

History and Philosophy of Physics

A FORUM OF THE AMERICAN PHYSICAL SOCIETY · VOLUME XV · NO. 5 · FALL 2023

The Lady in the Photo: Chrystine Ramsey Shack's Involvement in Project Matterhorn

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Walking into my home from the street mailbox, I saw that it contained the latest issue of *Physics Today*, dated 1 April 2009. I immediately pulled it out from the other mail and opened it to the table of contents where I spotted the highline for an article by Kenneth W. Ford titled, "John Wheeler's work on particles, nuclei, and weapons" [2]. Turning to this article and quickly leafing through its five pages, my attention was attracted to Figure 1. This figure contained the photo of the Project Matterhorn - B team and its support staff taken at Princeton University in 1952. But my real interest and fascination was with the sole African American woman standing in the front row. Her name was listed in the caption as Christine Shack and her position in the photo indicated that she was a member of the staff. This photo's caption stated that "the B team, headed by John Wheeler, devoted its efforts to thermonuclear weapons." In addition to Wheeler, other scientists in the photo included John Toll and Kenneth Ford. Straightaway, my mind raised the following questions and issues:

- Who exactly is Christine Shack?
- What did Shack do with regard to Project Matterhorn – B?
- Is Shack still living? (In 2009, as I found out later, she was 83 years old.)
- If alive, how can I contact her?

I immediately set out to resolve these questions and issues.

The Search for Shack

Immediately after reading the Kenneth Ford *Physics Today* article, I began a search to locate information on who exactly was Christine Shack. I wanted to learn as much as possible about her family life, education, careers, and accomplishments.

A search on the Internet for "Christine Shack" produced no results. However, I did find a "Chrystine Ramsey Shack", then living in Memphis, Tennessee. Also, I was able to locate several declassified technical report documents related to Project Matterhorn where the cover pages had the sign-out signature of Chrystine Ramsey Shack. At this point two things were clear: 1) I had located the lady in the photo. 2) Shack's first name was misspelled in Ford's *Physics Today* article.

I also discovered that Shack was a past president of Girl Friends, a civil and social organization of African-American women founded in 1927. My telephone contact with the national office went as follows: "I am Ronald Elbert Mickens, a Professor of Physics at Clark Atlanta University. I recently discovered that one of your past presidents, Chrystine Ramsey Shack was involved with a very important national Project in the early 1950s and I wish to interview her on her involvement in this Project and other issues related to her family, career, education, and leadership in the Girl Friends. I will provide you with details as to how she can contact me if this is of interest to her." Several days later Chrystine Ramsey Shack (CRS) telephoned me from Memphis Tennessee.

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2023 Pais Prize Awarded to Jürgen Renn

By Donald Salisbury, Department of Physics, Austin College, Sherman, Texas

The historian of science, Jürgen Renn, merits a far deeper and detailed overview of his lifetime accomplishments than I am able to provide here in this short notice. The occasion is his receipt of the FHPP sponsored APS Pais Prize award at the April 2023 APS meeting in Minneapolis. The official citation states “contributions to the historiography of modern and early modern science, in particular studies of Albert Einstein, and for contributing scholarship and taking public stances that directly raise the societal relevance of science historiography”. The range and depth of his accomplishments is astounding, as can be confirmed in his recent book on the evolution of knowledge [1]. Indeed, it was his grasp of the long term societal interconnections in this story that led his effort to establish a new research institute in Jena, Germany – the

Max Planck Institute of Geoanthropology of which he is now the Director. He has just retired from his thirty-year directorship of the Max Planck Institute for the History of Science in Berlin. In viewing his curriculum vitae [2] and the listing of 488 publications [3] our readers will surely be astounded at the range and depth of his studies – from the origins of science in Europe and Asia through a focus on the development of mechanics and knowledge exchanges between Arabic, Chinese and Latin languages. This constituted the framework of a recent gathering in Trieste, Italy, with the proceedings now available online [4].

