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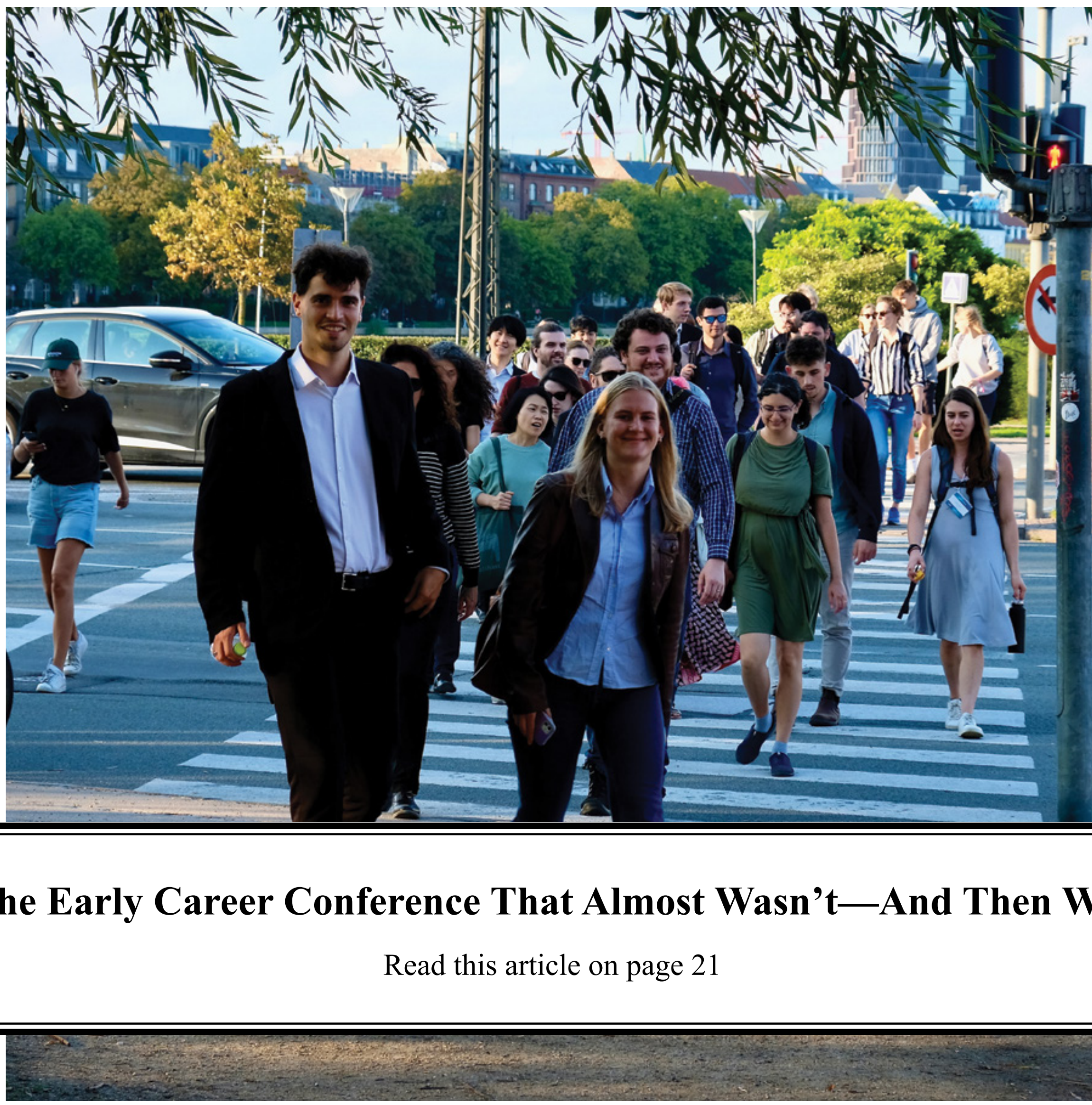

The Early Career Conference That Almost Wasn't—And Then Was

Read this article on page 21

A publication of the American Institute of Physics

ABOUT THE NEWSLETTER

This newsletter is a biannual publication of the Center for History of Physics, American Institute of Physics, 1 Physics Ellipse, College Park, MD 20740; email: **chp@aip.org** or **nbl@aip.org**. Editor: Joanna Behrman. The newsletter reports activities of the Center for History of Physics, Niels Bohr Library & Archives, and other information on work in the history of the physical sciences.

 This newsletter is available on request without charge, but we welcome donations (tax deductible) (**foundation.aip.org**). The newsletter is posted on the web at **www.aip.org/history-programs/history-newsletter**.

Front cover: Early Career Conference attendees walk from NBI to the conference dinner at Tivoli. Image credit: Christian Joas.

IN THIS ISSUE

TEN YEARS OF TEACHING GUIDES AND THE SPS INTERNS WHO MADE THEM

By Joanna Behrman, Assistant Public Historian

This year marks the tenth anniversary of one of the major educational endeavors at the Center for History of Physics (CHP). The *Teaching Guides on History of the Physical Sciences* (previously called the Teaching Guides on Women and Minorities in Physics, but we'll just call them the "teaching guides") first began in 2013 in an effort to diversify representation in the physics classroom. Now, ten years later, over 50 teaching guides are available online for K–12 classrooms, college professors, or anyone else who wants to learn about the diverse historical community of physical scientists.

The collection has expanded little by little every summer as it has been added to and worked on by graduate research assistants and interns from the Society of Physics Students (SPS). At CHP we have been delighted to welcome fourteen SPS interns in total so far to work on the teaching guides, many of whom also spent time working with the Niels Bohr Library & Archives. We say it every year, but each summer our corner of AIP feels reinvigorated with the infectious energy our new coworker(s) bring, and we're always sad to see them leave. To mark the tenth anniversary of the teaching guides, I reconnected with some of our former interns to talk about their experiences and see where they are now.

Why did you decide to do an SPS internship?

Brean Prefontaine (2015 SPS Intern): During my sophomore year, I was trying to figure out my place in physics. After completing a summer research project in astrophysics following my freshman year, I found that I wasn't genuinely engaged in the work. I started looking for ways to try out alternative paths I could take with my physics degree. This led me to explore the idea of teaching physics or working in physics education. When I heard about the SPS internship program, I thought it would be a great opportunity to work on a physics education project and explore different opportunities within physics.

Samantha Spytek (2016 SPS Intern): The SPS program was immediately attractive to me for several reasons. First, it was a paid internship at the headquarters for the American Institute of Physics, which not only is situated in DC, but also meant I would get to interact and network with people from more than just my subdivision and see how the structure of the institute functioned from the inside. Second, I was intrigued by the opportunity to do an internship in a very small cross-discipline that isn't offered anywhere else—science history and education.

MJ Keller (2023 SPS Intern): As an SPS member at my university, I first heard about the internship program through my department. The program interested me primarily because it provided a counterbalance to the pure astrophysics research I conduct during the school year. The position at NBL&A and CHP gave me an opportunity to work on scientific topics from a new perspective, which seemed an incredible and unique opportunity.

What aspect of the teaching guides did you work on?

Emma Goulet (2022 SPS Intern): My involvement in crafting the teaching guides allowed me to delve into the captivating stories of two remarkable women physicists: Émilie du Châtelet and Katherine Clerk Maxwell. As an intern, I was tasked with choosing teaching guide topics, performing extensive research on the women and creating teaching guides for an age group of my choice about them (I chose grades K–2). I made the teaching guides, including their supplementary materials, and did outreach, including conference presentations. … I LOVED doing the historical research and the content creation, making their stories come alive for the students.

MJ: I created two new teaching guides from concept to completion. My first was about meteorology in World War II, specifically Charles E. Anderson, and [the guide] taught middle and high school students the basics of forecasting and reading weather maps. My second covered the evolution of modern atomic theory and was designed to aid students in creating a timeline of the great discoveries of the twentieth century.

What are one or two good memories you had from that summer?

Simon Patané (2014 SPS Intern): It's very hard to point to one specific thing, every week that summer was incredible. One time that jumps out was when our intern group went to Capitol Hill for the 4th of July celebrations. It was an awesome time, and we had an equally fun adventure getting home that evening.

Cate Ryan (2019 SPS Intern): My favorite work memories all took place in the archives. I loved having access to so much knowledge and science history. I read through a copy of the Royal Society's publication from 1784, which contains the first published thought about black holes.

Maura Shapiro (2021 SPS Intern): I remember writing the *Physics Today* article about Eunice Foote and interviewing some of the people who helped publicize her. I was so nervous and was far out of my comfort zone, but [the interviewers] both reassured me and encouraged me. It made me feel that I was part of the science history community and that we were all working together to share the stories that have been overlooked. It felt really special to be part of a team working to correct history.

Emma: It is overwhelming to consider the number of amazing memories that were made from last summer! I genuinely consider last summer to be one of the best times of my life, and I have been feeling INCREDIBLY grateful to have experienced it alongside amazing fellow interns and mentors. All of the interns have continued to keep in touch (we are hoping to get together at some point, though everyone lives far and wide) and I am both thankful to have experienced it and sad that my time is passed. … I really cannot put into words how much of a joy it was and just how much value I place on my time and memories. It was more than an internship; it was an adventure, a journey of learning, giving back, and finding new passions.

What skills or interesting lessons did you learn through the internship?

Brean: Since I was working on lesson plans, I learned a lot more about lesson planning and the needs of teachers. But more importantly, I learned that I really liked working in physics education. The SPS internship was really my first foray into physics education and, it sounds a bit dramatic, but it really changed my trajectory. After the SPS internship, I went back to working on my undergraduate degree and got involved in physics education research.

Cate: I learned to be more confident in my writing. I had always been a confident math and science student, but when it came to any class [in which] I had to do extensive writing, that was not the case. My college professors and mentors at the SPS internship were the first people who made me feel more confident in my writing.

What are you most proud of accomplishing since your internship?

Simon: I'm most proud of my work in grad school and the past seven years of work in advancing In-Space Servicing, Assembly, and Manufacturing (ISAM) technology development. It's well beyond where I thought I'd be at this point, and I'm eternally grateful.

Brean: I am really proud of the research that I have been able to work on. After finishing my undergraduate degree, I went to graduate school and worked on research related to informal physics education. My dissertation work was focused on understanding physics identity development among undergraduate and graduate students facilitating informal physics programs. Now, I am very proud to be a postdoctoral researcher as a part of the Alliance for Identity-Inclusive Computing Education, working on research related to diversity, equity, and inclusion in accreditation criteria for computing departments.

Samantha: Since my internship, I graduated as one of the valedictorians from my physics program at Virginia Tech, earned my master's in education, and am entering my sixth year of teaching physics in Loudoun County Public Schools. I was awarded the PhysTEC Local Teacher of the Year Award in 2022, and every year I have been given an award from at least one student for my teaching that year. I am a very successful teacher in part because of the work and training I got that summer as an SPS intern.

Maura: I'm really proud of *Initial Conditions: A Physics History Podcast*! It was such a rare and special opportunity to work with Justin [Shapiro, no relation], a science historian

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I really admire, and that we had a lot of creative control and support from everyone. Though we had no prior podcast experience, we learned how to make a show that meant something. It's been really rewarding to hear which episodes people connect with. Even people in my life who don't love physics will tell me they identified with certain stories or were moved by certain episodes.

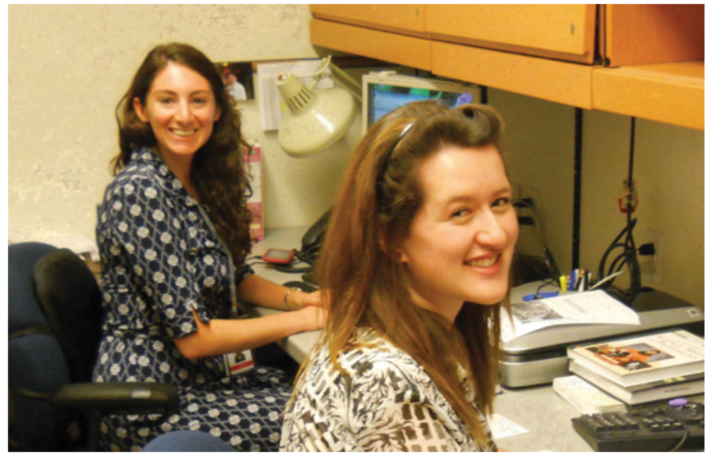
Is there anything else you would like to mention?

Cate: This internship changed me and my life in ways I never expected, even before I was an intern. I interviewed for the 2018 cohort and did not get in. But what changed me forever was a question in my interview. An AIP staff member asked me, "What are you proud of?" At the time, I wasn't doing research, didn't feel like I was excelling in classes, and was struggling to feel proud or like I had accomplished anything of merit....Walking away from the interview, I knew I needed to work on my perspective. While I hadn't checked these boxes that had been presented to me as the perfect physics student to-do list, I knew deep down I was still someone who had accomplishments and should feel pride in myself. I dug deep and recognized that I was a good friend, classmate, roommate, and teammate. Every day, I got myself out of bed and worked hard. That was all worthy of feeling proud of myself. After this perspective change I became a better student and refocused myself from fitting this "perfect physics student" model I had been striving to achieve and focused on what I loved to do and pursuing what made me happy.

Emma: The internship was not just a job, it was one of the best experiences of my life! I previously had no idea how much more fulfilling I would find physics history research and diversity outreach as opposed to technical physics. Outside of the job, it also taught me a lot about myself, my passions, and my newfound love of city-life.

These responses were edited in places for length and clarity. The full responses to all questions will appear in a future post on the NBL&A Ex Libris Universum blog.

With thanks to: Brean Prefontaine, Cate Ryan, Emma Goulet, Maura Shapiro, MJ Keller, Samantha Spytek, Simon Patané, as well as all the other SPS interns and AIP staff who have worked on the teaching guides.



Graduate research assistant Emily Margolis and SPS intern Fiona Muir created the first teaching guides in 2013. Image credit: Greg Good.

From left to right: SPS interns Jacob Zalkind and Simon Patané, and graduate research assistants Sharina Haynes and Serina Hwang Jensen worked on the teaching guides in 2014. Image credit: Greg Good.

The teaching guides team in 2016. From left to right: Greg Good, SPS interns Victoria DiTomasso and Samantha Spytek, and graduate research assistants Lance Burch and Stephen Neal. Image credit: American Institute of Physics.

NIELS BOHR LIBRARY & ARCHIVES AS A SOURCE FOR HISTORIES OF EGYPT'S SCIENCE DIPLOMACY

By Elizabeth Bishop, Associate Professor, Department of History, College of Liberal Arts, Texas State University

I draw attention to the Niels Bohr Library & Archives (NBL&A), a part of the American Institute of Physics, as a perhaps unexpected source for those historians who would like to use Egypt's state archives to answer existing questions in the histories of science diplomacy, as well as pose new ones. The International Union of Geodesy and Geophysics (IUGG), which is the international organization dedicated to advancing, promoting, and communicating knowledge of the Earth system, its space environment, and the dynamical processes causing change; its documents are located in the NBL&A.

In the opinion of Kian Byrne, "Scholars, especially foreigners, hoping to work within Egypt's state archives face an uphill battle" (Byrne 2020). Certainly, historians Omnia El Shakry (El Shakry 2015) and Khaled Fahmy (Hersh 2013) have discussed in depth the struggles facing scholars attempting to work inside Egypt's state archives, detailing obstructions and dangers facing researchers, which are very important to consider for those planning a trip to Egypt.

With this in mind, Pascale Ghazaleh and Malak Labib recently co-chaired a conference titled "Impossible Archives? Rewriting the Contemporary in Egypt." With support from the American University in Cairo, the Centre d'Etudes et de Documentation Economiques, Juridiques Et Sociales (CEDEJ), as well as the Institut Français d'Archéologie Orientale (IFAO), their call for papers sought to bring into conversation scholars, public historians, and archivists, and "invite papers based on primary research, which reflect critically on various aspects of the history and historiography of post-1952 Egypt and on the question of archives."

