johannes Regiomontanus became associated with a "new" method of constructing the astrological houses. Since the choice of house scheme is fundamental to the drawing up of any horoscope, every practitioner had to take sides on the controversial question of the best house system. One of the features of the so-called Regiomontanus system is that, unlike the standard medieval technique, the cusps of the houses are fixed for any given latitude, and can therefore be engraved on an astrolabe's plates. The evidence of instruments helps to chart the speed and scale of adoption of the Regiomontanus scheme in 16th-century Europe. While astrolabes did not deliver the numerical accuracy of working with tables, they did enable their users to grasp the geometry of the houses and to visibly display their adherence not only to astrology in general but to the Regiomontanus house system in particular.

Stephen Johnston is Head of Research, Teaching and Collections at HSM Oxford. Researches the early-modern history of the mathematical arts and sciences, publishing on topics from geometry to astronomy and architecture. Current work focuses on the materiality of Renaissance astrology and the culture of time in the pre-pendulum era.

09.30 – 11.30

Session 21 (parallel)

19th and 20th Century Astronomy

Chair:

Roland Wittje, Indian Institute of Technology Madras

Portable transit instruments and the 'American method' of longitude determination in late 19th-century India

Joshua Nall

University of Cambridge

Keywords: India, survey sciences, transit instrument, longitude, telegraphy

Abstract

Accounts of the Great Trigonometrical Survey of India (GTS) typically treat it as a product of East India Company (EIC) rule. So histories of its instrumental practices have been predominantly concerned with the work conducted under George Everest (Surveyor General 1830–43) and Andrew Scott Waugh (1843–61). Yet by far the greater volume of maps, data, and reports issued by the GTS post-date the demise of the EIC and the establishment of the British Raj in 1858. This talk will describe one strand of labour conducted in this latter era of Indian survey work, through a biographical account of a pair of surviving transit instruments now held in the collection of the Whipple Museum of the History of Science in Cambridge. Manufactured by Thomas Cooke & Sons of York and shipped to India in 1869, the lives of these instruments provide a material history of Indian survey work at three levels: firstly, of a novel instrument type, dubbed by the British as either 'Russian'- or 'German'-pattern and designed specifically for the exigencies of work in the field; secondly, of a particular form of instrumental labour, dubbed by the British as the 'American method' of longitude determination by electric telegraph; and thirdly of a specific example of instrumental history, made possible by these objects' curious and circuitous route to survival in a UK museum.

Joshua Nall is Curator of Modern Sciences at the Whipple Museum of the History of Science, in the Department of the History and Philosophy of Science at the University of Cambridge. His research focuses on mass media and material culture of the physical sciences after 1800.

"Machines Without the Certainty of Machinery": Labor, Correction, and the Native Observer

S. Prashant Kumar

Humboldt-Universität zu Berlin

Keywords: Observer, telescope, India, labor, instrument

Abstract

This paper is about how Company astronomers at Madras observatory began to rely on Indian observatory assistants who were trained and calibrated like machinery, using the personal equation and other techniques of discipline. Since astronomy aided navigation, as well as tax and revenue surveying, Indian observatories can be seen as collectorates for the stars, its astronomers effectively stellar clerks. Astronomers in India used upper caste Indians, skilled in kanakku [mnemonic calculation], as computers. Other high caste observatory hands were trained and calibrated like machinery, using the personal equation and ritual techniques of discipline. After the dissolution of the East India Company in 1858, administrative reorganisation allowed the first Government Astronomer, Norman Pogson, to initiate a program of extra- meridional observations, with the aim of discovering and cataloging new comets, minor planets, and variable stars. But the moral order which underwrote discovery was necessarily different, and couldn't be structured along factory lines. Extra-meridional observation required the telescope move along more than a single degree of freedom, so as to track fast-moving objects like comets and minor planets. I argue that the social organisation of an observatory depends crucially on the degrees of freedom of its observing apparatus.