Among the numerous historical studies that he and his collaborators have authored, I will simply briefly focus on two which have played a role in my own professional activities. The first is the extensive

study of the practical knowledge that led to the Galilean revolution. There we witness the confrontation of traditional systems of knowledge with new challenging objects, among them dubious cannonball trajectories and material strength puzzles. And of course one must bear in mind traditional religious doctrines, though most of us have likely not been aware of the relevance of the practical engineering obstacles that Brunelleschi had confronted in constructing the cupola of Santa Maria Fiori in Florence. Other mental models and external tools and machines that factored into Galileo’s thinking were related to his extensive interactions with military personnel at the Arsenal of the Venetian republic. Another related factor that plays a role in every scientific development are

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The Forum on History and Philosophy of Physics of the American Physical Society publishes this Newsletter biannually at <http://www.aps.org/units/fhp/newsletters/index.cfm>. Each 3-year volume consists of six issues.

The articles in this issue represent the views of their authors and are not necessarily those of the Forum or APS.

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FHPP Essay Contest Winners

By Alberto Martinez, Chair of the Forum on the History and Philosophy of Physics

The Forum held its seventh annual history of physics essay contest in 2023, and is pleased to recognize a winner and three runners up.



Rebecka Mähring

The winning essay by Rebecka Mähring is entitled “Hilde Levi: A Jewish Woman’s Life in Physics in the 20th Century.” This inspiring and scholarly account of Dr. Hilde Levi’s life describes her pioneering interdisciplinary labors in biophysics and on the applications of radioisotopes. For decades, Levi generously collaborated with various other physicists, scientists, and medical professionals. Mähring brightly shows how Hilde Levi’s unpretentious kindness enabled her to fulfill, renegotiate, and transcend traditional gender roles.

An abridged version has been published as the Back Page of [APS News](#) and the full essay is linked [here](#).

Rebecka Mähring received a cash award of \$1,000.00, plus support (up to a \$2,000.00 value) for travel, registration, hotel lodging and meals, to be an Invited Speaker at the APS April 2024 Meeting in Sacramento, California, to present a talk based on the essay. Her talk will be titled: “Negotiating Presence, Crafting Memory: The Elusive Life and Legacy of Hilde Levi.”

Mähring graduated in May 2023 with a bachelor’s degree in Physics from Princeton University. Her senior thesis research was on dark matter phenomenology. While at Princeton, she also developed a strong interest in the history of science, which led to a research visit at the Niels Bohr Archive

in Copenhagen, Denmark, during the summer. Her FHPP winning essay is the result of this research.

Three Runner-Up awards were also awarded this year, in a three-way tie, with cash awards of \$500 each.

The annual FHPP Essay Contest promotes interest in the history of physics. The contest is intended for undergraduate and graduate students but is open to anyone without a Ph.D. in physics or history. Entries can address the work of physicists, physics discoveries, or other related topics. At 2,500 words, entries should be scholarly and accessible to scientists and historians. Previously published work, excerpts, or entries with multiple authors are not accepted.

The three Runner-Up winners – Listed in alphabetical order:



Stefano Farinella

Stefano Farinella’s essay title is “Galileo’s Use of Mathematics in its Historical Context.” This lucid account shows how Galileo’s avoidance of algebra led him to convey the inapplicability of scale invariance by using a convoluted geometrical route. Since antiquity, sciences such as mechanics are hindered by practitioners’ tendency to hide their research methods and to instead present more complicated synthetic arguments, which make their writings more opaque. Farinella’s concise account of how algebraic notation changed within Galileo’s lifetime is impressive and professional.

Stefano Farinella is a first-year Ph.D. student at the University of Hamburg.

He completed his B.S. in Physics at the University of Padua, and his M.S. in Theoretical Physics at the University of Amsterdam. He is now part of the Centre for the Study of Manuscript Cultures in Hamburg, and his research focuses on the interplay between processes of knowledge transformation and early modern manuscript culture in the notes of mathematician and natural philosopher Thomas Harriot (1560-1621). The essay is linked [here](#).



Preetha Sarkar

Preetha Sarkar’s essay title is “Meghnad Saha: A Win for Science.” This well-balanced account traces how Meghnad Saha overcame class discrimination, as a *Shudra*, to nevertheless pioneer the field of radiation pressure with such great success. The beauty of his innovative application of early quantum theory to astrophysics shines brightly in Sarkar’s essay. It uses primary sources to clearly discuss ionization and atomic physics in stellar atmospheres, and it charts Saha’s humanistic dedication to supporting scientific, engineering, and social communities in India.