Historians of science are making key contributions regarding the development and deployment of modernist epistemologies in modern Egypt. Khaled Fahmy's *In Quest of Justice: Islamic Law and Forensic Medicine in Modern Egypt* (2023) identifies biomedicine and its forms of knowing as central to the emergence of modern governance in Nile lands during the nineteenth century. Rather than associating with art, Stephen Sheehi, *The Arab Imago: A Social History of Portrait Photography* equates photography with "naked, theoretical science" (2016, p. 75) as "physical science" (p. 80), and "the natural and biological sciences" (p. 81). Similarly, Maria Golia's *Photography and Egypt* plays up the significance of scientific and technical innovations which together yielded publication in *Al-Ahram* of "photographs of a joyous crowd" with nationalist identification of King Farouk as "their first-Arabic-speaking monarch" (2010, p. 81).

While noting the problematic posed by access to primary sources, new questions emerge from other historians' work in the exciting field of histories of science diplomacy. S. Kunkel posits that "histories of science diplomacy . . . make the study of international interactions their central frame of reference" (Kunkel 2021). While S. Robinson et al. consider the key date to be 1970, that "historical moment when science diplomacy was becoming a global phenomenon" (Robinson et al. 2023), the occultation of women's contributions to major scientific developments (Hawkinson and McGrath 2023) gesture toward other aspects of repression which the history of science diplomacy may be best-prepared to address (Cooper et al. 2023).

The IUGG has held general assemblies since 1922. Even though these first assemblies gathered only a few hundred scientists and several thousand experts, access to these documents facilitates larger arguments about colonialism, imperialism, and neo-imperialism. Documents located in the NBL&A include ongoing correspondence between diplomats with the Ministry of Foreign Affairs of the Kingdom of Egypt during the reign of the Muhammed Ali dynasty, as well as its successor institution, the Ministry of Foreign Affairs of the United Arab Republic, as these diplomats and their allies in the scientific community (who represented Alexandria University, Cairo University, the institution formerly known as Heliopolis University, the Helwan Observatory, the Meteorological Department, and the Ministry of Public Works, as well as other institutions) sought to bring Egyptian experts into

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closer communication with the international research community. Documents are in English and French, with the earliest communications dated 1947 and the most recent 1976.

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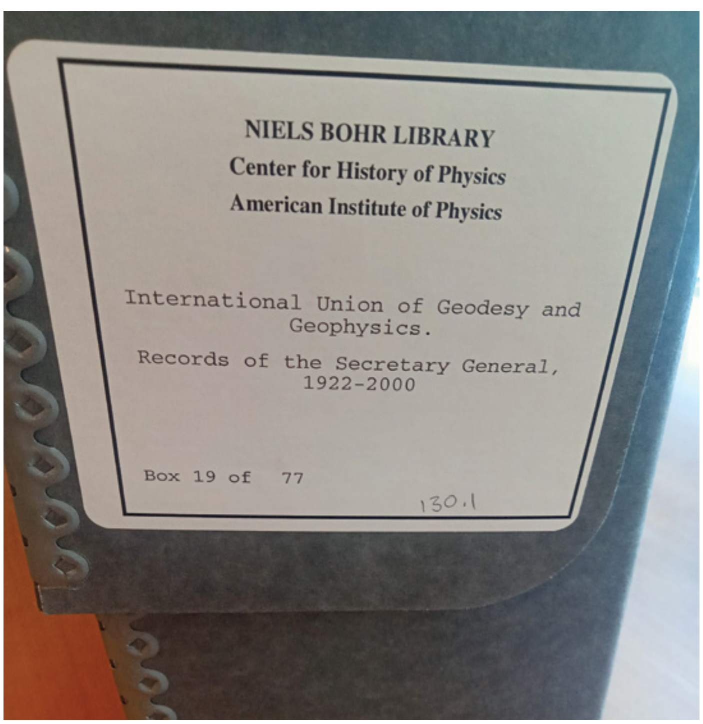
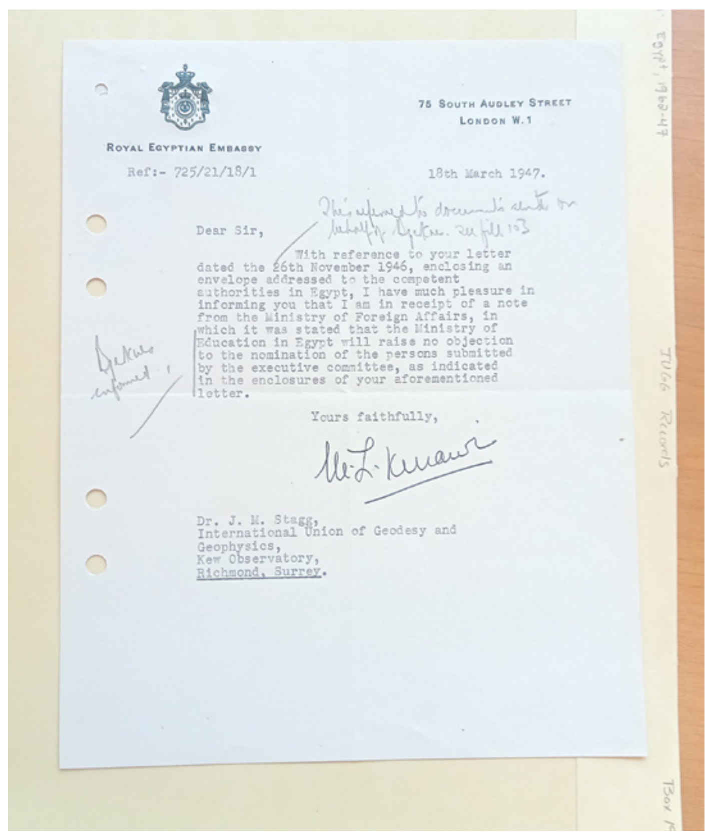


Box 19 of the records of the International Union of Geodesy and Geophysics. Niels Bohr Library & Archives. Image courtesy of the author.

The records of the Secretary General of the IUGG are organized by member country. Niels Bohr Library & Archives. Image courtesy of the author.



ROYAL EGYPTIAN EMBASSY

75 SOUTH AUDLEY STREET
LONDON W.1

Ref:- 725/21/18/1

18th March 1947.

Dear Sir,

With reference to your letter dated the 26th November 1946, enclosing an envelope addressed to the competent authorities in Egypt, I have much pleasure in informing you that I am in receipt of a note from the Ministry of Foreign Affairs, in which it was stated that the Ministry of Education in Egypt will raise no objection to the nomination of the persons submitted by the executive committee, as indicated in the enclosures of your aforementioned letter.

Yours faithfully,

Dr. J. M. Stagg,
International Union of Geodesy and Geophysics,
Kew Observatory,
Richmond, Surrey.

The IUGG Collection includes this letter to Dr. James Stagg, the Secretary General of the IUGG, from M. Z. Kinawi of the Royal Egyptian Embassy in London. Niels Bohr Library & Archives. Image courtesy of the author.

Gabriela González. Image courtesy of the LSU Department of Physics and Astronomy.

FEATURED ORAL HISTORY INTERVIEW: GABRIELA GONZÁLEZ

Edited by Chip Calhoun, Digital Archivist

In this issue we are featuring an oral history interview with Gabriela González, Boyd Professor of Physics at Louisiana State University. Dr. González grew up in Córdoba, Argentina, where she completed her undergraduate education in physics and developed her love of relativity. She met her husband when he transferred to Córdoba University due to its strength in relativity. The couple moved to the United States on what they planned to be a temporary basis, intending for Gabriela to take some graduate courses while her husband completed a postdoctoral position. They decided to stay, and she completed her PhD at Syracuse University. Her postdoctoral appointment was at MIT, in Rainer (Rai) Weiss's group, where she was part of the Laser Interferometer Gravitational-Wave Observatory (LIGO) Project. She maintained contact with MIT and continued her work on gravitational waves when she took up a faculty position at Penn State. In 2001 she moved to Louisiana State University, near the LIGO Livingston Observatory. In 2016 LIGO detected gravitational waves, and in 2017 three of its contributors were awarded the Nobel Prize in Physics.

On her early interest in physics:

David Zierler: …Were you ever made to feel like science was not an appropriate path for you? Were you ever discouraged…?

Gabriela González: Well, certainly not by my family. Although long after [laugh] I migrated to the US, my mom and my dad told me that when I wanted to study physics in college, they thought, "Oh, what is she going to do with that degree?" But they never discouraged me for what I

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was going to college to do. There wasn't a question about us going to college, my brother and I. But what we wanted to study was up to us. In college, and even graduate school, I did hear from people saying women are not good in science, and women are not good for physics. Especially for physics, and they said that in front of me. In front of other women. And I think with the intention of discouraging us. Of course, these were older physics professors. But somehow, that didn't discourage me, although of course I understand how it discourages many people. It's terrible, terrible. And somehow it made me more, I don't know...

Zierler: Determined.

González: [laugh] More resolved, yes, because I said to myself: I'm going to show them. I lost respect for those people, I have to say. I was brought up to respect senior people or people who were older than I was, because they knew better. But then I realized that sometimes they don't know better. … But like I said, I just wanted to learn explanations for things. I wasn't thinking about physics as a career. I wasn't thinking about a career in general, if I have to be honest. [laugh] But it was in college from the beginning that I learned that the physics professors were also investigators. They were all men. Well, I had one female professor in the third year. But everybody else was a male professor. But they were all investigators. They were all scientists, so that's when I learned that not all the answers are known, but not even all the questions are posed. And I loved that.

On the need for multiple LIGO sites:

González: They were designed to be not redundant, but as identical as possible. [laugh]

Zierler: Yeah, I don't mean redundant like one is not necessary, but if they're both detecting the same thing, they can provide confirmation of a detection.

González: That's right, that's right. And that's the way they were designed, installing identical technologies at two places, so they have the same laser technology, the same suspensions, the same everything. … Livingston had more problems, too. Because even though this wasn't known at the time [laugh] at the time that the sites were chosen, the seismic noise in the band of gravitational waves frequency is actually smaller at Livingston than at Hanford. But in order to keep all the systems operating, one needs to push mirrors against large motions at low frequencies. At much, much lower frequencies. The ground moves and moves most with periods of several seconds. And that's called a micro-seismic noise. And at Livingston, because the soil is softer and it's closer to the coast, it moves a lot more, so one needs to push a lot harder, which introduces more noise. So, the interferometer at Livingston took a lot longer to get operational than the two at Hanford. In the initial LIGO project there were two detectors at Hanford.

On the LIGO Collaboration:

González: This collaboration that was founded in 1997 was first led by Rai Weiss as spokesperson. The spokesperson is the scientific leader of the collaboration, which is different than the executive director of the LIGO Laboratory. That is a person that organizes and pays the salaries of everybody working at Caltech, MIT, Hanford, and Livingston. But the Collaboration is a collaboration, international collaboration of people who agree to, not to pool financial resources together, but to pool work together. So that was proposed by Barry Barish in 1997. Rai was the first spokesperson, then Peter Saulson in 2003, then Dave Reitze in 2007. I was elected spokesperson in 2011, right after we finished with Initial LIGO. In 2011 we had just finished taking data with Initial LIGO, and we were beginning to install Advanced LIGO.

On the buildup to detection of gravitational waves:

González: We were preparing for a detection sometime in the future. And we actually had begun seriously preparing for that, having what we called a detection plan. What would we do? What confidence we needed to have? What statistical confidence we needed to have? We were going to have a red team, a detection committee, that was going to try to poke holes, to look at all the angles. [laugh] If we had a detection, we actually talked about what journal we would publish in. We talked about waiting for peer review before making any announcement. So we had been talking about all these things, but with the expectation that this was for years in the future. We needed to do it, and I was really insistent that we needed to do it before the first observing run, because I was afraid that if we didn't do it, then we were going to just set it aside.

So luckily, we actually decided on the journal and the wait for peer review and all that, we approved that detection plan in September of 2015, [laugh] before we were going to start the first observing run at the end of September of 2015. The detection appeared on September 14, before we started taking data 24/7. It was a huge, huge surprise. And not only because it was a detection, but because it was a strong detection. It was a very large amplitude. Even now, after having published 50 detections, this one has the record of largest amplitude.

Zierler: The first one.

González: The first one has the detection of largest amplitude, yes.

Zierler: What besides serendipity do you think explains that?

González: Nothing. [laugh] Nothing.

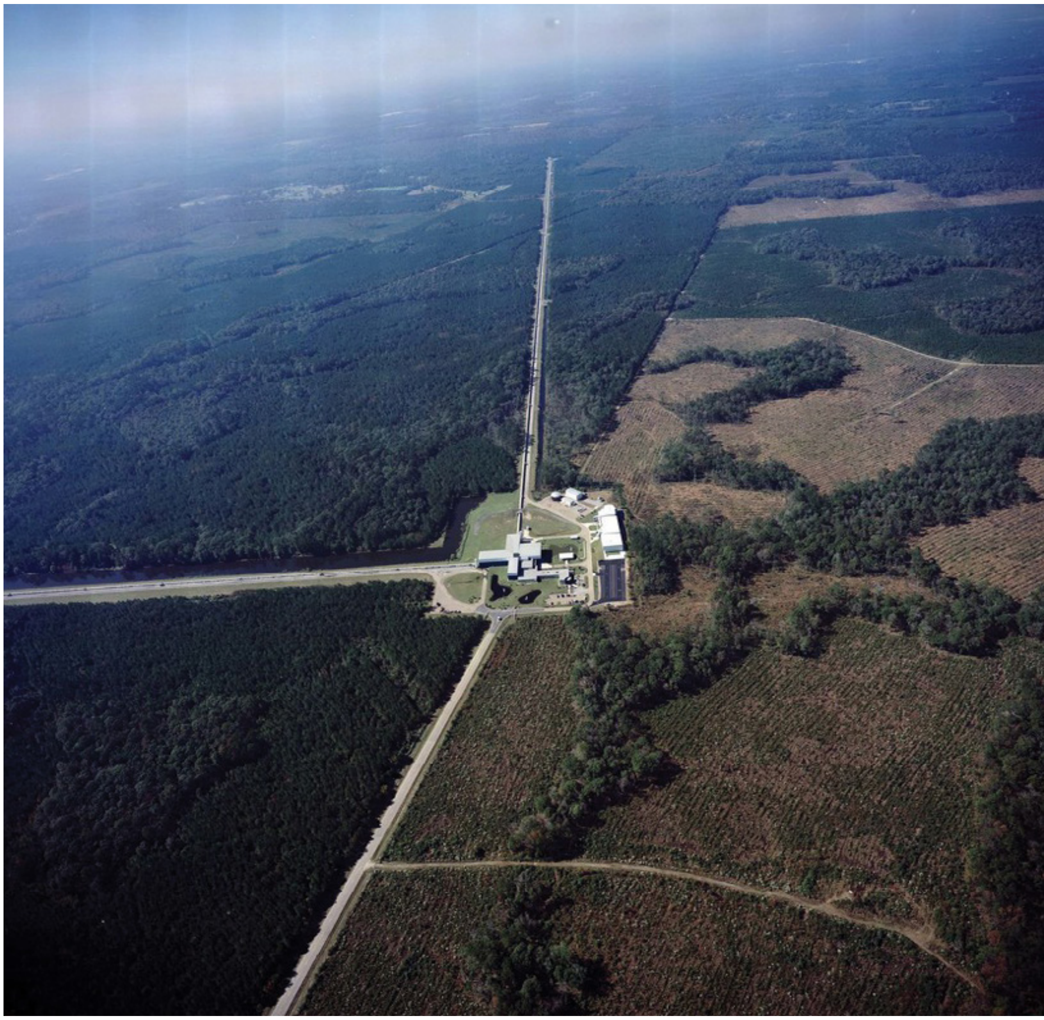
On confirming the detection, and the discoveries that came with it:

González: Of course, most candidates are insignificant, statistically insignificant. But there was this candidate that was found by this algorithm, and then people in Germany and in Florida—they woke up very, very early in Florida, and people around noon in Germany looked at this thing. Note at the time that it happened, the signal had been already passed two or three hours earlier. They looked at this candidate and they said, "This is just really big." It seemed to be very large. I mean, you could see the filtering and in a spectrogram, you could see it with your eyes. It looked incredible, and they thought that it was a test, because we had been injecting gravitational waves, pushing the mirrors with simulations, because we do that all the time to test the system.