S. Prashant Kumar is Postdoctoral Fellow in Global Intellectual History at the Humboldt-Universität zu Berlin, where he is working on the history of mathematics and astronomy, global history, and South Asia studies.

The 1905 Time Service of the Royal Observatory of Belgium

Ricardo Barbosa

Royal Observatory of Belgium

Keywords: Astronomy, Time Service, Clocks, Longitude

Abstract

After moving to a new location, the Royal Observatory of Belgium (Brussels) installed in 1905 a new system for its Time Service. Commissioned to C. Riefler of Munich who supplied most of the equipment, it also integrated some pieces from other makers like Dent and Gautier. The time signal was distributed inside the Observatory, and also to the city of Brussels and the Port of Antwerp, where an office with time flaps and chronometric service was established to assist navigational needs.

All clocks could be electrically synchronized to the main clocks through an elaborate central switchboard. The main clocks kept the time to 0.02s.

Work is in progress to identify the extant components of this system, in order to assess their state and to preserve them in the best conditions. To this date there are six clocks in working condition, four others need care. Two chronographs are extant, one missing. Bibliography giving a detailed description of the system has been found.

A presentation of Time Service will be given and details of some notable instruments will be examined.

Ricardo Barbosa has worked in the Lisbon University's National Museum of Natural History and Science, the Lisbon Astronomical Observatory, and collaborated with the Science History Museum of Geneva. He is now at the Royal Observatory of Belgium where he has been studying its XIX and early XX c. collections.

Tracing the path of the circle built by Nicolas Fortin for the Paris Observatory (1822) from the minutes of the Bureau des longitudes and its databases

Martina Schiavon and Frédéric Soulu

Université de Lorraine, Archives Henri Poincaré,
and Centre François Viète, Nantes Université

Keywords: Bureau des longitudes, Nicolas Fortin, astronomical circle, instrumental research tools, Beginning XIX Century

Abstract

From its creation in 1795 and until 1932, the Bureau des longitudes worked as an international "academy of astronomical sciences". The minutes of its meeting form an archival source of about 3 million words that has been integrally transcribed and is now available on a dedicated website with many tools of research (http://bdl.ahp-numerique.fr/).

By relying on these tools, and in particularly on the instruments databases, in this talk we propose a case study: the manufacture of the circle built by Nicolas Fortin for the Paris Observatory in 1822. We will present the career of an artist of the Bureau des longitudes in the mid-19th Century, and the work that led to the manufacture of this instrument in a context of negotiations that is fairly well documented in the minutes. More generally, our aim is to show how the minutes and the databases could help researcher in writing a history of a scientific instrument more connected with its historical context.

Martina Schiavon is historian of sciences at the Université de Lorraine (Archives Henri Poinacré/PReST/UMR 7117, CNRS). Between 2016 and March 2022 she was general coordinator of the ANR project "Le Bureau des longitudes (1795-1932): de la Révolution française à la Troisième République" (http://bdl.ahp-numerique.fr/ ; https://histbdl.hypotheses.org/a-propos). More details here:
http://poincare.univ-lorraine.fr/fr/membre-titulaire/martina-schiavon

Frédéric Soulu is historian of sciences; he had a post-doctoral fellow on the ANR project "Le Bureau des longitudes (1795-1932): de la Révolution française à la Troisième République" and is currently researcher in residence at the Observatoire de Paris-PSL. More details here: https://cv.archives-ouvertes.fr/frederic-soulu

"Excellentissimo tubo Dollondiana":

The 10-foot achromatic refractor of the Royal Swedish Academy of Sciences

Johan Kärnfelt

Gothenburg University, Sweden

Keywords: John Dollond, Samuel Klingenstierna, Pehr Wargentin, Achromatic lens, Stockholm observatory

Abstract

In 1764 the Royal Swedish Academy of Sciences in Stockholm acquired for its observatory a 10-foot achromatic refractor built by John Dollond (London). The double lens technology had first been mastered by Dollond – at the time it was just a few years old – and the Stockholm refractor was one of the most powerful instruments yet to come out of his workshop. Together with a transit circle by John Bird (London), the refractor was to become the main instrument of operations at the observatory, used diligently by director Pehr Wargentin, and later by several of his successors. The last recorded observation with the instrument was made in 1825. This paper tells the story of how an instrument, originally intended for the Prince of Wales, ended up in Stockholm, and discusses its subsequent uses under the stars.