Preetha Sarkar is a Ph.D. candidate in the Department of Physics and the Illinois Materials Research Science and Engineering Center at the University of Illinois Urbana-Champaign. Her research focuses on understanding how the electronic properties of two-dimensional van der Waals materials, such as graphene, are modified under mechanical strain by conducting

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Update on the 2025 International Year of Quantum Science and Technology

from Paul Cadden-Zimansky, Physics Program, Bard College

The FHPP-initiated project to mark 100 years of quantum mechanics in 2025 with a global celebration and public outreach campaign continues to gain steam. In November, the biannual General Conference of UNESCO convened in Paris and unanimously passed a resolution, co-sponsored by 60 countries, recommending

that the United Nations General Assembly officially declare 2025 to be the [International Year of Quantum Science and Technology \(IYQ\)](#). Final declaration by the UN is expected in the coming months. FHPP members are encouraged to start thinking about how they can facilitate the creation of events, activities, or online resources for 2025 that can aid the public understanding of the beauty, importance, history, and philosophical implications of quantum science and technology. This year's call for APS Innovation Fund proposals has an IYQ focus in looking for ideas that recognize "the imperative to cultivate, enrich, and disseminate activities that

foster a deeper understanding of quantum concepts and offer opportunities to the public." Any APS member can apply to the Innovation Fund; pre-proposals are due May 6, 2024. In addition to actions by individuals, IYQ is gathering together an expanding list of institutions, organizations, universities, and corporations who are contributing funds to be official fiscal sponsors of IYQ initiatives and activities. All inquiries about IYQ can be sent to info@quantum2025.org

[Links in text, <https://quantum2025.org/> and <https://www.aps.org/programs/innovation/fund/>]

March 2024 FHPP Sessions

Wednesday 3/9 3:00 – 5:24 pm (Invited Session)

The American Physical Society at 125 – Alberto Martinez (Chair), Joseph Martin (Organizer)

- “The APS: Origins and Adolescence,” Joseph Martin, Durham University
- “That’s Not Physics,” Andrew Zangwill, Georgia Institute of Technology
- “The American Physical Society and Cold War Political Activism,” Sarah Bridger, California Polytechnical
- “A Brief History of Women in APS,” Frances Hellman, University of California, Berkeley

Thursday 3/7 11:30 – 12:30 pm

Session T62: FHPP, FECS, CSWP – Manchen Hu (Chair)

- “Review of Antimatter Experiments: from Theory to Experiment & Experiment to Theory,” Mark Pickrell, Vanderbilt University
- “How Einstein Was Influenced by the Philosopher Arthur Schopenhauer,” Alberto Martinez, University of Texas at Austin
- “Many faces of Casimir: Mirrors, Black Holes, and Beta Decay,” Evgenii Ievlev (presenter), University of Minnesota (coauthored with Michael Good and Eric Linder)
- “To be or not to be a faculty administrator?” Lev V Gasparov, University of North Florida
- “Women In Physics In DIstrict Swat Khyber Pakhtunkhwa Pakistan Author: Naeem Ullah Subject Specialist at Government Higher Secondary School No.3 Mingora Swat KPK Pakistan,” Naeem Ullah, GHSS No.3 Mingora

Thursday 3/7 3:00 – 6:00 pm (Invited Session)

Thirty Years of Quantum Computing since Shor’s Algorithm – Christopher Fuchs (Chair),

- Quantum Algorithms 30 Years After Shor, Scott Aaronson, University of Texas at Austin
- Thirty Years of Ion-Trap Computing Tool, Ignacio Cirac, Max Planck Institute of Quantum Optics,
- Quantum Computing: Technology AND Science, David P. DiVincenzo, Forschungszentrum Jülich & RWTH Aachen University,
- How Peter Shor Changed Physics, John P. Preskill, California Institute of Technology

April 2024 FHPP Sessions

Wednesday 4/3 1:30 – 3:18 pm (Invited Session)

Pais Prize Session

Physics History: Yesterday, Today, Tomorrow – Catherine Westfall (Chair),

- Oppenheimer, Wheeler, and the Golden Age of General Relativity, Paul Halpern, Saint Joseph’s University
- Does It Count as History if I Can Still Remember?, Virginia Trimble, University of California, Irvine
- Virginia Trimble: A Scholar of the Past Guiding the Future, Katelyn A. Horstman, California Institute of Technology