So they thought it was that. They called the observatories to ask if that was the case. They said, no, it wasn't. But we also had been planning to do something we called blind injections, where we charge a small team of people to test us injecting simulations without telling anybody what they injected, or whether they injected anything. We call that blind injections. And we had done that in the past in the last two data-taking runs in Initial LIGO. So, emails began floating. I got text messages that woke me up saying—

Zierler: So you were at home, you were sleeping at this point?

González: Yeah. Yeah. I mean it happened at 5 am, and this was discovered at 5 am local time, and it was—emails began floating like an hour or a couple of hours later, and I woke up to this. I received these text messages like, "Who put this there?" Everybody thought it was a blind injection. It took about a day to realize that at least it wasn't a planned injection. It could be a hacked injection, and we had to worry about that. But by the next day, we knew that it wasn't a test. It wasn't a drill. [laugh] But it was so big, and from the frequency we could also tell roughly that these were not neutron stars but black holes. And big black holes that were not known of that size. So, this was all incredible. The size, the fact that...



Aerial view of LIGO Livingston. Both the Livingston and Hanford LIGO sites are L-shaped. Image courtesy of Caltech/MIT/LIGO Laboratory.

Zierler: So, these are discoveries within discoveries that are happening right now?

González: That's right. It was a gravitational wave of large amplitude. It was a binary system of black holes. No black hole binary system had been known before. People thought they existed, but they had not been seen, because they're black, they don't emit light. And they were black holes that were very large: thirty solar masses. The largest one known was twenty solar masses. So this was too good to be true, too incredible. We first had to make sure that it wasn't a glitch in the instrument that looked like this and happened to appear at both detectors at the same time. So everything froze at both detectors.

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- Interview of Gabriela González by David Zierler on March 22, 2021, Niels Bohr Library & Archives, American Institute of Physics, College Park, MD USA. **www.aip.org/history-programs/niels-bohr-library-oral-histories/47028.**

PRESERVING THE PAPERS OF BRAZILIAN PHYSICIST JOSÉ LEITE LOPES

By Corinne Mona, Assistant Librarian, and Olival Freire Jr., Professor of Physics and History of Physics at the Universidade Federal da Bahia

Part of what makes the Niels Bohr Library & Archives unique as an archive is our agenda of facilitating and promoting archival work in the physical sciences at other institutions. Here are some examples:

- The International Catalog of Sources (ICOS), in which users of our catalog may view archival records having to do with the physical sciences at institutions worldwide (not just our own records)
- Our finding aids website, which also includes links to finding aids at institutions around the world, and
- The work of our director, Melanie Mueller, who will help to place archival collections at appropriate institutions.

Since the late 1990s, NBL&A has been proud to offer our Grants to Archives program. This program helps support significant work to make accessible records, papers, and other primary sources that document the history of modern physics and allied fields (such as astronomy, geophysics, and optics). For more on the Grants to Archives program, ICOS, and our finding aids website, please visit **history.aip.org** or email us at **nbl@aip.org**.

In 2021 we were pleased to present one of the awards to the Centro de Pesquisa e Documentação de História Contemporânea do Brasil (CPDOC) for the preservation of physicist José Leite Lopes's papers. We interviewed physicist and historian Olival Freire Jr., who, with Antonio Augusto Passos Videira, applied for the grant on behalf of CPDOC. He is professor of physics and history of science at the Federal University of Bahia in Brazil. For more from Olival, check out his book, *The Quantum Dissidents—Rebuilding the Foundations of Quantum Mechanics (1950–1990)*, and other publications.

NBL&A: Tell us a little about the Centro de Pesquisa e Documentação de História Contemporânea do Brasil (CPDOC). What are the activities of the CPDOC, and what kind of collections do you house there?

Olival Freire Jr.: The CPDOC was created in 1973 as part of the Fundação Getúlio Vargas in Rio de Janeiro, which is an

Olival Freire. Credit: Pesquisa FAPESP.

outstanding Brazilian institution for research and teaching in the social sciences. The main bulk of CPDOC collections is related to the political, economic, and administrative history of the country. It has also been very active in the use of oral history methods, indeed, having played a pioneering role with these methods in Brazil.

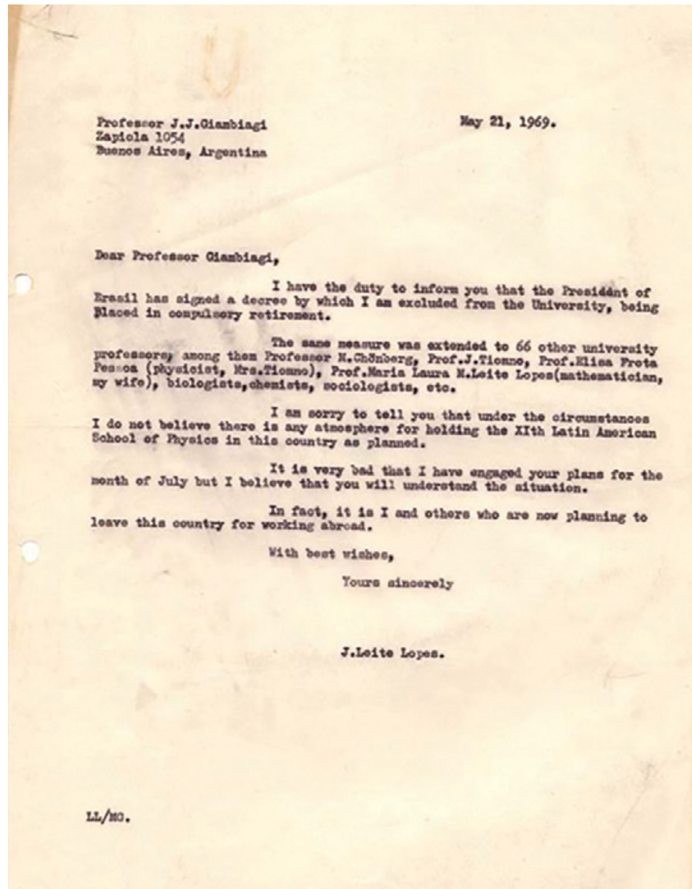
Do you want to share anything else about CPDOC with our readers? Do you have a favorite collection or item, or a project or initiative you are particularly excited to be working on?

The CPDOC collections are of interest for the history of science in Brazil, as science grows in social settings that are related to the political and economic contexts. My favorite collection is the 70+ oral histories of Brazilian scientists, collected in the mid-1970s by Simon Schwartzman as part of the research for his book, *A Space for Science: The Development of the Scientific Community in Brazil*. Nowadays I am engaged with a team of historians of science to grasp the vicissitudes marking Brazilian science in the second half of the twentieth century. For this research, the Leite Lopes papers are very instrumental.

The grant is funding the preservation of the Brazilian physicist José Leite Lopes (1918–2006) papers. Please tell us about the project and how it's going.

The Leite Lopes collection is a huge one. We applied both for the American Institute of Physics and the Brazilian CNPq and were successful in both. In addition, we have support from the CPDOC which concerns expertise, staff, and other items. The project entails various tasks, including cleaning, organizing, cataloging, digitizing, and making José Leite Lopes's archive accessible for public consultation. The work is approaching its completion, as the catalogue is ready, the series Nuclear and Atomic Energy, Politic Action, Honor and Nominations, and part of the Correspondence Academic were digitized, and the full work is going to be completed at the end of this year.

The archive comprises around 56,000 pages of content. The José Leite Lopes archive was arranged by the CPDOC Personal Archives Program team over a span of 10 months, resulting in a total of 20 linear meters of documents. These materials have been organized into ten series, namely, Academic Correspondence; Associations, Organization and Research Entities; Academic Activity; Political Action; Honors and Nominations; Nuclear and Atomic Energy; Personal Documents; Various Additional Shipping and Photographs. The José Leite Lopes personal archive enhances CPDOC's collection, making a valuable contribution to the preservation of Brazil's scientific and political heritage. The accessibility of these documents provides research opportunities into the life and legacy of this significant Brazilian scientist, thereby fostering the appreciation of science and education within the nation.



Professor J.J.Giambiagi
Zapiola 1054
Buenos Aires, Argentina

May 21, 1969.

Dear Professor Giambiagi,

I have the duty to inform you that the President of Brasil has signed a decree by which I am excluded from the University, being placed in compulsory retirement.

The same measure was extended to 66 other university professors, among them Professor M.Schönberg, Prof.J.Tiomno, Prof.Elisa Frota Pessoa (physicist, Mrs.Tiomno), Prof.Maria Laura M.Leite Lopes(mathematician, my wife), biologists,chemists, sociologists, etc.

I am sorry to tell you that under the circumstances I do not believe there is any atmosphere for holding the XIth Latin American School of Physics in this country as planned.

It is very bad that I have engaged your plans for the month of July but I believe that you will understand the situation.

In fact, it is I and others who are now planning to leave this country for working abroad.

With best wishes,

Yours sincerely

J.Leite Lopes.

LL/MO.

Letter from José Leite Lopes to Professor Giambiagi explaining the exile situation and plans to leave Brazil. Credit: José Leite Lopes personal archive, FGV CPDOC.

Who is José Leite Lopes, and how does he figure into the history of science in Brazil?

José Leite Lopes was a Brazilian physicist. He was born in Pernambuco and moved to Rio de Janeiro to do his undergraduate studies in physics. Then he went to Princeton, where he obtained his PhD under the supervision of Wolfgang Pauli. He worked on quantum field theory and particle physics. His research results on analogies between weak nuclear and electromagnetic forces

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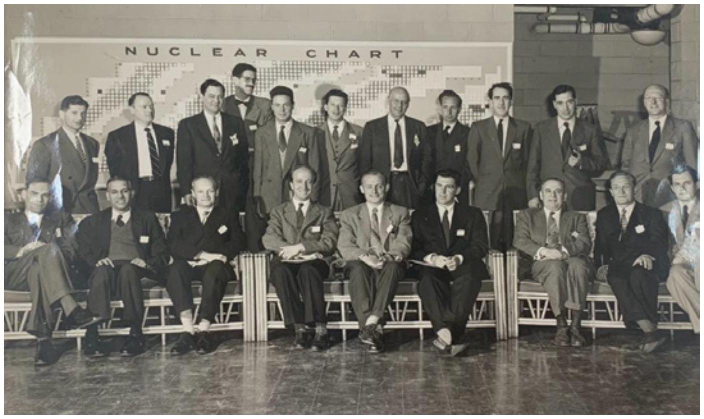
contributed to Steven Weinberg, Sheldon Glashow, and Abdus Salam's work on the electroweak interaction, leading them to the Nobel Prize in Physics. Leite Lopes also contributed to the building of Brazilian scientific institutions. He and César Lattes were among the founders of the Brazilian Center for Physics Research (CBPF). He was very engaged in the formulation of Brazilian politics for science and technology, in particular, the relation between science and development. As a consequence of these political activities, the military dictatorship persecuted him, which led him into exile for more than ten years.

How did you hear about the grant?

I have been visiting the Center for the History of Physics since 2002. I have also supported some of my students to do the same. In 2018 I finished my biography of David Bohm during a stay at AIP. Throughout these I have built professional and personal relations with the AIP staff, including Spencer Weart and Gregory Good, former directors of the center. Thus it was very natural to look for the AIP support when we needed it.

Is there anything else you want to share with us about your Grants to Archives experience, or anything about the project?

Just to tell the important role AIP has played in supporting the history of science—from Thomas Kuhn's project of the Archives for the History of Quantum Physics to the conferences for early career scholars and PhD students in history of physics. As the history of physics may be enriched through the perspective of transnational history, history of American physics is well connected with the history of physics in the world. Thus AIP support for the history of physics has been useful for scholars in all parts of the globe.



José Leite Lopes at the International Conference on the Peaceful Uses of Atomic Energy held in Geneva, 1955. Credit: José Leite Lopes personal archive, FGV CPDOC.

All digitized materials from the archive can be accessed through the following link: **https://docvirt.com/docreader.net/docmulti.aspx?bib=fgv_jll.**

José Leite Lopes and César Lattes at UNICAMP. Credit: The José Leite Lopes archive, FGV CPDOC.

Passport photo of José Leite Lopes. Credit: José Leite Lopes personal archive, FGV CPDOC.

CHRISTINE LADD-FRANKLIN: AN EARLY START FOR WOMEN IN OPTICS

By Jeff Hecht, Science and Technology Writer

The first woman joined the Optical Society of America (OSA, now Optica) as member no. 118 in 1919, three years after its foundation. Then aged seventy-one years, Christine Ladd-Franklin first published on vision in 1892, but the next eight women—who had followed her by the society's tenth anniversary in 1926—were all at least a generation younger. These were Gertrude Rand, Mabel Katherine Frehafer, Elizabeth Laird, Janet Howell Clark, Miriam O'Brien, Louise Littig Sloan, Madelaine May Brown, and Louise Sherwood McDowell. All but one are listed in today's version of *Who's Who*, Wikipedia, and the only one who left science or medicine (O'Brien) became a prominent mountaineer. Here is the story of Ladd-Franklin, who led the way.

Christine Ladd-Franklin:
Born in 1847 in Windsor, Connecticut, Ladd-Franklin was valedictorian of her preparatory school and studied with pioneering astronomer Maria Mitchell at Vassar College. She graduated in mathematics in 1869, but later said she would have preferred physics if any labs had been open to women at the time. She taught science and math in secondary schools but grew bored.

In 1878 she applied and was accepted to the recently founded Johns Hopkins University as "C. Ladd" to study mathematics with James J. Sylvester. When university officials discovered she was female, they tried to reject her, but the sympathetic Sylvester insisted she be accepted as his student. Her dissertation, "On the Algebra of Logic," was published in 1883, but Hopkins did not award her a PhD until 1926. After she married fellow student Fabian Franklin in 1882, Hopkins would not let Ladd-Franklin teach there until 1904, and then limited her to one course a year without pay.

Active in research but unpaid, she visited Germany to work with experimental psychologist Georg E. Müller and physicist Hermann von Helmholtz. That led to her research on color vision, which she began publishing in 1892. The American Psychological Association accepted her as a member the next year. In 1915 Columbia University gave Ladd-Franklin an unpaid lectureship, which lasted until her death in 1930. She published six papers, gave two exhibits at OSA events, and published her own book on color theory in 1929.

Christine Ladd-Franklin as a young woman circa 1870. Image credit: Special Collections, Vassar College Libraries. Public domain, via Wikimedia.

Trailblazers:
Looking back a century, the society's first nine women members all were pioneers in science, but they spanned half a century in age. Ladd-Franklin, born in 1847, was in many ways a trailblazer. She was taken to women's rights talks by her mother when only a toddler, but her mother died when Ladd was only twelve. Her father, his second wife, and the rest of the family paid her way through a coeducational prep school, where she was valedictorian. But with money tight, she had to persuade the family by telling them she was too unattractive to attract a husband and that she would need to attend college to support herself. She was part of the second class to enter Vassar in 1865, one of the early women's colleges.

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At Vassar, she blossomed with a growing interest in physics and math, but when she graduated her only option seemed to be teaching in high school, which she came to detest. Determined to continue her education, she hid behind her initials to get into Hopkins, where she eventually was given a scholarship, although she was never formally admitted. In her mid-thirties she married a math professor in his twenties and continued research and teaching—although never securing a regular academic post. Her photos portray a formidable woman.

The younger generation that followed her found more colleges open to them. Interestingly, these women had some institutions in common. Of the eight women who followed Ladd-Franklin, all but one (Louise Sherwood McDowell) attended Bryn Mawr College at the undergraduate or graduate level. In addition, Ladd-Franklin, Frehafer, and Clark all earned PhDs from Johns Hopkins University. Hopkins began admitting women to the medical school in 1893, but only after four daughters of the university's original (male) trustees agreed to raise the half-a-million dollars needed to pay for the medical school's new building on the condition that it admitted qualified women. They succeeded, and that opened the door for many of OSA's early women to enter the medical field. All but O'Brien held professional positions in science or medicine from graduation until retirement age, including those who had children. It was a big step beyond Ladd-Franklin's struggles.