Johan Kärnfelt is an associate professor of the History of Ideas and Science at the Department of Literature, History of Ideas, and Religion, University of Gothenburg.

11.30 – 12.00 Coffee Break

12.00 – 14.00

Session 22 (parallel)

19th and 20th Century Instruments

Chair:

Trienke van der Spek, Teylers Museum, Haarlem

To the North Pole and back:

The scientific instruments of the "Italia" airship expedition (1928)

Francesco Guerra

Department of Physics, Sapienza University of Rome and Museo Storico della Fisica e Centro Studi e Ricerche “Enrico Fermi”, Rome

Matteo Leone

Department of Philosophy and Education Sciences, University of Turin and Museo Storico della Fisica e Centro Studi e Ricerche “Enrico Fermi”, Rome

Nadia Robotti

Department of Physics, University of Genova, Genova and Museo Storico della Fisica e Centro Studi e Ricerche “Enrico Fermi”, Rome

Keywords: Italia polar expedition; Italia airship; Umberto Nobile; Aldo Pontremoli; Finn Malmgren; Frantizek Behounek

Abstract

The 1928 airship “Italia” expedition, commanded by General Umberto Nobile, was the first air mission to the North Pole having important scientific goals. While the previous expeditions were aimed at reaching the Pole or discovering new lands in the polar ocean, the Italia expedition enrolled three prominent scientists – the Swedish meteorologist Finn Malmgren, the Czech radiologist Frantizek Behounek and the Italian physicist Aldo Pontremoli – to research on terrestrial magnetism, meteorology, atmospheric electricity, cosmic radiation and on oceanographic, biological and bacteriological topics in the Arctic region.

In order to study the above topics a set of suitably designed and manufactured scientific instruments was delivered to the forward operating base at Ny-Ålesund, Spitsbergen, in the Arctic Archipelago of Svalbard and some of them were installed within the cabin of the Italia airship. Nobile had planned five flights exploring different areas of the Arctic but the third flight tragically ended on the morning of May 25, 1928, when the airship crashed onto the ice after a sudden loss of altitude.

In the following months, the survivors were rescued and the materials for the expedition were recovered. Among the latter were a number of scientific instruments now preserved by repositories, like the Historical Museum of the Italian Air Force at the Vigna di Valle seaplane base, near Rome, and the historical collection of the Institute of Public Health in Rome. In this talk we explore these collections, discuss the most significant instruments and place the recovered items within the context of the Italia expedition.

Francesco Guerra is Professor of Theoretical Physics (Emeritus) at the Department of Physics of Sapienza University of Rome. His research interests include Quantum Field Theory, Elementary Particle Theory, Statistical Mechanics of Complex Systems, and History of Nuclear Physics.

Matteo Leone is Full Professor of Didactics and History of Physics at the Department of Philosophy and Education Sciences of the University of Turin. His research activities focus on the 19th- and 20th-century history of physics.

Nadia Robotti is Full Professor of History of Physics at the Department of Physics of the University of Genova and a member of the Académie Internationale d'Histoire des Sciences. Her research activities focus on the history of atomic physics, nuclear physics and quantum mechanics.

General undulation theory and instrumentation in Sweden in the mid 1800s

Karl Grandin

Center for History of Science at the Royal Swedish Academy of Sciences

Keywords: Optical instruments, Teaching instruments, Fabian Wrede

Abstract

As a son of a Swedish Field Marshal, it might not be surprising that Fabian Wrede started his military career at the age of 12. He introduced grooves in rifles and cannons for the Swedish army. His military career ended with him appointed general for the Swedish artillery. He also played a crucial role for the introduction of the decimal system in Sweden 1889 and by publishing a textbook in 1847 claiming the benefits of a decimal system with many examples.