April 2024 FHPP Sessions *(continued)*

Thursday 4/4 8:30 – 10:18 pm

Session F16: Historical, Diverse, and Inclusive Physics

- “Stereotactic Radiosurgery; a Historic Appraisal,” Juan Diego D. Garcia, Texas Tech University
- “Entropy and Tropes Chad Kishimoto,” Diane Keeling, University of San Diego
- “Three Minutes 28 Seconds of Darkness: When The South of Mexico Became in 1970 the World Biggest Solar Observatory,” Noel Alberto Cruz Venegas, University of Manitoba
- “The Evolution of Atomic Theory: Using Archival Materials in Physics Education,” Mia J. Keller, University of Rochester
- “The Dye That Binds: Discovering the Gluon,” Michael Riordan, U. California, Santa Cruz
- “Taking High Energy Physics to Higher Altitudes,” Suyog Shrestha
- “Increasing HEP Participation at Minority Serving Institutions through the GROWTH-MSI Traineeship Program: Progress, Successes, and Lessons Learned So Far,” Wing To
- “Updates on APS-IDEA: Facilitating Community Transformation,” Tiffany R Lewis, Vemitra Alexander, Kayla Baker, Sidney Brandhorst, Erika Brown, Dessie Clark, Marvin Q Jones, Jasper Scelsi
- “Being blind in the world of High Energy Physics,” Orgho A Neogi

Thursday 4/4 3:45 – 5:33 pm (Invited Session)

Science Across Borders – Joanna Behrman (Chair)

- Sharing Data with Russia: Friedrich Wilhelm Bessel and the Geopolitics of Prussian Territorial Data, Kathryn M. Olesko, Georgetown University
- NASA’s Other Science Diplomacy = Spacemobile Goes Abroad in the 1960s, Christina Roberts, University of California, Santa Barbara
- Negotiating Presence, Crafting Memory: The Elusive Life and Legacy of Hilde Levi, Rebecka Mähring
- Friday 4/5 10:45 am – 12:33 pm (Invited Session)
- Panel Discussion: Physicists and Arms Control – The Role of Science in Global Security – Dylan K. Spaulding (Chair)
- Dylan K. Spaulding, Union of Concerned Scientists
- Stephen I. Schwartz, Bulletin of Atomic Scientists
- Lisbeth D. Gronlund, Massachusetts Institute of Technology
- Raymond Jeanloz, University of California, Berkeley

Saturday 4/6 5:30 – 6:18 am

Session JJ01: V: Forums & GPER II * NOTE: Virtual Only

- “I’m a Physics Professor Running for State House, and You Should Too!” Ramón S Barthelemy
- “Counterfactual restrictions and Bell’s Theorem,” Jonte R. Hance
- “The Role of A. Trautman, I. Robinson and Associates in the Renaissance Period Development of Gravitational Wave Theory,” Donald C Salisbury and Daniel Kennefick
- “Comparative Study on Spectral Response and External Quantum Efficiency...,” Papa Touty Traore, Dame Diao

The Lady in the Photo: Chrystine Ramsey Shack's Involvement in Project Matterhorn

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Our first telephone conversation lasted 3/4 of an hour and covered the following points:

- Brief summary presentations of our lives, careers, education and family backgrounds.
- Exchange of working telephone numbers and addresses for each of us (We were of that generation for which communication was only done by letter or telephone.)
- An agreement that Shack would mail, ASAP, Mickens a copy of her full vita.
- We also made plans to carry out several additional telephone interviews after REM received Shack's vita [7].

Out of both "historical interest" and "curiosity" I contacted Ken Ford through the American Institute of Physics. This was done in mid-April 2009. My main questions to him were: Do you remember Chrystine Ramsey Shack? If so, what was the nature of your interactions? He replied that he has no recollection of Shack!

Project Matterhorn

The creation of the Manhattan Project [5,10] during World War II was initiated by the fear that Germany might produce fission nuclear weapons and use them to help in their effort to win the war in Europe. However, there were certain scientists who had ideas for much larger nuclear weapons, based on fusion [5]. In 1951, John Archibald Wheeler [14] returned to Princeton University from Los Alamos Laboratory, and set up what was known as Project Matterhorn (PM) [6]. This project had two components, PM - B and PM - S, led respectively by Wheeler and Lyman Spitzer, a Professor of Astrophysics at Princeton [11].