The onset of World War II, like that of World War I, helped open doors for women in optics and other sciences. However, afterward, "There were institutional backlashes against the opportunities which had opened up for women in science and the larger defense industries during the war," says Joanna Behrman, assistant public historian at the Center for the History of Physics. Women who had filled traditional male jobs during the war were fired or pushed to resign to make room for returning soldiers. "The increasing bureaucratization of the way science was done tended to close off opportunities that women had been able to take advantage of before the war," she adds. "Just having one good mentor could make a woman's career possible before the war, but this was harder after the war because there were more layers of bureaucracy."

In addition, she says, "Standards of gender tightened, because the Cold War made a particular view of the family and gender roles extremely important to the identity of Americans." Cornell University historian Margaret Rossiter wrote that women who never married and had children were considered poorly adjusted, and those who worked when they had children were considered poor mothers because they didn't care for their children.

Those of us born soon after World War II can remember seeing those standards change along with the world around us. In mid-century America, many colleges with strong undergraduate programs in science and engineering clung to the old idea that coeducation of men and women undergraduates was a bad idea. Even Daniel Coit Gilman, the founding president of Johns Hopkins University and an advocate of higher education for women, and a cofounder of Goucher College, thought women should be taught separately. Indeed, the Hopkins undergraduate school remained limited to men until 1969. Caltech, one of the country's most selective universities, did not admit women undergraduates until 1971. Since then, we have seen more women selecting science and engineering majors, graduating, and becoming part of the scientific community.

Optics mirrors science and technology at large. When OSA announced its first fellows in 1959, five of the 115 were female, a fraction similar to the number of women members in 1926. Over my years in OSA, I have seen the numbers of women grow and

come to know many of them. In 2016 and 2018 the society formed "rapid action committees" to address the gender gap. Change is taking time, but progress is evident in the higher fraction of women among student members than members as a whole, and in the larger fractions of women among governance and directors.

Roles	Percentage of Women
Members	17%
Students	28%
Fellows	18%
Governance	41%
Board of Directors Seats	65%

Table 1: In 2016 and 2018, Optica created two rapid action committees to address the gender gap. The table shows the percentage of women in various membership and management roles within Optica as of 31 December 2022. Table courtesy of Optica.

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Above: A close-up of the group photograph showing the women in attendance. Please email nbl@aip.org if you have suggestions for identifying these individuals. Image credit: AIP Emilio Segrè Visual Archives, W. F. Meggers Collection.

Top image: Group photograph of the Optical Society of America (now Optica) meeting at the Bureau of Standards, Washington, DC, on November 2, 1928. Image credit: AIP Emilio Segrè Visual Archives, W. F. Meggers Collection.

INTERVIEW WITH SCIENCE WRITER KENNA HUGHES-CASTLEBERRY

By Joanna Behrman, Assistant Public Historian

To start, could you tell me a little bit about yourself?

I'm the science communicator at JILA, a world-leading physics institute in Colorado that's half NIST (National Institute of Standards and Technology) and half University of Colorado Boulder. JILA researches a range of physics, from AMO (atomic, molecular, and optical) physics, to atomic clocks, biophysics of protein folding, and PER (physics education research). As such, I'm always writing about various physics subjects and studies, which helps to satisfy my curiosity about the field. Besides writing popular science articles for JILA based on recent publications from each of our thirty PIs, I also host JILA's podcast *Humans of JILA*, which interviews research groups within the institute, along with our talented staff shops (like the instrument shop) and inspiring individuals. Beyond this, I also teach various courses within JILA, including a science writing workshop, media training, and science presentation.

If that wasn't enough, I also do a lot of freelance writing outside of work (can you tell I'm a workaholic?). I'm a freelance news editor for Inside Quantum Technology, a quantum computing–focused news outlet, which gives me a nice inside look at the quantum industry beyond JILA research. Besides this, I also write articles for a variety of publications, including *Scientific American*, *New Scientist*, *Discover Magazine*, *Leaps Magazine*, *Ars Technica*, *Astronomy Magazine*, and others. When I'm not working, I love biking, hiking with my husband and dog, listening to podcasts, reading, and doing archery.

Kenna Hughes-Castleberry. Image credit: Kenna Hughes-Castleberry.

How did you become a science communicator?

I didn't really think about being a science communicator until my undergraduate degree. I double majored in both English and biology at Colorado State University, and it was during my junior year that I realized I could marry the two fields into one for science communication. I worked at the Denver Botanic Gardens the summer of my junior year (as my biology degree was focused on botany) and wrote a virtual tour of the gardens about medicinal plants, combining ancient knowledge with conventional medicine. It was the first science communication project I did, and I loved it. That virtual tour, which takes users all over the gardens, is their website's third most popular tour. When I finished my undergraduate degree, I also wrote a book about weedy sea dragons for my honor's thesis, combining narrative writing with scientific facts.

I then transitioned to my master's in science communication from Imperial College, London. Living in another country and getting an international perspective on science writing, documentary making, podcasting, museum design, and more was a wonderful opportunity. Unfortunately, due to COVID-19, I returned home to Colorado and completed my degree remotely, with my master's thesis focused on the ethics of using familial DNA testing to solve cold cases.

After graduating I dabbled in some marketing and SEO writing before accepting the position at JILA. I've been at the institution for almost three years and absolutely love it. The scientists I work with are passionate and incredibly creative, and the students I teach are just as dedicated and curious about their research's impacts on the scientific community. Working with these individuals, I feel honored to be able to highlight their work and make sure the general public gets an inside look into the scientific process.

You just published a book, *On the Shoulders of Giants: 10 Quantum Pioneers of the Past*. Could you tell me how this project began and what inspired you and your coauthor Brian Lenahan to write this book?

Brian was the one who approached me for this project. He has written a few books before and published them through his company (via Amazon) and wanted to start a somewhat different book than his previous works. Knowing my journalist work and passion for human narratives, he asked me if I wanted to partner with him and write a book highlighting some of the untold stories in quantum physics. While he had subjects like [Gottfried Wilhelm] Leibniz and [Louis] de Broglie in mind, I suggested we push the book subject further and highlight individuals from underrepresented backgrounds who hadn't been covered or their stories untold entirely.

How did you and Brian divide responsibilities for the book?

According to the contract I signed with Brian's company, I would be the sole writer of the book, with Brian offering a few tidbits here and there, along with editorial input. Brian would then be the one to market and promote the book after publication.

As such, I did the entirety of the research and writing for this book. I ended up writing this book in 60 days (it's 70,000 words), which I wouldn't recommend for any writer. Brian then helped edit the book and promoted it to his channels.

***On the Shoulders of Giants* focuses on ten figures in the history of quantum mechanics, mathematics, and computing: Muhammad al-Khwarizmi, Gottfried Leibniz, Elmer Imes, Satyendra Nath Bose, Sin-Itiro Tomonaga, Claude Shannon, Betty Holberton, Pantur Silaban, Mark Reed, and Deborah Jin. How did you select these ten?**

A few of them Brian recommended, such as al-Khwarizmi and Leibniz, but he hadn't done really any research on other potential subjects, except people who had already been highlighted. I saw this as an opportunity to promote new individuals who hadn't really been discussed or highlighted yet. Researching underrepresented groups in physics, I suggested a few names, like

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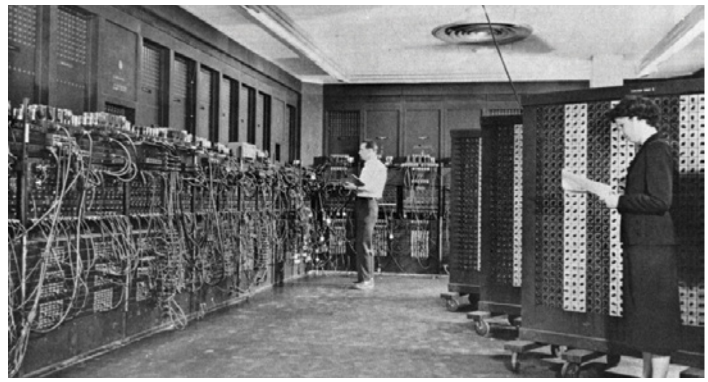
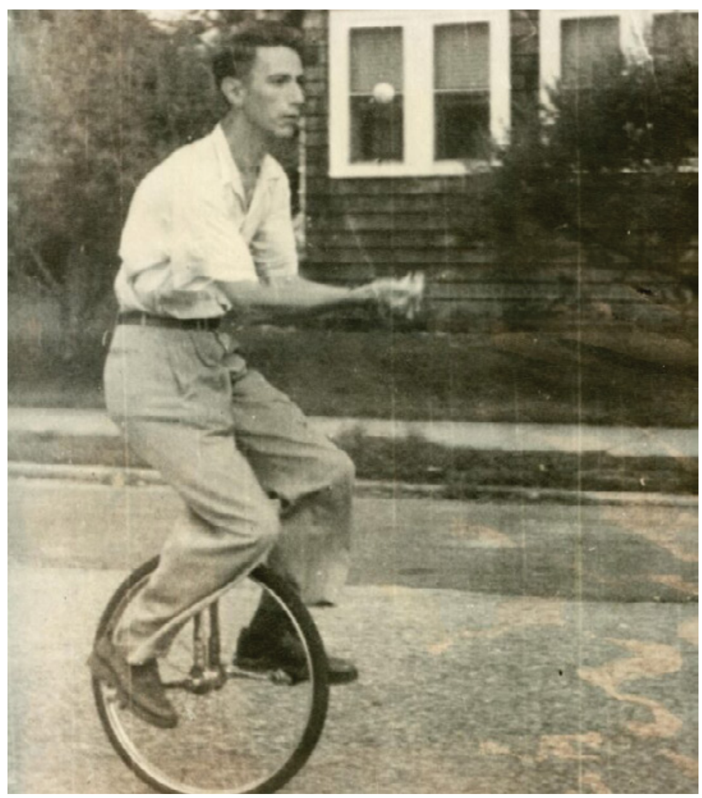
Satyendranath Nath Bose viewing a photo of Albert Einstein, 1953. Image credit: AIP Emilio Segrè Visual Archives, gift of Kameshwar Wali and Etienne Eisenmann.



Betty Holberton (right) reading a datasheet in front of the ENIAC computing system. Image credit: NIST.



Claude Shannon riding a unicycle. For photographs of scientists riding bicycles, see Audrey Lengel's article on page 29 in this issue. Image credit: The Shannon family and Jimmy Soni.

Imes and Silaban. Our criteria was that all subjects had to be already deceased, so it did help narrow down potential individuals to cover.

With my work at JILA, I quickly found Debbie Jin as a potential subject to cover, as I already knew a bit of her story.

Our book is the first book with the complete stories of Imes, Jin, Reed, and Silaban, which I think is a pretty big deal!

Did you come across anything that surprised or delighted you in particular when you were in the research stage?

Oh absolutely! I learned so much while researching this book. It was especially helpful for me in understanding how the key theories within physics (like relativity, QED, and more) had been historically established and evolved throughout time. I hoped through this book that I could help the reader better understand these theories in quantum physics in an easy and engaging way. There were so many theories popping up in the early 1900s that I consider it a “quantum renaissance” of sorts, and during this time, many of our Giants interacted with these concepts or expanded on them. However, because of their backgrounds, many did not receive the credit they deserved, or their story was completely brushed over and lost to time.

Through this book we really wanted to highlight the prejudices many of these individuals faced, not only in their lifetimes but often after their deaths, in how they were portrayed. There are still issues within STEM in including individuals of underrepresented backgrounds, and we hoped, through highlighting these individuals, readers of these same backgrounds have role models to inspire them and to show them that they can achieve a career in science and make a difference.

If you could have added an eleventh or a twelfth figure, who would you have included?

Oooh, that’s such a tricky question! If I had to pick, I’d either go with Mileva Marić (Einstein’s first wife) or Betty Shannon (Claude Shannon’s wife).

It’s often said that the science of quantum mechanics is very counterintuitive. What, if anything, do you think is counterintuitive about the history of quantum mechanics and technology?

Hmm, this is a great question! I think the biggest thing I would say about the history of quantum mechanics and technology that’s counterintuitive is that the progression in this field was/is not linear. As I found in my research, sometimes ideas would pop up in quantum physics that would advance previous theories or disprove others. Then scientists would try to work on these theories and advance them further, but it wouldn’t be until the technology caught up that many of them could actually advance. So, the progression was not always linear. In many ways, theories that were forgotten or pushed aside would also come back later and be explored thanks to better technology (such as lasers or computers). We’re still seeing this with theories like GUT that may not be advanced until we have more advanced technology, like a working quantum computer.

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CHP AND NBL&A SOCIAL MEDIA

- Niels Bohr Library & Archives
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- AIP History

Attendees listen to presentations in the historic Auditorium A of the Niels Bohr Institute. Image credit: Christian Joas.

THE EARLY CAREER CONFERENCE THAT ALMOST WASN'T—AND THEN WAS

By Joanna Behrman, Assistant Public Historian, Editor

In the Jewish diaspora, there is a tradition at the end of a Passover Seder to sing, "Next year in Jerusalem!" It's a tradition that connects individuals far across the globe. And for the past four years another song has been sung by a far-flung community:

"Next year in Copenhagen!"

After 2018's lively conference in Donostia-San Sebastian, Spain, early career historians of the physical sciences across the globe were looking forward to coming together in Copenhagen in 2020. Unfortunately, the pandemic had other plans, and the conference was pushed to 2021 … then 2022 … then 2023. The organizing committee, who'd started planning the conference when they themselves were early career scholars, earned their PhDs and moved on to new jobs. One organizer, Jeni Barton, was unable to continue on the committee, and Climério Silva Neto stepped in to take her place.

But, finally, after many years of waiting, a sunny day (actually it was a bit rainy) dawned in Copenhagen and the Fifth Early Career Conference for Historians of the Physical Sciences began.

The theme of the event, "Crossing Borders and Fostering Collaborations," seemed to achieve some resonance at the conference. It was originally chosen back in 2020 as something which might inspire people on their presentations but also be so broad that no one could conceivably feel left out. The theme harmonized with the talk from our keynote speaker, Dr. Simone Turchetti, an expert on international scientific collaborations who spoke about the International Geophysical Year and its connections to colonial legacies. His talk also crossed borders through the ether,

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as it was the first time at an Early Career Conference (ECC) that the keynote was live-streamed as part of the Lyne Starling Trimble History of Science Public Lecture Series. And, of course, the conference theme was a direct reference to the twenty-eight participants themselves, who came from fifteen different countries and four different continents.

Besides bringing the ECC keynote lecture to our Trimble audience, there were several other firsts for the conference. This was the first ECC to have its own conference hashtag: #AIPECC23. It was the first ECC to have a group presentation. And it was the first ECC to collaborate extensively with the Inter-Union Commission for the History and Philosophy of Physics (IUCHPP). The IUCHPP sponsored the travel of multiple attendees, and the IUCHPP president, Jaume Navarro, presented the first-ever Early Career Prize for the History of Physics to Jean-Philippe Martinez. We hope the collaboration between the AIP ECC and the IUCHPP (say that three times fast) continues years into the future.

But! The most important firsts were not the organizational ones (no matter how proud I was of them as one of the organizers). The most important firsts were the ones experienced by the participants themselves. For some this was their first time at a conference or the first time presenting their research. Most had never been among such a large group of historians of the physical sciences, let alone so many early career ones. It was also quite a heady experience to conduct the conference in Auditorium A of the historic building of the Niels Bohr Institute.

The conference program was structured to maximize the opportunities for crossing paths of different scholars and fostering conversations. (See what I did there?) There were no parallel sessions, so all attendees saw all the talks and so had a common frame of reference for discussions. Every paper was part of a group of three to four papers in a session. In a session, each presenter gave their talk, followed by commentary from a senior scholar, which drew together themes of the talks. Finally, the floor opened to questions and discussion from the audience.

Almost always, we ran out of discussion time before we ran out of questions. Fortunately, the conference was liberally sprinkled with coffee breaks (themselves liberally sprinkled with Danish pastries) put together by Rob Sunderland, Freja Ganderup, and Signe Strecker. The coffee breaks were great opportunities for discussions about research and the profession of history. Early career scholars connected with their counterparts from other parts of the globe, as well as senior scholars from the Copenhagen area.

In the end, it was a miracle that there was time to squeeze in any activities outside the walls of the Niels Bohr Institute. The conference dinner was one such event, and it was certainly memorable. In another "ECC first," the conference dinner was held among roller coasters and bumper cars at Tivoli, an amusement park and pleasure garden in Copenhagen.