He was elected member of the Royal Swedish Academy of Sciences in 1835 a year after he had published a paper on "Attempt to derive the absorption of light from the undulation theory" where he opposed Brewster's emission theory. Wrede argued that the dark lines observed by Brewster ought to be explained as an interference phenomenon. Wrede's theory may not have stood the test of time either, but it caught a lot of interest at the time.

Later he collaborated with the Academy's instrument maker designing optical instruments to illustrate how "two polarised light wave systems influence each other". This design later became an item in a catalogue providing scientific instruments for high schools being advertised as Wrede's apparatus for rectilinearly polarised ether waves. This apparatus can be associated with his theoretical paper opposing the emission theory. But he also designed a wealth of other instruments, like a galvanometer, magnetic travel instruments, spectroscopes and a wave-machine. This paper will discuss Wrede and his instruments.

Karl Grandin is the Director of and Professor at the Center for History of Science at the Royal Swedish Academy of Sciences. He holds an MSc and a PhD from Uppsala University. His research has mainly dealt with the history of modern physics. He has experience of international collaborations.

The Albert Nestler AG Slide Rules

Martin Weiss

TECHNOSEUM – Landesmuseum für Technik und Arbeit, Mannheim

Keywords: Slide rule, early 20th century, analogue computers

Abstract

One of the casualties of electronic calculators was the slide rule. Its ubiquity soon forgotten, many of its once prominent manufacturers who failed to understand the tectonic shift taking place after pocket calculators became affordable soon had to cease production.

One such example is the "Albert Nestler AG". Founded in 1878 in the Black Forest, it had established a reputation as one of the market leaders for slide rules by the 1920s and continued production after World War II, until it had to close its doors in the early 1990s. The personal collection of slide rules assembled by one of the original founder's descendants was subsequently donated to the Landesmuseum für Technik und Arbeit in Mannheim, where it is embedded in a larger collection of analogue computing devices.

This exploratory paper will introduce the Nestler collection in Mannheim and present possible directions the research on and the public presentation of the slide rules could take in the following years, by addressing questions such as what is known about production techniques at Nestler and how developments there related to those at other companies.

Martin Weiss is a curator at the Technoseum / Landesmuseum für Technik und Arbeit in Mannheim, Germany. He received his PhD on the history of Teylers Museum from Leiden University in 2013 and has previously worked at the German Maritime Museum as well as teaching at the University of Brunswick.

Measuring terrain with the naked eye
The hovering mark as an overlaying tape measure

Andreas Junk

Europa-Universität Flensburg

Keywords: Stereoscopy, measuring marks, photometry, photogrammetry

Abstract

Distance measurements rely on the concepts of planar geometry, when the distance to a far-off position is calculated by making angular measurements from two different observation points with a well defined distance between those points, the so-called baseline. In cartography, the calculation process in particular takes place after the measurement. The double telescopes which were devised by various inventors and companies shortly after 1900 aimed at cutting this time consuming process to make the calculation at the time of the observation itself. The Zeiss company from Germany relied on the so-called "hovering mark".

The mark is a concept devised by the German engineer Franz Stolze (1836 – 1910), one of the pioneers of photogrammetry in Germany, who also devised the "wandering mark". The hovering marks, which made use of the stereoscopic vision of the human eyepair, are implemented as glas plates in the lines of sight of double telescopes. They were a novelty because the scale would be clearly visible at all times, no matter to which distance the telescopes were adjusted to. Only one of the mark sets for a particular distance seemed to be hovering over the targeted position, as if it were part of the landscape. Hence the readout could be made in the observation process. Although the necessity to train the personnel for using these double telescopes was not yet fully realised, the hovering marks proved to be pretty accurate in early field tests.