PM - S was focused on the design and analysis of devices to control



Figure 1. Group photo of John Wheeler's Project Matterhorn Team at Princeton University in 1952. L-R Front row; Margaret Fellows, Margaret Murray, Dorothea Ruffel, Audrey Ojala, Christene Shack, Roberta Casey. Second row: Walter Aron, William Clendenin, Solomon Bochner, John Toll, John Wheeler, Kenneth Ford. Third & Fourth row: David Layzer, Lawrence Wilets, David Carter, Edward Frieman, Jay Berger, John McIntosh, Ralph Pennington, Unidentified, Robert Goerss. Photograph by Howard Schrader, Princeton University, courtesy, AIP Emilio Segré Visual Archives, Wheeler Collection

thermonuclear reactions such that useful fusion-based power could be generated. Spitzer develop the stellarator concept and, with funding from the Atomic Energy Commission, constructed and investigated the properties of a number of such magnetic fusion machines. However, in 1958, this research was declassified and PM - S was renamed the Princeton Plasma Physics Laboratory [9].

PM - B, where "B" stood for "bomb", carried out theoretical and computational work on various possibilities for hydrogen fusion bombs [2,6,9,13]. However, Wheeler had great difficulty staffing his project among many of the senior scientists who were involved with the Manhattan Project, consequently, he recruited the help of young graduate and post-doctoral students such as Kenneth Ford [2, 3]. PM - B was discontinued in 1953.

Involvement with Project Matterhorn

Chrystine Ramsey's one and only boyfriend, while she was a student at

Wilberforce University, was a classmate from Trenton, New Jersey, Arthur Shack. They married during their senior year. After graduation, she took a position at Hampton Institute (Hampton, Virginia) as a secretary to the Dean of Students, but left after one academic year to join her husband in Trenton, where she was employed as secretary to the Superintendent of the Bordertown Manual Training School, BMTS.

The low pay at BMTS and the desire to stay near her husband led to Chrystine Ramsey Shack seeking new employment at a much higher salary. Thus, in 1950, she got a job working with professor Lyman Spitzer at Princeton University. When asked, How did you get this job?, she replied [4,7],

"I don't know. I guess I was the best thing coming down the pike (laughter) at that time. I was a good secretary, a damn good secretary. And I had to get top-secret clearance to work on the job. And they interviewed two or three other people, but they didn't pass the clearance, and I did. And I guess that's how, that's how I got it."

Shack recalled that in the short period before she received top-secret clearance [4,7]

"... I worked in another building completely different from where Dr. Spitzer worked and he would come over to ___ from Project Matterhorn to where I was and bring work to me there because I couldn't go into the building where they had the top-secret, you know, investigations going on. But that didn't last long because they rushed through my clearance, you know. They, somehow, they managed to get it going just like that. And I was cleared in a rather short time."

In response to the query: describe a typical workday (once a top security clearance was granted), she replied [4,7]

“My typical day was to first gain admittance... Once I got in there, it was to provide any kind of reports that the fellows wanted or needed, and that I had complete charge of the files, any kind of physics reports, or chemical reports or anything like that. Nobody could go in the files but me. And if any of them had to dictate reports, they dictated them to me. And I spent the day either producing reports clerically or producing them — every time they did a report, they would have to send copies to other scientists, top-secret mailings, you know. And I would have to type them up. We used a special mailing process to send them off. And so special that from the minute it left Princeton, I knew where it was in the post office... until they got it. And the minute they got it, they called to let me know that they had it...”

Shack recalls there were three persons that she closely worked with during her stay on Project Matterhorn. They were Lyman Spitzer, James Van Allen, and John Wheeler. Other scientists that she met and worked with included Edward Teller, James Tuck, and Robert Oppenheimer. To the question, “what did you do with Dr. Oppenheimer?”, she replied [4,7]

“Reports, you know. I would go over to the Institute of Advanced Study and he would dictate reports... about the project and I would take it down and go back and type it up. They had massive reports that they put out...”

In my (REM) interview with Shack, I raised the issue of the loss of a file by John Wheeler in January 1953. She stated [7] it was “a really big deal” and that several persons “got in hot water” because the lost file pertained to the history of the American efforts regarding a hydrogen bomb. For details see [13,14]. When asked about her knowledge and understanding of the significance of the project, she replied [4,7]

“...Yeah, I knew it was top-secret, and I knew they were working on the development [of] some phase of the atom bomb, and I also knew that they were trying

to develop something that they called... the stellarator...I was aware of the significance of the whole thing... And wondered how did I happen to get there, to get this job, except as I said, and I’m not boasting, I was a damn good secretary. (laughter) I really was!”