Sadly, a conference years in the making had to come to an end after a few days. One attendee remarked that this was the first time she had ever been disappointed—rather than relieved—for a conference to come to an end. My own emotions were fairly bittersweet. On the one hand, I felt like I could let out a breath that I had been holding essentially since before the pandemic. On the other hand, it was a great pleasure working with my fellow organizers and just thrilling to meet and talk with all the attendees. In sum, finally bringing years of work to such a successful point was wonderful.

It is therefore with hope and celebration that I can say that the conference was such a success that plans are already in the works to host the next one! Pretty soon, all around the world, early career historians will be singing:

"Next year in Brazil!"

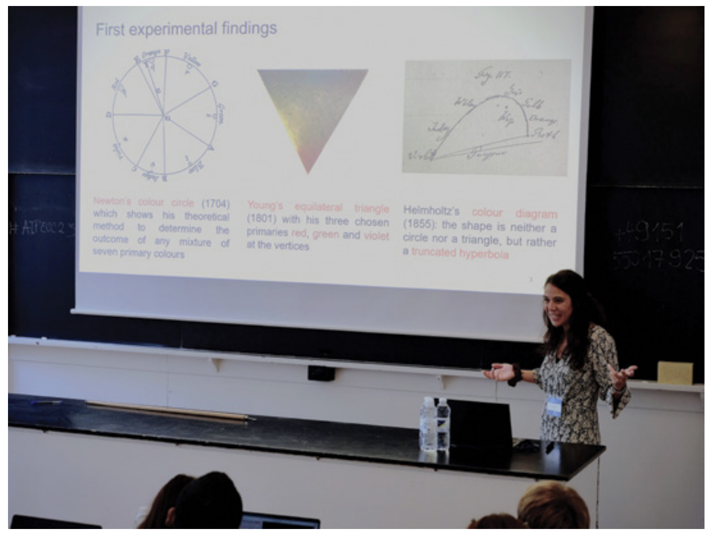
Acknowledgments: Thank you to everyone who made this conference possible, including, in alphabetical order: Jenifer Barton, Julia Bloemer, Magnus Bøe, Rebecca Charbonneau, Nathan Cromer, Freja Ganderup, Greg Good, Stephanie Jankowski, Christian Joas, Melanie Mueller, Climério Silva Neto, Signe Strecker, Rob Sunderland, and William Thomas, as well as the American Institute of Physics, the Inter-Union Commission for the History and Philosophy of Physics, and the Niels Bohr Archive.

The group photograph of the 2023 Early Career Conference for Historians of the Physical Sciences. Image credit: Christian Joas.

Members of the conference committee. From left to right: Joanna Behrman, Julia Bloemer, Climério Silva Neto, Magnus Bøe, and Rebecca Charbonneau. Image credit: Christian Joas.

Simone Turchetti gives the keynote lecture. On the chalkboard behind him is the conference hashtag: #AIPECC23. Image credit: Christian Joas.

Jaume Navarro (right) presents the Early Career Prize for the History of Physics to Jean-Philippe Martinez. Image credit: author.



Valentina Roberti gives a presentation on Helmholtz and Erwin Schrödinger's research into color theory. Image credit: Christian Joas.

Thijs Latten and Christoph Lehner converse during a coffee break. Image credit: Christian Joas.

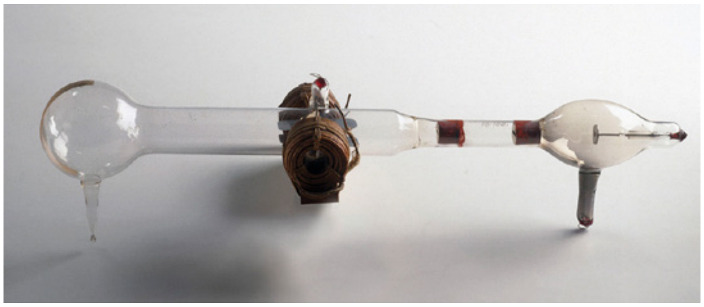
Miguel Ohnesorge, Robert Naylor, and Hiroto Kono in discussion during a coffee break. Image credit: Christian Joas.

UNSEEN CONTRIBUTORS TO ATOMIC PHYSICS

By MJ Keller, University of Rochester, 2023 Intern for Niels Bohr Library & Archives and Center for History of Physics

Everything we see, from the page these words are written on to the eyes we read them with, is made of atoms. That much—knowing that things are made up of other things—originated with the Greek philosopher Democritus (ca. 460 BC–ca. 390 BC), one of the first to postulate a theory of atomism.

Other major figures in the history of atomism include John Dalton (1766–1844), who developed the law of partial pressures and proposed that different substances are made of different atoms. Michael Faraday (1791–1867) chanced that the structure of the atom might have something to do with his field of study: electricity. J.J. Thomson (1856–1940) took his thoughts one step further and used Faraday's equipment to confirm that there are "cathode rays" (later named electrons) inside every atom. And following Thomson's laboratory studies came Robert Millikan (1868–1953), who experimentally discovered the charge of an individual electron using a microscope and charged droplets of oil. But beyond Dalton, Faraday, Thomson, and Millikan were many lesser-known individuals who were also part of atomic history. Here is a closer look at three of them.



Thomson based his thinking and experimentation on a cathode-ray tube. The one pictured here is taken from his laboratory at Cambridge University, and was used in the late 19th and early 20th centuries to conduct atomic research. Photo credit: London Science Museum.

Elizabeth Laird

Elizabeth Laird (1874–1969) was a Canadian physicist born to a minister in Ontario. Throughout her early education she excelled, finishing her studies ahead of her anticipated timeline, despite health challenges and the early death of her mother. Though she had no exposure in high school to physics, she pursued mathematics and physics at University of Toronto. A rumor circulated before her final year that a significant scholarship would be granted to an individual studying physics who showed promise for advancing science or industry. It was later decided internally that the scholarship would only be awarded to men in the department; nevertheless, Laird was already set on pursuing physics.

She received a graduate fellowship at Bryn Mawr College, along with an invitation to study in Berlin. Thus began her work alongside some of the biggest names in physics at the time, as she attended lectures given by Max Planck (1858–1947) on theories of the electromagnetic spectrum and light.

Following her time in Berlin, she returned to the United States to chair the physics department at Mount Holyoke College in 1903. There she studied radioactivity and emitted particles, but her time at Mount Holyoke was interrupted by an invitation to conduct research alongside J.J. Thomson at the Cavendish Laboratory. At Cavendish, Laird pursued research in a new direction, inspired in part by Planck's lectures. Thomson's iconic cathode-ray tubes were unused for the moment, and she took it upon herself to begin studying whether rays could propagate through solid objects. It was already known that rays emitted within the tube could imprint on a photographic plate at the end, but Laird certified that rays could still leave marks on photographic plates even if a sheet of fiber or paper was used to try to block the rays. The cathode rays, she found by spectroscopic analysis, emit X-rays weakly, showing the further reach of the electromagnetic spectrum.

After her summer in the United Kingdom, Laird returned to Mount Holyoke to continue chairing the department. In the meantime, Albert Einstein (1879–1955) received his 1921 Nobel Prize in Physics for his discovery of the photoelectric effect, the means by which excited particles are ejected from metals upon being struck by an electromagnetic ray—and the emissions included weak X-rays, such as the ones Laird studied.

This discovery would prove relevant to Laird's further research, as she took a research leave to study at the University of Chicago, further considering the emission of X-rays. In her studies she worked with soft X-ray propagation through solid objects, such as paper or thin sheets of silver foil, focusing on the effectiveness of transmission and imprinting. Soft X-rays comprise the segment of the electromagnetic spectrum between extreme X-rays, such as those emitted by stellar objects, and the upper end of ultraviolet light. This, at the time, was the cutting edge of electromagnetic and spectroscopic research and would develop into the technology now used in X-ray imaging.

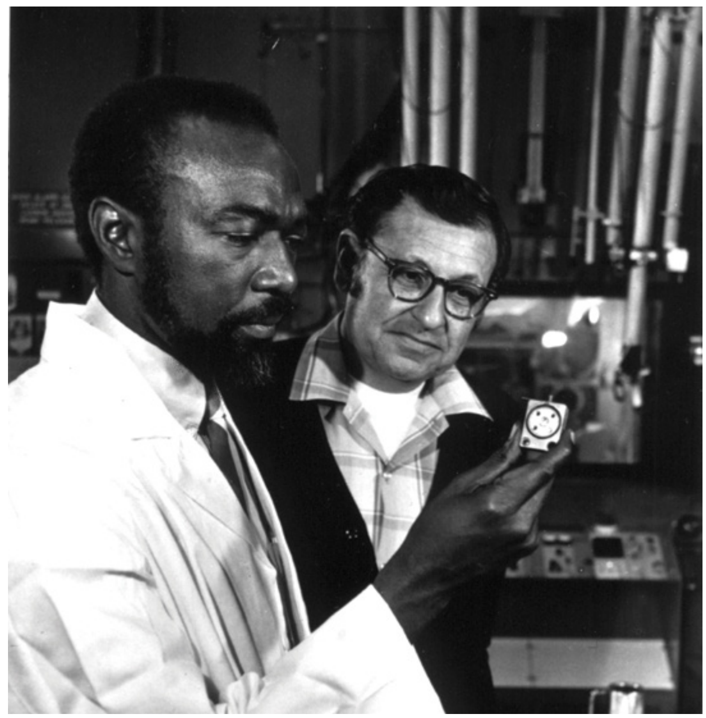
Elizabeth Laird in her laboratory at Mount Holyoke College, circa 1934. Courtesy AIP Emilio Segrè Visual Archives.

At this epoch, the atom was still thought to be a solid object, and scientific discoveries had been advancing despite the lack of firm knowledge surrounding atomic structure. Over the next two decades, the discovery of the nucleus advanced our understanding of the physical properties of the atom and allowed for an overhaul of the organization of the periodic table, leaving holes where elements were theorized to exist but hadn't been captured yet.

James A. Harris

In the race to discover the remaining "missing" elements on the periodic table, the world's premiere scientific forces sought to synthesize the unnatural elements in labs. The Lawrence Radiation Laboratory in Berkeley, California, was the United States's hub for element synthesis. In the 1940s, Glenn Seaborg (1912–1999) postulated that the missing elements from Moseley's reorganization fit into certain categories. The transactinide elements, as they were so coined, were elements with atomic numbers greater than 103—now visible at the bottom of the periodic table. They had a few prominent common features, namely, their electron structures and short half-lives, but they were only theoretical.

Physicists and chemists of the era formed tight-knit lab groups to study, and it was hard enough for established scientists to get a foot in the door. James A. Harris (1932–2000), an African American from Waco, Texas, faced additional adversities. Seeking to get involved in a White-dominated field, Harris interviewed for laboratory positions and was summarily dismissed, offered simple mathematics quizzes or positions as a janitor rather than having his chemistry degree acknowledged. Finally, he was accepted to join the Lawrence team, where he soon became one of the coleads of the project. Alongside Albert Ghiorso, Harris constructed the atomic targets—lighter elements held in place to be bombarded with particles until they fuse into heavier elements—to allow the controlled synthesis of new elements. Ghiorso handled the construction of the machinery, and together the pair and their research team synthesized four isotopes of atomic number 104, the first in the transactinide series.



James A. Harris on the left and Albert Ghiorso on the right. Courtesy Department of Energy Digital Photo Archives and AIP Emilio Segrè Visual Archives.

This would have been a success for the American effort to expand the periodic table, but a Russian lab managed to synthesize atomic number 104 and its neighbor, atomic number 105, at nearly the exact same time. After a hefty debate, the naming responsibilities for atomic number 104 were given to the Lawrence lab, and the naming rights for 105 were given to the Russian lab.

Harris became the first African American to discover an element, and the newly dubbed rutherfordium cemented his legacy on the periodic table.

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Jane Dewey

Since Marie Curie's death in 1934, few women had reached any level of prominence in the physical sciences. Jane Dewey (1900–1976) was the only woman to be counted in the "lucky generation" of physics, where discoveries in quantum mechanics were progressing at a rapid rate. Dewey was a precocious student, but, like Laird, it took her well into college to discover her niche. After attending Barnard College, she moved to the Massachusetts Institute of Technology to study physical chemistry, physics, and mathematics. Her doctoral thesis, finished in 1925, was on the search for "fragments of the atom," according to her father, philosopher John Dewey.

Jane Dewey outside the National Academy of Sciences in Washington, DC Photograph by Samuel Goudsmit. Courtesy Emilio Segrè Visual Archives, Goudsmit Collection.

After her doctorate she conducted research in Copenhagen, Denmark, with none other than Niels Bohr at the Universitets Institut for Teoretisk Fysik. Her stipend was $1,800 a year for three years, amounting to over $30,000 per year in today's dollars. She spent her time with Bohr, Werner Heisenberg, and Arthur Compton studying atomic theory through spectroscopic methods, searching for chemicals within known compounds that had been missed up to that point. Her work thus focused on quantum chemistry, specifically, the manner in which light waves and chemicals interact.

During her time with Bohr's research group, Dewey gave lectures to the team on wave mechanics. According to Dewey, her lectures went far over their heads, as many of the other researchers knew little about wave dynamics. Nevertheless, she lectured not just with Bohr but beyond, as a quantum and wave mechanics lecturer in the applied optics department at University of Rochester.

Despite being one of the most promising scientists of the time, Dewey ran into significant struggles gaining lecture opportunities, research positions, and jobs, repeatedly fully giving up scientific research to travel with her father or seek secretarial work. Though she faced adversity at every turn, Dewey's work with quantum chemistry influenced Bohr's atomic theory, including some of its failures and contradictions surrounding electron orbits.

Where atomic theory will go next, no one knows for certain. Discoveries can come from unexpected quarters, and are—just as often as not—made by people unheard-of at the time. To learn more about the evolution of atomic physics and encounter more individuals with groundbreaking and underappreciated work, see the "Evolution of Atomic Theory" teaching guide at **aip.org/history-programs**.

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JAPANESE SCIENTISTS AT THE JUNCTION OF PHYSICS AND CHEMISTRY

By Hiroto Kono, Curator, National Museum of Nature and Science, Tokyo

"For want of a better name, since Physical Chemistry is already preempted, we may call this common field Chemical Physics" —John Clarke Slater (1900–1976) wrote in the preface of *Introduction to Chemical Physics*, the book in which he attempted to give a unified presentation of this "common field" of physics and chemistry. With the advent of quantum theory, "there is really nothing separating them any more" (Slater 1939, p. v). Slater's overconfidence notwithstanding, the intensifying interest in matter during the first half of the twentieth century did lead physics and chemistry to cross paths, opening up horizons for a new science. But as Slater's "chemical physics" exemplifies, the naming of this new science can be arbitrary and context dependent.

This is also the case with *Busseiron* in Japan. The term literally means the study of substances—*butsu* as substance or matter, *sei* as property or character, and *ron* as theory or discourse. First used mainly in the context of education in the mid-nineteenth century, the term was adopted to represent the new research field of matter in the early 1940s. The field has since developed rapidly to become one of the largest subdisciplines of physics in Japan, and through institutions like *Bussei Kenkyūjo* (Institute of Solid State Physics, ISSP)—a national joint research institute established at the University of Tokyo in 1957—its namesake has also earned broader recognition and eventually gained authority as a discipline. The fact that Japanese scientists end up keeping this term that originated from their own intuition rather than opting for a direct translation from disciplines of a similar nature, i.e., solid-state and condensed matter physics, quantum chemistry, chemical physics, etc., testifies to a development of the discipline unique to Japan.

This uniqueness, together with the status the field has acquired, surely warrants a comprehensive historical analysis of *Busseiron*. Though its history has indeed not gone unnoticed, yet compared with the history of nuclear and particle physics in Japan, our knowledge of this discipline is still largely limited to lists of research topics compiled from a small number of participating physicists' reminiscences. Only Atsushi Katsuki, a physicist turned historian of physics, has made substantial efforts to systematically document the history of *Busseiron* by conducting interviews with physicists as well as collecting and preserving primary sources. However, Katsuki's choice of English translation for *Busseiron* suggests that he might have mistaken solid-state physics for the entire Japanese discipline, possibly because of certain overlaps between the two. As a result, Katsuki's findings, as published both in Japanese and English (Katsuki 1997), are at best a partial history of *Busseiron*.