Andreas Junk is a trained experimental physicist and switched his focus to history of physics for his PhD thesis. He is currently lecturer at the University of Flensburg. His focus is the history of the development of instruments for stereoscopic imaging. Other interests comprise photopraphic techniques and the Standard History of Nanotechnology.

12.00 – 14.00

Session 23 (parallel)

Astronomy and Astronomical Instruments in Inter-religious and Inter-cultural Entanglements in the Medieval and Early Modern Periods

Organizer:

Josefina Rodríguez-Arribas, L & A Birkenmajer Institute for the History of Science, Polish Academy of Sciences

This session collects four papers dealing with the entanglement of astronomical concepts and instruments in three great cultures of the medieval and early modern periods: Christendom, Islam, and Judaism. These cultures embodied a treasure of astronomical knowledge that they inherited from Antiquity and enriched with specific contributions. Their distinctive (local and temporal) implementation of astronomical and technical data has reached us in a body of texts and instruments whose most apparent difference is, perhaps, the distinctive language that each of these cultures chose to express it (Latin, Arabic, and Hebrew). Among other aspects, this linguistic feature especially alerts researchers and curious to approach texts and objects with an eye, not only attentive to their content but also to their specific cultural, religious, and historical contexts, as well as to their possible cross-cultural connections and entanglements in some periods and areas. A quadrant or an astrolabe in Hebrew or described in Hebrew remains a quadrant or an astrolabe, but it is also something else; this something added might get lost if not handled with care. Loan words in texts, engravings in artifacts, translations, different hands working and re-working texts and objects speak of circulation among individuals and cultures, shared workshops and teachers, hybrid identities, widespread readings, traveling scholars, or oral exchanges with no textual witnesses. In this session, we intend to explore how textual data and object data changed hands and moved—in usual and unexpected ways—embodying successive layers of history in texts and instruments.

Keywords: Manuscripts and instruments, Arabic, Hebrew, Latin, planispheric and universal astrolabes, quadrants, astrology, Yemen, Ottoman Empire, Europe

Chair:

Silke Ackermann, History of Science Museum, Oxford University

Scientific Instruments and Jewish Scholars in the Ottoman Empire

Robert Morrison

Bowdoin College

Abstract

Jewish scholars in the Ottoman Empire are beginning to attract attention from researchers. This presentation treats the role of instruments in Jewish scientific culture in the late fifteenth and early sixteenth centuries and focuses on the role of instruments in intellectual exchange between religious communities.

The rabbi and scholar Mordekai Kumaṭiano (d. 1487) donates a universal astrolabe plate, pioneered by Ibn al-Zarqāl (d. 1100), to an Ottoman military judge presuming that there would be another to be found somewhere in the region. Unfortunately, after great effort, Kumaṭiano and his colleagues were unable to locate another such instrument. Thus, a student asks Kumaṭiano to compose a treatise about how to complete (tiqqūn) a similar instrument so that there would always be one such instrument found in the Jewish community.

A few decades later, the scholar and noted intermediary Moses Galeano (d. > 1542) translates the introduction to a treatise by Ibn al-Zarqāl on how to use a universal astrolabe. As Galeano/Jālīnūs was constantly on the lookout for ways to acquire social capital, his translation activity is evidence that Kumaṭiano's donation did not occur in a vacuum. Indeed, Bayezid II (r. 1481-1512), the sultan during Galeano lifetime, was a student of astronomy. Two astrolabes are made for Bayezid, indicating that instrument production, along with the study of scientific texts, had a heightened significance during Galeano presence at the Ottoman Court.

Finally, I will place these exchanges in the Ottoman Empire in the broader context of exchange of instruments between religious communities.

Robert Morrison is George Lincoln Skolfield, Jr. Professor of Religion at Bowdoin College in the United States. A scholar of science in Islamic societies and Jewish cultures, he is currently finishing a book on cultural exchange in the Eastern Mediterranean.