My research project thus aims at a more complete picture of the development of *Busseiron*, and it has benefited a great deal from the AIP's Grants in Aid program.

My study on *Busseiron* started with an interest in the experience of a young student of physics around 1940—Ryogo Kubo (1920–1995). Kubo would later become a leading figure in theoretical physics and develop the general formula of the linear response theory, which was named after him. In the early 1940s, during the early days of *Busseiron*, Kubo was in his early twenties and took an interest in this burgeoning field. I had the fortune to gain first-hand access to the materials Kubo left behind, thanks to the keen preserving efforts of his family and his disciple Kazuo Kitahara, who kindly let me take over and organize them into an archive (Kono et al. 2019), and from there my research found momentum.

By examining Kubo's unpublished materials and published papers in the early 1940s, I was able to identify two distinct interests from his: statistical mechanics and solid-state physics (or electron theory of solids) (Kono 2020). In statistical mechanics, Kubo worked on several topics, for example, melting and rubber elasticity, using the method of eigenvalue. In the electron theory of solids, Kubo explored nonequilibrium phenomena such as high-frequency resistance. He was also made part of a wartime research program on "noctovision," in which he mainly worked on semiconductors photoemission.

Kubo's unpublished manuscripts also manifest his fondness of problems in physical chemistry. In a manuscript entitled "Polarization of the Dipole Gases," he came up with a statistical approach to a model of dipole gases and compared the result with that of his elder brother Masaji Kubo (1911–1994). Masaji

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had studied at the chemistry department of the Tokyo Imperial University, where the study of physical chemistry was an ongoing tradition and was at the time practiced by leading scholars in the field, like San-ichiro Mizushima (1899–1983). Through Masaji, Ryogo was likely influenced by this tradition.

By chance, my biographical study of Kubo had the opportunity to develop into an exhibition at the Komaba Museum of the University of Tokyo to celebrate the centenary of his birth. (The exhibition was delayed to 2021 due to the COVID-19 pandemic). Titled "Intrigued by *Genri no Gaku* [the learning of principles]—The research and life of Ryogo Kubo," the exhibition highlights, among other things, the friendship between Kubo and Nobel laureate Philip W. Anderson (1923–2020). Organizing this exhibition in turn helped me find a job and the Kubo archive a new home at the National Museum of Nature and Science, Tokyo, and further preservation and research work are now conducted at its Tsukuba site.

From left to right: Ryogo Kubo, Philip W. Anderson, Kei Yoshida, and Sadao Nakajima. The picture was likely taken at the International Conference of Theoretical Physics in Japan in September 1953 and annotation in Kubo's album. The Japanese sentence "eraku bureta" means "terribly blurred." Courtesy of the Kubo family.

This new environment has allowed me to follow Kubo's foray into *Busseiron* and immerse myself in the discipline's history (Kono 2022). Two sources may be considered as symbolizing the emergence of *Busseiron* as a research field: a survey in 1942 by Hidetosi Takahasi (1915–1985) of recent research in Japan of what he summarized as *Bunshironteki* [molecular theoretical] *Busseiron*, and the program of the first colloquium dedicated to *Busseiron* held in 1943. Both suggest that research under *Busseiron* at the time mainly attempted to explore macroscopic properties of matter by treating objects as systems composed of elements with degrees of freedom—like atoms, molecules, or spins—and their interactions, and applying the tools of statistical mechanics to them. Interestingly, at this early stage the new field scarcely entailed any inquiry into the electron theory of solids, though as Katsuki's later misconception indicates, solid-state physics appears to be the natural field in which to find correspondence to *Busseiron*.

Instead, I have found a closer connection between *Busseiron* and physical chemistry, or what Slater felt compelled to call chemical physics. Mizushima, the teacher of Masaji Kubo, gave a talk on molecular structure and entropy of rotational isomers at the 1943 colloquium and drew attention. Meanwhile, several problems addressed by the physicists at the colloquium were also discussed in the context of chemical physics, such as the phase transitions of NH_4Cl, on which chemist Linus Pauling (1901–1994) had published his theory in *Physical Review* in 1930, and those of KH_2PO_4, on which Slater had published his research in *Journal of Chemical Physics* in 1941. *Busseiron*, as a study of matter, was indeed at the cross-section of physics and chemistry, despite its lack of certain topics like the electron theory of solids for the time being. This would not last long, as my preliminary findings show, now that I am moving forward to the discipline's later development.

After WWII, it was only a matter of time before Japanese scientists were reengaged in international exchanges, and thus an international perspective became essential to my research. This is the area in which the AIP's Grants in Aid program proved particularly helpful. Sponsored by the program, I have managed to investigate several invaluable primary sources at the Niels Bohr Library & Archives. The papers of historian Lillian Hoddeson (No. AR 2010-984) contain materials related to her group's brilliant work on the history of solid-state physics (Hoddeson et al. 1992) and even communications with Japanese researchers like Katsuki. The correspondence of Roman Smoluchowski (No. AR 164) is of great help in understanding the complicated process of forming the division of solid-state physics of APS, as already illustrated by historian Joseph D. Martin (Martin 2018). The correspondence of Henry A. Barton (No. AR 2001-198) sheds light on how the *Journal of Chemical Physics* was operated in the APS, and since there was also a dedicated journal of *Busseiron* in Japan, which was run by physicists yet addressed problems in chemical physics, a comparison might generate some interesting insights.

Though my research on the history of *Busseiron* is still ongoing, there are certain aspects of the discipline that have already left a strong impression on me. For instance, I am constantly reminded that disciplines are historical entities whose roots must be sought in their specific contexts and that the formation of each is a social process. With the help of the AIP's Grants in Aid program, I look forward to sharing more findings in the future.

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THE BALANCING OF BICYCLES

By Audrey Lengel, Adult Services Librarian at the Cambridge Public Library and Former NBL&A Digital Collections Manager

This article was inspired by an episode of the Vox podcast *Unexplainable* that was released in the beginning of this year that I still haven't stopped thinking about. (Thank you to the *Unexplainable* team, who provided some of the references used in this article and who have used resources from our library and archives in previous episodes of their show.)

In this 30-minute episode, titled "Unexplainable or Not: Bikes, Planes, Ice Skates," hosts Noam Hassenfeld, Meradith Hoddinott, and Brian Resnick quiz guest and fellow journalist Avery Trufelman on three scientific mysteries (*Unexplainable* 2022). Trufelman has to guess which mystery has recently been solved, and which two mysteries remain unsolved. The mysteries in question include

1. We do not understand how air turbulence in our atmosphere works.
2. We do not understand why the surface of ice is slippery.
3. We do not understand how bikes self-stabilize.

I won't give away the entire episode for you, but I will tell you that one of the unexplained mysteries of science is item number 3—we really *can't* figure out why bicycles balances so well! Understanding this phenomenon, known as self-stability, has evaded scientists for centuries.

In 1970, David Jones's *Physics Today* article titled "The Stability of the Bicycle," and more recently, Kooijman et al.'s *Science* paper helpfully titled "A Bicycle Can Be Self-Stable Without Gyroscopic or Caster Effects," formally debunked the leading theories of both the gyroscopic effect and caster effects as the single rationales for bicycle balance. You can see an example of the 2011 research group's bicycle that shows self-stabilization even when the caster effect is negated in a video released by the team (Schwab 2011).

The reason why bicycles self-stabilize? Well … for now it's unexplained (or at least very complicated) and the scientific community will have to keep researching.

It delights me, but also scares me, that a form of transportation that dates back to the eighteenth century, which is used by hundreds of thousands of Americans to commute to work (Burrows 2019), still is the subject of ongoing research. The beauty of the world we live in is that there will always be more questions to be investigated and answered.

Inspired by the mystery of the bicycle, here are some photographs from our archives showing a bunch of scientists from the past who were too busy riding bikes to investigate the dynamics of the bicycle itself!

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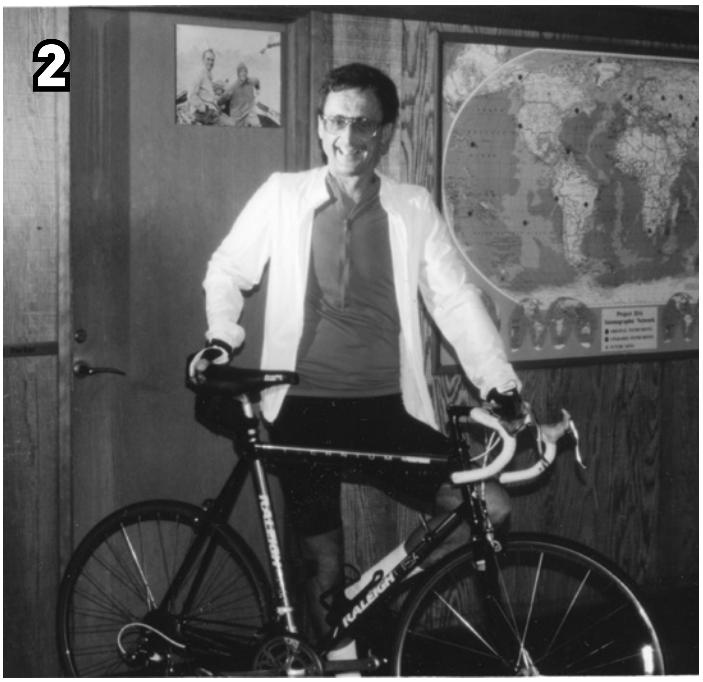

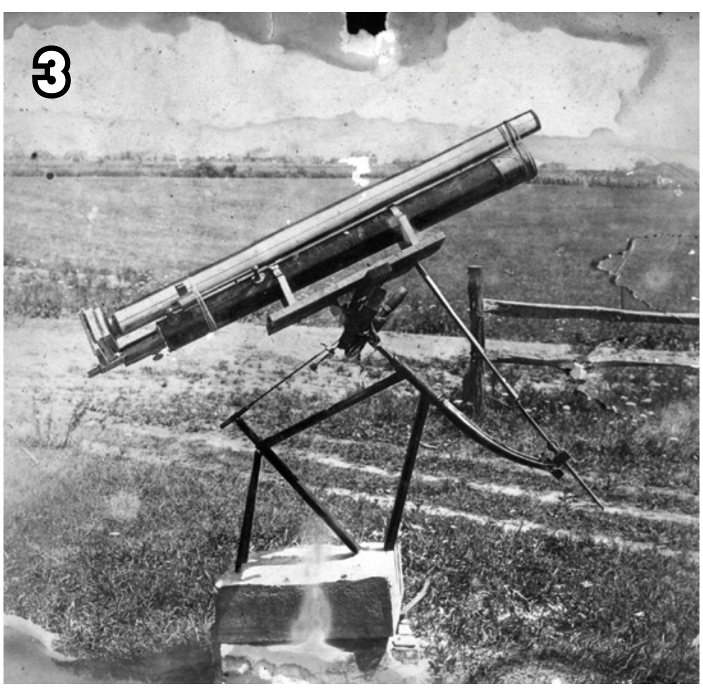

Figure 1. Overhauser Albert, G1. Image credit: AIP Emilio Segrè Visual Archives, Overhauser Collection, Gift of Dr. Overhauser.

Albert Overhauser (yes, the namesake of the Overhauser effect) and his family demonstrate that biking is for kids and adults of all ages!

Figure 2. Parker Robert, B1. Image Credit: AIP Emilio Segrè Visual Archives, American Geophysical Union (AGU) Collection.

Geophysicist Robert L. Parker was, in his own words, a "serious recreational road cyclist" (Parker n.d.). He's shown here with his road bike.

Figure 3. Wood Robert Williams, F4. Image credit: AIP Emilio Segrè Visual Archives.

This image, credited to Robert Williams Wood, was a mystery to me, until I got my hands on a copy of William Seabrook's *Doctor Wood: Modern Wizard of the Laboratory*:

> "In the summer of 1909 Mars was in opposition, and all the astronomers were on tiptoe. Wood took out the six-inch lens of his big spectroscope at East Hampton and mounted it on a block of cement on the lawn in front of his laboratory door. A silvered mirror reflected the light of the red planet through the lens and thence to an eyepiece forty feet away, at the back of the dark laboratory, where he viewed the magnified image of the planet while lying comfortably on the floor on an old mattress. During this same summer he resumed his experiments on photographing the moon in ultraviolet light…" (Seabrook 1941).

Robert Wood then took this spectroscope mounted on cement to a new level, as described in a 1910 paper published in the *Monthly Notices of the Royal Astronomical Society*: "The preliminary experiments were made at my summer laboratory… with an improvised instrument made out of odds and ends…" He attached a 6-foot photographic telescope made with a quartz lens to an iron stovepipe with a photographic plate holder on one end, and then attached all of that to a 5-foot astronomical telescope that could follow the moon over the three minutes needed to expose the photograph. "Both were attached to an equatorial mounting made of an old bicycle frame embedded in a block of cement, the steering axis pointing to the pole star. A slow motion enabled me to make exposures of several minutes if necessary" (Wood 1910).

You can view the photographs of the moon and results of this labor in the above-mentioned paper. And if you'd like to make your own, luckily Dr. Wood published some instructions (Wood 1909)! For more information on Wood, who was quite the character, I highly recommend Joanna Behrman's *Ex Libris Universum* blog post from last April: "Pipes, Poems, and Physics: The Life of R. W. Wood" (Behrman 2022).

Figure 4. Curie Pierre, C7. Image credit: Photo from Laboratoire Curie, Institut de Physique Nucleaire, courtesy AIP Emilio Segrè Visual Archives.

Pierre and Marie Curie in Sceaux, outside Paris, in 1895, with bicycles they purchased with gifts from their recent wedding. The Curies often enjoyed long bike rides together (Pasachoff 2000).

Figure 5. Weisskopf Victor, C6. Image Credit: AIP Emilio Segrè Visual Archives, *Physics Today* Collection, Gift of Jost Lemmerich.

Victor Weisskopf, Maria Goeppert Mayer, and Max Born bike riding together. Although the date is unknown, it's likely that this photograph was taken in Göttingen while Weisskopf and Mayer were students under Max Born's guidance.

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National History Day parade.
Credit: Corinne Mona

FRONTIERS IN TRANSISTORS AND AVIATION: NATIONAL HISTORY DAY

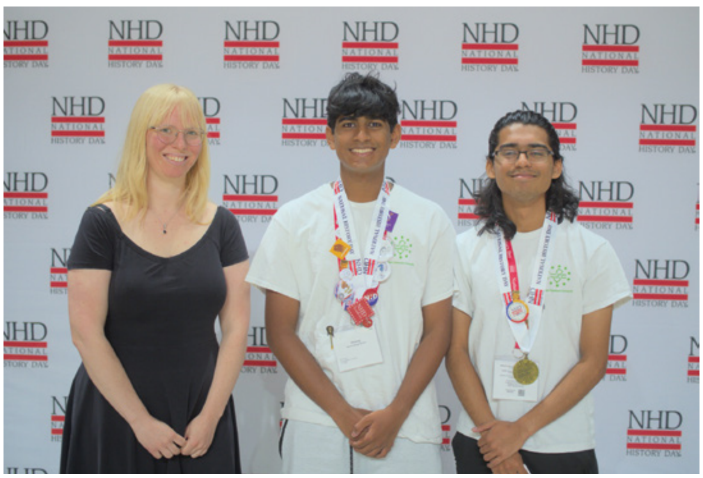
By Corinne Mona, Assistant Librarian

After four years of online ceremonies, it was a true pleasure to witness the exuberant festivities that are National History Day. The title "National History Day" is a bit deceiving; NHD is not one day, but a whole school year's worth of research, work, and local contests. Middle and high school students across the US and several countries outside the US choose a topic that fits a theme, and work under the guidance of a mentoring teacher (usually a history teacher) to develop a project that they then submit to local contests, and finally the national contest.