Latin Astrolabe Literature during the Twelfth Century

(Did the Astrolabe Have a Twelfth-Century Renaissance?)

Philipp Nothaft

All Souls College, University of Oxford

Abstract

The Arabic-to-Latin 'translation movement' of the twelfth century had a profound impact on the way astrolabes were constructed, used, and understood in a Latin Christian context, despite the fact that the original introduction of this instrument into the Latin West goes back much further, to the late tenth century. My presentation seeks to give an account of the expansion and transformation of Latin astrolabe literature during the twelfth century and the role played in this transformation by transfers of astronomical knowledge from the Islamic world, facilitated by textual translations from Arabic undertaken on the Iberian peninsula. Particular attention will be paid to the changing practical uses of the astrolabe and its role as an observational tool in the context of medieval astrology.

Philipp Nothaft is a research fellow at Trinity College Dublin and £50-fellow at All Souls College, Oxford.

Wandering Stars, Wandering Names: Denoting the Planets in 13th Century Yemen and Beyond

Petra G. Schmidl

Friedrich-Alexander-Universität Erlangen-Nürnberg

Abstract

The planets and their characteristics, responsibilities, associations, and correspondences is a common astrological topic and is widely discussed in the pre-modern introductory literature to astrology in Islamicate societies. For instance, the future Rasūlid sultan al-Ashraf ʿUmar (d. 1296) includes it in chapter viii of the Kitāb al-Tabṣira fī ʿilm al-nujūm ("Enlightenment in the science of the stars"). Additionally, he includes the last-letter-abbreviations of the planets and their symbols, as well as an example of a cross-cultural entanglement, namely their names in Persian and Greek. The motivation to include the former two appears rather obvious. Their minimum space requirements make them especially suitable on instruments, but also in diagrams, schemes, and tables. The impetus, however, to add the Persian and Greek names of the planets is less comprehensible.

Starting from this observation, this talk will search in related Arabic texts that might have served al-Ashraf ʿUmar as a source for his chapter. Do they also provide the Persian and Greek names of the planets? On the basis of the search results, more general questions will then be addressed, in particular that of text fidelity and stability of remnants in foreign languages with regard to authority, credibility, and reliability. The talk will conclude with a short look on the planetary symbols, not only presented in Kitāb al-Tabṣira fī ʿilm al-nujūm, but also on al-Ashraf ʿUmar's astrolabe and in his Instrument Book, that provide further evidence for another cross-cultural entanglement.

Petra G. Schmidl is research partner at the International Consortium for Research in the Humanities (IKGF), Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany. she is a historian of science with a focus on pre-modern astronomy, astronomical instruments, and astrology, prognostic practices, and occult studies in Islamicate societies.

The Quadrant of Israel and Its Circulation in Hebrew Manuscript Sources

Josefina Rodríguez-Arribas

L & A Birkenmajer Institute for the History of Science, Polish Academy of Sciences

Abstract

The quadrant of Israel of the Hebrew sources and the *quadrans novus* of the Latin texts is the most widespread astronomical instrument of the Middle Ages after the astrolabe. Despite the odds with its usage and the few exemplars that have survived, the high number of manuscripts attests that it was widely known, studied, and depicted among Christians and Jews (Islamicate culture wrote on and produced astrolabic quadrants different from it). I present an overview of the manuscript tradition of this instrument in different Jewish traditions using Hebrew as their language of knowledge. The transmission spreads between the fourteenth and eighteenth centuries and presents distinctive features, allowing researchers to classify the manuscripts into distinct groups.

Josefina Rodríguez-Arribas is a Marie Curie Fellow at the Polish Academy of Sciences (Warsaw). The core of her research is the intellectual history of Jews with a focus on scientific manuscripts and pre-modern and early modern science and technology (including mathematical instruments and prognostication/divination).

14.00 – 15.30 Lunch

15.30 – 17.30 Annual General Meeting of the SIC and Farewell

20.00 Conference Dinner