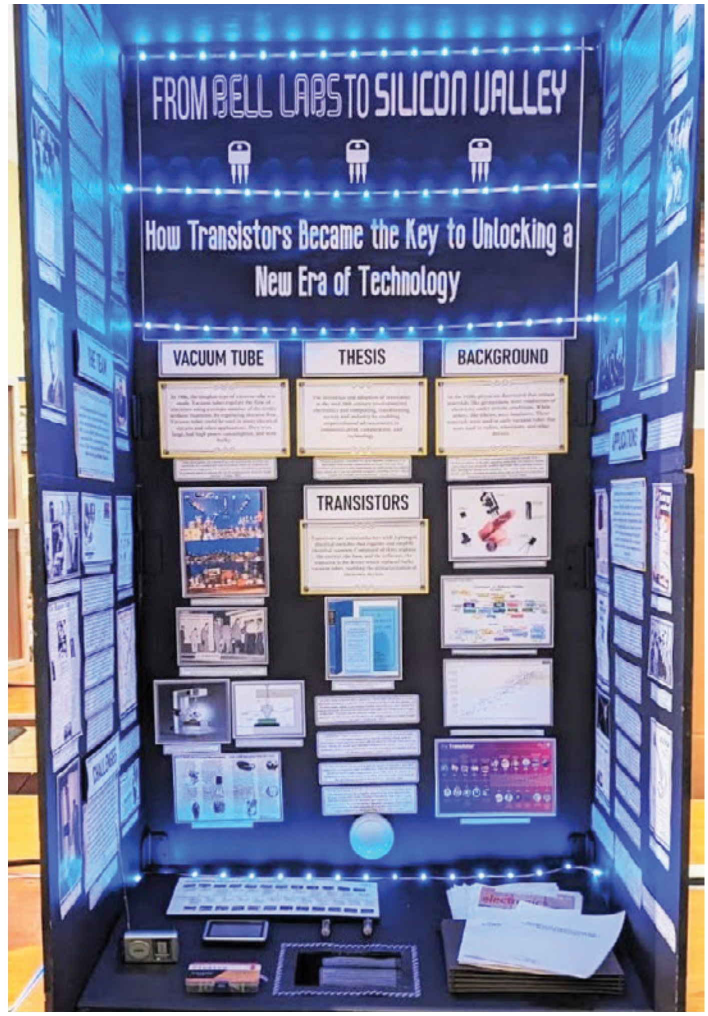
I had the privilege of attending the 2023 National Contest awards ceremony, which was held on June 15 at the giant Xfinity Center at the University of Maryland, which boasts a capacity for 17,950 people. The energy was, in a word, hype. For an hour before the award ceremony began, students and teachers walked, galloped, strutted, and sauntered on the main floor in groups representing their states or countries to the melodious strains of John Philip Sousa's "Stars and Stripes Forever" march on repeat. (A classic march if there ever was one, but there are more marches!) I witnessed banners with state animals, flags, and flowers, inflatable dinosaurs, beach balls, students on each others' shoulders, matching T-shirts, students hitting each other with inflatable bats, and lots of smiles. After the parade, students, teachers, and NHD fans sat in sections organized by region. When a winner from that region was announced, the whole section cheered energetically. Then the awardee got to jog down from the bleachers and across the main floor to the presentation stage on the other side of the auditorium, where they shook hands with several NHD representatives, including myself for our sponsored prize, had a medal placed over their heads, and then took a picture. After four years of online ceremonies, it was a treat to experience.

I got to very briefly meet the winners of our sponsored prize, the History of the Physical Sciences and Technology Prize, which falls in the Special Prize category. Our prize lent itself very nicely to

Junior prize photo with (L-R) Corinne Mona, Grace McWilliams, and Genevieve (Evie) Petersen. Credit: NHD.



Senior prize photo with (L-R) Corinne Mona, Dheeraj Menon, and Deepak Menon. Credit: NHD.



Deepak and Dheeraj Menon's exhibit, "From Bell Labs to Silicon Valley: How Transistors Became the Key to Unlocking a New Era of Technology." Photo courtesy of Deepak Menon.

the NHD theme of the year, which was "Frontiers in History: People, Ideas, and Events." In the senior division, Deepak Menon and Dheeraj Menon won with a slightly rarer category, a Physical Exhibit. One goal in choosing their topic was to highlight a piece of history from their native New Jersey, and they learned that the transistor was made at Bell Labs in New Jersey. Their exhibit title was "From Bell Labs to Silicon Valley: How Transistors Became the Key to Unlocking a New Era of Technology." Deepak and Dheeraj were able to visit the labs at the Bell Labs Museum and talk with historians there.

In the junior division, Genevieve Petersen and Grace McWilliams took home the prize with their website, "Pan Am: Frontiers in Aviation." I learned that Genevieve, who goes by Evie, has family connections to Pan Am and grew up hearing stories about the airline. Her thank you note arrived at NBL&A on a Pan Am note card. From their website, I enjoyed learning that Pan Am truly paved the way—literally, as they built new airports and presumably, runways—for international flights as we know them today, in addition to being important to advances in aviation technology and international relations. Indeed, there was a time when the Pan Am station chief was as important to international business people as the American embassy. Check out the website at **https://62902465.nhdwebcentral.org**.

From their conclusion:

> *"Shrinking the world for six decades, Pan Am established new aviation frontiers despite encountering political and economic opposition. By building crucial airports and infrastructure, establishing aviation standards, international diplomacy, and technical advancements, Pan Am frontiered the aviation industry we know today. The Pan Am legacy lives on as the airline that transformed the world."*

CAPTURING THE STARS: THE UNTOLD HISTORY OF WOMEN AT YERKES OBSERVATORY

By Kristine Palmieri, Postdoctoral Researcher, Institute on the Formation of Knowledge, The University of Chicago, and Andrea Twiss-Brooks, Director of Humanities and Area Studies, The University of Chicago Library

Women contributed to the advancement of astronomy and astrophysics at Yerkes Observatory in the early twentieth century. They were not only calculators or assistants. They earned degrees, conducted their own research, collaborated on projects with peers of both sexes, worked on publications, and went on to have a variety of careers both within and beyond the sciences. Yet their stories have remained untold—until now.

Free and open to the public at the Joseph Regenstein Library through December 15, 2023, the exhibition *Capturing the Stars: The Untold History of Women at Yerkes Observatory*, explores the astronomical work and lived experiences of the women who contributed to research at the Yerkes Observatory. As cocurators of the exhibition, we tell this story using letters, books, journals, photographs, astronomical glass plates, and scientific tools from the University of Chicago Library's Hanna Holborn Gray Special Collections Research Center, as well as materials borrowed from Yerkes Observatory, Lowell Observatory, and the Adler Planetarium. In so doing, we also foreground the ways in which Yerkes Observatory was an unusually welcoming place for women and the role communities play in the advancement of both science and individual careers.

Among the women featured in the exhibit are Jessie M. Short, Evelyn W. Wickham, Vera M. Gushee, Harriet M. Parsons, Dorothy W. Block, and Alice H. Farnsworth. All were graduate students at the University of Chicago in the period 1916–1920 and participated in a wide range of activities during their time at the observatory. More information about these women can be found in a forthcoming article in *Physics Today* by Dr. Palmieri.

The scope of this labor is partially described in a letter from observatory director Edwin B. Frost to Wickham's mentor Caroline Furness, the Alumna Maria Mitchell Professor of Astronomy at Vassar College and director of the Vassar Observatory. As he explained, at Yerkes, Wickham would "give half time to computing and the other half to regular work as graduate students at the observatory thus having an opportunity to work in spectroscopy, stellar photography, photographic and visual photometry, and other lines of work which we undertake here" (Frost 1916). This arrangement suited Wickham in large part because it would enable her to earn a master's degree in a single academic year. She graduated from the University of Chicago in 1917 with a thesis titled "Investigation of Spectrograms made with Different Dispersions for Detection of Systematic Error." University of Chicago Convocation Catalogues are available online at **https://campub.lib.uchicago.edu**.

Further light is shed on the scope of Wickham's work by a recommendation letter sent by Frost on her behalf for a position in the engineering lab at AT&T—which she got! As he reported, "She has been with us nearly three years, as graduate student and computer in stellar spectroscopy, and has meanwhile taken her degree of Master of Science. She is an efficient and accurate computer. I think she is well qualified for your work. She has also been an observer, using the large telescope, and thus has gained experience in handling instruments and making delicate measurements. We shall be sorry to lose her" (Frost 1919). This letter is on display in the exhibit.

Also on display are multiple items curated by University of Chicago students. These contributions were part of the final projects that students prepared for a class, Capturing the Stars: Exhibiting the History of Women at Yerkes Observatory in Early Twentieth-Century America, which Dr. Palmieri taught in winter 2023. These include a machine for measuring spectra and Harriet Parson's master's dissertation, "The Photo-Visual Magnitudes of the Stars in the Pleiades," as well as multiple letters, a postcard send by Anne S. Young and Emily E. Dobbin to Yerkes following their visit to the Paris Observatory in 1910, and a historical reproduction of the dress worn by Vera M. Gushee in one of the university's archival photos. In the seminar, students not only learned about the history of women in science and the history of astronomy and astrophysics, but they also participated in exhibit development. Through class discussions about different kinds of labor, the allocation of research credit, and arguments about what counts as "science," the students helped refine and develop the learning goals of the exhibit, while also exploring how societal norms and cultural expectations of the early twentieth century deeply shaped the lives and experiences of the Yerkes women.

This exhibition is presented by the University of Chicago Library with additional generous support from the University of Chicago Women's Board, the John Crerar Foundation, and the Kathleen and

Howard Zar Science Libraries Fund (University 2023). The ongoing work of the Capturing the Stars Research Group, an interdisciplinary research program at the University of Chicago investigating the history and science of Yerkes Observatory, is funded by the Neubauer Collegium for Culture and Society at the University of Chicago (Neubauer).

References

- Frost, Edwin B. to Carline Furness, April 27, 1916. University of Chicago. Yerkes Observatory. Office of the Director. Records [Box 66, Folder 6], Hanna Holborn Gray Special Collections Research Center, University of Chicago Library.
- Frost Edwin B. to Miss Marion McCracken, May 23, 1919. University of Chicago. Yerkes Observatory. Office of the Director. Records [Box 76, Folder 2], Hanna Holborn Gray Special Collections Research Center, University of Chicago Library.
- Neubauer Collegium for Culture and Society. Capturing the Stars: Women's Networks and the Advancement of Science at Yerkes Observatory, 1895–1940. **https://neubauercollegium.uchicago.edu/research/capturing-the-stars#summary.**
- The University of Chicago Library. "Capturing the Stars: The Untold History of Women at Yerkes Observatory." August 23, 2023. **https://www.lib.uchicago.edu/about/news/capturing-the-stars-the-untold-history-of-women-at-yerkes-observatory.**

Top image: Yerkes Observatory staff, 1916, from left (back row): Helen N. Davis, Max Petersen, Clifford Crump, Frances Allen; (front row): Evelyn W. Wickham (MS 1917), Harriet M. Parsons (PhD 1921), Anne S. Young, Alice Hall Farnsworth (PhD 1920), and Inez Wendell. Credit: University of Chicago Photographic Archive, apf6-00399, Hanna Holborn Gray Special Collections Research Center, University of Chicago Library.

Graduate student Vera Gushee (MS 1917) (left) and stenographer Elsie Johns (right), who had just completed her undergraduate studies at the University of Chicago, standing in front of Yerkes Observatory (1916). A replica of Gushee's dress, made by undergraduate student Raquel Buriani (class of '25) is currently on display as part of the exhibit. Credit: University of Chicago Photographic Archive, apf6-04188, Hanna Holborn Gray Special Collections Research Center, University of Chicago Library.

THE PRESENT, PAST, AND FUTURE OF HISTORY AT AIP

By William Thomas, Spencer Weart Director of Research in History, Policy, and Culture

William Thomas is the new Spencer Weart Director of Research in History, Policy, and Culture. Image credit: AIP.

There were some big changes this past summer here at the Center for History of Physics — and for AIP more broadly.

In the last issue of the Newsletter, AIP CEO Michael Moloney wrote about the completion of the work of the Blue-Ribbon Panel to Envision the Future for AIP's History, Library, and Archives Programs. Informed by the panel's report, Dr. Moloney and other AIP leaders decided to reconfigure the directorship of the Center for History of Physics so that its title is now the Spencer R. Weart Director of Research in History, Policy, and Culture. The directorship is also now a key position within a newly integrated operational unit known as AIP Research, which will be led by a chief research officer with the goal of enabling vibrant, well-grounded conversations connecting the past, present, and future of the physical sciences enterprise.

AIP launched a search for the director position in July, and I'm excited to have taken on the role as of August 30. I'd like to thank Niels Bohr Library & Archives director Melanie Mueller for serving as interim director of the History Center and historians Joanna Behrman and Jon Phillips for keeping the Center going since Greg Good's retirement.

My own journey in the history of science began almost a quarter-century ago, when I was studying physics as an undergraduate at Northwestern University but found I had a stronger aptitude for history, something I had not previously thought of as a career option. However, I was encouraged to make the leap into the humanities when I learned that the history of science was a thriving specialty that would not require me to abandon my interest in science. I started by writing a junior-year thesis under the supervision of Holocaust historian Peter Hayes on Werner Heisenberg's experiences in the Nazi era. I then wrote a senior thesis on the origins of the field of operations research, working with Ken Alder, who is known for his writing on science and technology in Revolutionary France.

In 2002 I joined the history of science department at Harvard University as a PhD student of the historian of modern physics

Peter Galison. I decided to extend my undergraduate thesis work for my dissertation, which I finished in 2007, and it became the basis of a book I published in 2015 with MIT Press called *Rational Action: The Sciences of Policy in Britain and America, 1940–1960*. After finishing my degree, Spencer Weart hired me as AIP's associate historian, a rotating three-year postdoctoral position. Aside from working on my book, I undertook two new projects, one on the history of glaciology in Antarctica, and another to develop a web-based resource on the historical US physics community, later adopted and adapted by NBL&A as the Physics History Network.

Once my AIP postdoc concluded in 2010, I took on another three-year role at Imperial College London's Centre for the History of Science, Technology, and Medicine (which has since moved to King's College London), and then I worked for three years for a Maryland-based company called History Associates, doing history projects on contract, most of which were in the science and technology area. I returned to AIP in 2016, working up until now on the team at *FYI*, our science policy news service. For those unfamiliar, *FYI* is sent by email for free to about 10,000 subscribers, providing updates and analysis of developments in Congress and federal science agencies, and it is also available online at **www.aip.org/fyi.**

My experiences in science policy have been eye-opening. As an academic historian, publishing is a relatively rare event, and, unless one targets a popular audience — and is successful in doing so — one's readership tends to be very small. By contrast, *FYI* regularly lands in the inboxes of scientists and officials across the government, in the national labs, and academia, and we often hear from our readers about how valuable they find our work. It's clear there is a real demand for detailed, well-vetted information about changes in the scientific enterprise.

It has also become clearer to me how valuable it is to study the past to understand the present, as well as how important it is to actively steward knowledge of the present into becoming an enduring and accessible record.

Every situation that scientists (and indeed all of us) deal with in the present is the outcome of innumerable decisions made in the past. Typically, placing current events in context requires at least some knowledge of the past decade or two, but it is not uncommon for conditions from the more distant past to have a bearing on the present. If we are, for instance, trying to understand why we do things the way we do, a detailed understanding of the past can help us determine if it is because of some forgotten wisdom, if it was never sensible to begin with, or if circumstances have changed and it is time for a rethink. The past can also provide us with a much richer storehouse of examples than the present can for drawing comparisons and contrasts around the situations we face.

At the same time, I am constantly amazed at the sheer complexity of just the present. Reporting responsibly and insightfully on science policy requires an almost encyclopedic knowledge of agencies, programs, projects, leaders, budgets, and rules and statutes that it has taxed the *FYI* team to achieve. And that is just for science policy in the United States, never mind all the activities of the global physical sciences enterprise! It is daunting to think about how all of this knowledge could ever be preserved and consolidated so that it could be useful to people in the future, and more daunting still to imagine recovering it later if it is not carefully preserved and consolidated right now.

Building a more usable historical record is, in some sense, the challenge that confronts me in my new role, and choosing a sensible strategy is a task of paramount importance. When I was serving last year as AIP's staff coordinator for the Blue-Ribbon Panel, I had the opportunity to learn more about our own history, and it is comforting to know that AIP has confronted this challenge in the past as well.

The History Center's origins trace back to a project AIP pursued on the advice of a committee chaired by physicist-historian Gerald Holton to gather source material on the history of "recent physics." That project and a parallel effort led by philosopher Thomas Kuhn to obtain materials related to quantum mechanics were pursued out of a concern that the field of physics was going through a period of extraordinary change and that little care was being taken to preserve the history of that time. Those early efforts focused on encouraging archival preservation and recording oral histories, making it possible for future scholars to conduct research.

Over subsequent decades, AIP remained committed to that work, particularly through the leadership of NBL&A director Joan Warnow-Blewett, who conducted a series of what were called "documentation studies." History Center directors and associate historians contributed to the task, with the first director, Charlie Weiner, doing groundwork on nuclear physics and Spencer Weart collaborating on an effort focused on condensed matter physics. Associate historian David DeVorkin laid foundations for the history of astrophysics and went on to become a renowned scholar in the area, and Ron Doel followed a similar trajectory in Earth science.

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I think the current task is somewhat different. It is possible to accumulate sources for research without necessarily accumulating knowledge. There are areas where historians have done excellent work in transforming sources into knowledge, such as with the materials on quantum mechanics that Kuhn and his colleagues gathered. There are also many areas, including in very recent history, where few historians work but where scientists themselves might find the greatest value. In both cases the question is, How do we build resources that make it as easy as possible to learn about history, to navigate through the record, and hopefully to make good use of it?

My predecessors have given us clues as to how to answer these questions. Spencer Weart saw the potential of the internet very early on, and his Discovery of Global Warming website remains among the most-consulted corners of the AIP website. Greg Good was very active in building up a cohesive global community of scholars of the history of the physical sciences, and one of his main initiatives, a conference for early-career historians, held its fifth iteration in Copenhagen just days after I took on this job.

We're going to need a strong community effort for AIP's work in history to rise to the occasion over the coming years, not just from historians, but also scientists, administrators, policymakers, and many others. I hope that you will be inspired to contribute, such as by making donations through the AIP Foundation, by participating in our programs, by being in touch with us, and, of course, by finding any ways that you can to add to the conversation.

(Clockwise from left): Spencer R. Weart, Paul Hoch, Jerome Rowley, Ernest Braun, Jurgen Teichmann, Michael Eckert, Peter Galison, and Lillian Hoddeson converse at the History of Solid State Physics Meeting. Credit: Department of Physics, University of Illinois at Urbana-Champaign, courtesy of AIP Emilio Segrè Visual Archives.

DOCUMENTATION PRESERVED

Compiled by Chip Calhoun, Sam Holland, Max Howell, and Audrey Lengel

Our report of new collections and new finding aids is based on our regular survey of archives and other repositories. Many of the collections are new accessions, which may not be processed, and we also include previously reported collections that now have an online finding aid available.

To learn more about any of the collections listed below, use the International Catalog of Sources for History of Physics and Allied Sciences at libserv.aip.org. You can search in a variety of ways, including by author or repository.

Please contact the repository mentioned for information on restrictions and access to the collections.

NEW COLLECTIONS

Brown University. The John Hay Library. University Archives. Providence, RI 02912, USA

Zenas R. Bliss papers. Collection dates: 1952–1966. Size: 21.5 linear feet.

Richard Dobbins research papers. Collection dates: 1970–2009. Size: 6 linear feet.

Maurice Glicksman professorial files. Collection dates: 1958–1971. Size: 6 linear feet.

Inner City Teachers of Science Program records. Collection dates: 1964–1977. Size: 4.25 linear feet.

Joseph John Loferski papers. Collection dates: 1965–1985. Size: 6.25 linear feet.

Philip Rieger papers. Collection dates: circa 1970. Size: 1.25 linear feet.

Carnegie Mellon University. Hunt Library. University Archives. 4909 Frew Street, Pittsburgh, PA 15213, USA

Mellon College of Science Records. Collection dates: 1953–2008. Size: 2.5 linear feet.

Lincoln Wolfenstein papers. Collection dates: 1940–2012. Size: 3 linear feet.

Hagley Museum and Library. Manuscripts and Archives Department. 298 Buck Road East, Greenville, DE 19807, USA

David A. Hounshell and John K. Smith research notes for "Science and Corporate Strategy." Collection dates: 1903–1986. Size: 8 linear feet.

Hounshell and Smith oral history transcripts. Collection dates: 1981–1988. Size: 3 linear feet.

RCA Victor Camden/Frederick O. Barnum III collection. Collection dates: 1887–1983. Size: 250 linear feet.

Howard Ensign Simmons, Jr., papers. Collection dates: 1857–1997. Size: 2.6 linear feet.

Hologic Digital Mammography oral histories. Collection dates: 2019–2021. Size: 15 digital files.

Harvard University. Archives. Pusey Library. Cambridge, MA 02138, USA

Harvard College Observatory computations. Collection dates: 1841–1923. Size: 15.75 cubic feet (23 document boxes, 12 flat boxes, 4 portfolio folders).

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Harvard University Division of Engineering and Applied Physics Office of Naval Research technical reports. Collection dates: 1967–1988. Size: 3 cubic feet (7 boxes). 100 volumes.

Dudley R. Herschbach papers. Collection dates: 1932–2018. Size: 69 cubic feet (67 record cartons, 2 flat boxes, 1 portfolio folder, 0.008 GB).

James Mills Peirce diary. Collection dates: 1849–1850. Size: 1 flat box.

S. Reid Warren, Jr., papers. Collection dates: 1931–1967 (bulk 1940–1960). Size: 1 records center carton.

Henry E. Huntington Library. 1151 Oxford Road, San Marino, CA 91108, USA

Allan Sandage papers addenda. Collection dates: circa 1950–2010. Size: 2 record storage cartons, 1 oversize folder.

Johns Hopkins University. Special Collections. Milton S. Eisenhower Library. 3400 N. Charles St., Baltimore, MD 21218, USA

The Barritt-Serviss Star and Planet Finder volvelle. Collection dates: 1906. Size: 0.5 cubic feet (1 custom box).

Johns Hopkins University Department of History of Science records. Collection dates: 1960–1982. Size: 1.5 cubic feet.

Johns Hopkins University Department of Aeronautics records. Collection dates: 1946–1961. Size: 3 cubic feet.

Johns Hopkins University Department of Electrical Engineering and Computer Science records. Collection dates: 1924–1985. Size: 10 cubic feet.

Scientific Association of the Johns Hopkins University records. Collection dates: 1877 October—1919 October. Size: 0.2 cubic feet (1 bound volume).

Leo Baeck Institute at the Center for Jewish History. 15 West 16th Street, New York, NY 10011, USA

Gertrude S. Goldhaber papers. Collection dates: 1920–2007 (bulk 1950–1980). Size: 18.25 linear feet.

Southern Illinois University at Carbondale. Morris Library. Special Collections. Carbondale, IL 62901, USA

Daniel B. Parkinson papers. Collection dates: 1897–1913. Size: 0.5 cubic feet.

Charles S. Peirce papers [microfilm]. Collection dates: 1857–1914. Size: 1 linear feet.

Otis Bigelow Young papers. Collection dates: circa 1930–1967. Size: 5.5 cubic feet.

State University of New York at Albany. Archives. University Libraries B-43. 1400 Washington Avenue, Albany, NY 12222, USA

Charles Luther Andrews papers. Collection dates: 1936–1967. Size: 1 cubic feet.

Atmospheric Science Research Center records. Collection dates: 2014–2017. Size: 6.5 cubic feet.

Syracuse University. Special Collections Research Center. E. S. Bird Library. Syracuse, NY 13244-2010, USA

Howard Wesley Davis papers. Collection dates: 1949–1963. Size: 4.5 linear feet.

David Dietz papers. Collection dates: 1916–1977. Size: 31 linear feet.

Charles Julius Kullmer papers. Collection dates: 1905–1927. Size: 1.5 linear feet.

Willy Ley collection. Collection dates: pre-1969. Size: 1 linear foot.

Université de Lorraine. Archives Henri-Poincaré—Philosophie et Recherches sur les Sciences et les Technologies. Nancy, France

Bureau des Longitudes meeting minutes. Collection dates: 1795–1932. Size: 28 volumes.

University of Illinois at Urbana-Champaign. University Archives. 1408 West Gregory Drive, Urbana, IL 61801, USA

University of Illinois Observatory histories. Collection dates: 1986–1987, 1989, 2012. Size: 0.2 linear feet.

Adriaan J. de Witte papers. Collection dates: 1955–1973. Size: 1 linear foot.

University of Kansas. Kenneth Spencer Research Library. University Archives. Lawrence, KS 66045, USA

Architectural drawings of the William Pitt Telescope. Collection dates: 1927–1970. Size: 1 box.

University of Massachusetts Boston. Joseph P. Healey Library. University Archives and Special Collections. Boston, MA 02125, USA

Julian M. Avery papers. Collection dates: circa 1945–1998. Size: 0.25 linear feet (one-half document case and 1 oversize folder).

University of Nevada, Reno. Library. Special Collections Department, Reno, NV 89557, USA

Astronomical Society of Nevada history. Collection dates: 1982. Size: 0.1 linear foot.

University of Tennessee, Knoxville. Special Collections Library. James D. Hoskins Library. Knoxville, TN 37996, USA

James M. Robinson astronomy paper. Collection date: 28 March 1836. Size: 0.1 linear feet.

University of Texas at Austin. Harry Ransom Humanities Research Center. P.O. Drawer 7219, Austin, TX 78713-7219, USA

Pierre-Gilles-Antoine-Honoré Flaugergues collection. Collection dates: 1787–1830. Size: 1.26 linear feet (3 boxes).

E. C. George Sudarshan papers. Collection dates: 1953–2005. Size: 27.5 linear feet.

NEW FINDING AIDS

Leo Baeck Institute at the Center for Jewish History. 15 West 16th Street, New York, NY 10011, USA

S. Theodor Stein collection. Collection dates: 1865–1965. Size: 0.25 linear feet.

State University of New York at Albany. Archives. University Libraries. B-43, 1400 Washington Avenue, Albany, NY 12222, USA

State University of New York at Albany Atmospheric Sciences Research Center records. Collection dates: 1959–1984. Size: 5 cubic feet.

Syracuse University. Archives and Records Management. E. S. Bird Library. Syracuse, NY 13244, USA

Michel Licht papers. Collection dates: 1910–1957. Size: 1.25 linear feet.

University of Illinois at Urbana-Champaign. University Archives. 1408 West Gregory Drive, Urbana, IL 61801, USA

University of Illinois at Urbana-Champaign. Graduate Dean's Office administrative correspondence. Collection dates: 1906–1977. Size: 20.0 cubic feet.

University of Illinois at Urbana-Champaign. University Library. Illinois History and Lincoln Collections. 1408 West Gregory Drive, Urbana, IL, USA

Gustavus Detlef Hinrichs papers. Collection dates: 1842–1917. Size: 10 cubic feet.

University of Pittsburgh. University Archives. 7500 Thomas Boulevard, Pittsburgh, PA 15208, USA

Edward Gerjuoy papers. Collection dates: 1937–2016. Size: 35.2 linear feet (28 boxes, 1 document case).

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University of Texas at Austin. Center for American History. University Archives. Austin, TX 78713, USA

Frank N. Bash papers. Collection dates: circa 1962–2006. Size: 41.5 linear feet.

Harry Benedict papers. Collection dates: 1855–1865, 1874–1940. Size: 1 linear foot.

Lawrence Biedenharn papers. Collection dates: 1931–1997. Size: 41 linear feet.

Charles P. Boner papers. Collection dates: 1918–1979. Size: 1 linear foot.

Gérard Henri de Vaucouleurs papers. Collection dates: undated. Size: 7 linear feet.

Bryce S. DeWitt papers. Collection dates: 1950–2005. Size: 10 linear feet.

Cécile DeWitt-Morette papers. Collection dates: 1946, 1983–2007. Size: 0.7 linear feet.

Earl Dickens papers. Collection dates: 1905–1990. Size: 0.5 linear feet.

Edsger W. Dijkstra papers. Collection dates: 1948–2002. Size: 40 linear feet.

James N. Douglas papers. Collection dates: undated. Size: 4 linear feet.

William F. Eberlein papers. Collection dates: 1936–1986. Size: 16 linear feet.

Frank Norman Edmonds, Jr., papers. Collection dates: 1950–1986. Size: 14 linear feet.

David S. Evans papers. Collection dates: 1391–2004. Size: 6.6 linear feet.

Maurice Ewing papers. Collection dates: 1912, 1925–1974. Size: 140 linear feet.

ExxonMobil records. Collection dates: 1790–2004 (bulk 1880s–1990s). Size: 1074.4 linear feet.

Karl Gordon Henize papers. Collection dates: 1964–1967. Size: 1.5 linear feet.

William H. Jefferys papers. Collection dates: 1977–2004. Size: 14.25 linear feet.

John Matthias Kuehne photograph collection. Collection dates: 1894–1950. Size: 8 linear feet (571 silver gelatin prints, 1 color print, 356 glass negatives, 184 film negatives, 289 lantern slides and other glass positives, 2 film positives, 280 autochromes and glass film color transparencies, 15 35-mm color slides).

Robert N. Little papers. Collection dates: 1935–1986. Size: 0.25 linear feet.

J. Ross MacDonald papers. Collection dates: 1932–1989. Size: 34 linear feet.

Alexander Macfarlane collection. Collection dates: 1900–2006. Size: 0.1 linear feet.

Hans Mark papers. Collection dates: 1961–1987. Size: 78 linear feet.

Mathematical Association of America records. Collection dates: 1916–present. Size: 319 linear feet.

Mathematical Association of America, History of American Mathematics in World War II Committee records. Collection dates: 1943–1981. Size: 0.8 linear feet.

McDonald Observatory records. Collection dates: 1971–1999. Size: 4 linear feet.

Walter E. Millett papers. Collection dates: 1923–1928 and 1946–2003. Size: 10 linear feet.

Otton Marcin Nikodym papers. Collection dates: 1925–1981. Size: 12 linear feet.

George Yuri Rainich papers. Collection dates: 1925–1982. Size: 3.5 linear feet.

Franklin E. Roach papers. Collection dates: 1955–1972. Size: 1 linear foot.

Alfred Schild papers. Collection dates: 1915–1982. Size: 18 feet.

Harlan Smith papers. Collection dates: 1953–1991. Size: 80 linear feet.

Athelstan Spilhaus papers. Collection dates: 1912–2003. Size: 50 linear feet.

Clifford Truesdell papers. Collection dates: 1939–1989. Size: 18 linear feet (49 boxes).

Texas Symposium on Relativistic Astrophysics records. Collection dates: 1980s–2000. Size: 1.7 linear feet.

University of Texas at Austin. Department of Physics. Mechanical Harmonic Synthesizer / Multiharmonograph collection. Collection dates: 1939–1948 and undated. Size: 0.2 linear feet.

John Von Neumann collection. Collection dates: 1913–1925, 1942–1956, 1989–1992. Size: 0.5 linear feet.

J. Craig Wheeler papers. Collection dates: 2005–2010. Size: 1 linear foot.

John Wheeler papers. Collection dates: 1938–1987. Size: 15 linear feet.

University of Texas at Austin. Harry Ransom Humanities Research Center. P.O. Drawer 7219. Austin, TX 78713, USA

Albert Einstein collection. Collection dates: 1906–1955. Size: 2.5 linear feet (5 boxes).

Herschel family papers. Collection dates: 1721–1951 (bulk 1810–1871). Size: Approximately 21 linear feet (44 document boxes, 2 oversize boxes, 17 oversize folders, and 2 framed objects).

Ilya Prigogine papers. Collection dates: 1977–1980. Size: 2 boxes.

University of Virginia. Alderman Library. Special Collections. Charlottesville, VA 22903, USA

James P. C. Southall papers. Collection dates: circa 1889–1945. Size: circa 500 items.

University of Washington. University Archives. Box 352900, Seattle, WA 98195, USA

Ronald Geballe papers. Collection dates: 1938–1990. Size: 14 linear feet.

Western Michigan University. University Archives and Regional History Collections. Kalamazoo, MI 49008-5081, USA

Kalamazoo Astronomical Society collection. Collection dates: undated. Size: 1 folder.

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AMERICAN INSTITUTE OF PHYSICS
1 PHYSICS ELLIPSE
COLLEGE PARK, MD 20740

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