Shack, in an aside, told me (REM) that during the time she worked with Project Matterhorn she began to pick up some of the details of both the “B and S” Matterhorn Projects from the various reports that she typed, copied, and distributed, and from random conversations with the scientists. She further emphasized that while she now (doing the interview) does not remember anything about this work, “... I did when I worked [on the project]” [4,7].



Figure 2 Chrystine Ramsey Shack
(A copy of this photo was given to Professor Micken on the occasion of his interview with her)

In 1955, Shack left the Matterhorn Project for two very practical and personal reasons [4,7]. First, she and her husband lived near Trenton New Jersey, and she had to commute back and forth every day between Princeton and Trenton. Second, her husband wanted her to work nearby to where they lived and close to where he was employed at Hamilton High School East. So, she ended her stay on the project and took a position as an elementary school teacher at Hamilton High School West. The Hamilton Township Public School System had two high schools, one on the eastern side of the township that was almost totally white and another on the western side that was mainly non-white [4,7]. Shack remembers that,

“...When I left the [Matterhorn] project, they gave me a going away gift. It was a silver... bowl... They knew why I was leaving, you know. I was coming home because my husband was in Trenton and I was commuting every day to Princeton, and I needed to change that arrangement completely.”

Family and Careers

Chrystine Ramsey Shack had many careers in diverse areas related to education and civic engagement. She was born in Memphis, Tennessee on 18 November 1926 to DeLocha Perkins Herron and Royal Ramsey. Her extended family were members of the local, conservative, Black middle class and owned property, a grocery store, and a drayage business at the Central Illinois Railroad Station. After graduating from the segregated Booker T. Washington High School, she attended Wilberforce University (Wilberforce, Ohio) and finished with a business degree in 1947.

At Wilberforce University, she met Arthur T. Shack, and they married and eventually had several sons. After a short secretarial position at Hampton Institute in Virginia, she joined her husband in New Jersey with a position as secretary to the Superintendent of the Manual Training and Industrial School for Youth located in Bordentown. From this position, she moved to Project Matterhorn at Princeton University. However, after several years, she became somewhat frustrated with daily commutes to Princeton and left Project Matterhorn to be nearer to her husband. Thus, she began a teaching career at an elementary school in Trenton, New Jersey, followed by becoming a business instructor at Hamilton High School East, which was close to where her husband was teaching at Hamilton High School West. Both of these facilities were situated in Hamilton Township.

Shack’s role in education administration was elevated when she became Director of Program Development in the New Jersey State Department of Education, 1969 to 1971. Also, she was a Vice President and member of the Board of Education for the Trenton, New Jersey Public Schools during 1968 - 1971, and after moving with her husband to Michigan became a Consultant for Post-Secondary Programs for the Michigan State Department of Education, 1972 -1974. In 1981, Shack was selected as president of

the Highland Park Community College.

Shack considered family, social connections, and civic participation as being critical aspects of her service to her community. Thus, one way of fulfilling these this aspiration was becoming National President of the organization The Girl Friends in 1978. The full details of Chrystine Ramsey Shack's life and careers can be obtained from references [4,7,8]. During my interview of Shack, I discovered the following interesting details [7]:

- Shack's full name is Ethel Chrystine Ramsey Shack, but she generally did not include "Ethel".
- Shack did not like her given name "Christine" so she inserted a "y" to obtain "Chrystine."
- Both Shack and her husband were very active in churches associated with their Episcopalian faith in all locations where they lived.
- Both Shack and her husband, Arthur Theodore, Shack, received doctorates in 1973 from Rutgers University, Brunswick, New Jersey.

Final Comments

We have presented some useful information on those aspects of Chrystine Ramsey Shack's life that played important roles in her involvement with Project Matterhorn. Of interest is her general attitude towards her stay on the project: "it was just another job... no big deal" [7] When family considerations arose, she departed the project and obtained employment to be closer to her husband.

Shack's general attitude and actions should be looked at and interpreted within the framework of Black "middle-class respectability". She and her family were members of the African American elite, which had a mindset that concerned itself with how you look at yourself, how you perceive your present and future goals, who were your friends and colleagues, and how you expected to be treated and were treated to others. It was a process of instilling all the positive values held by the dominant Americans society, such as hard work, honesty, independence, and cultural refinement. Also, of utmost importance was having a deep, strong faith in God, and all that this belief implied.

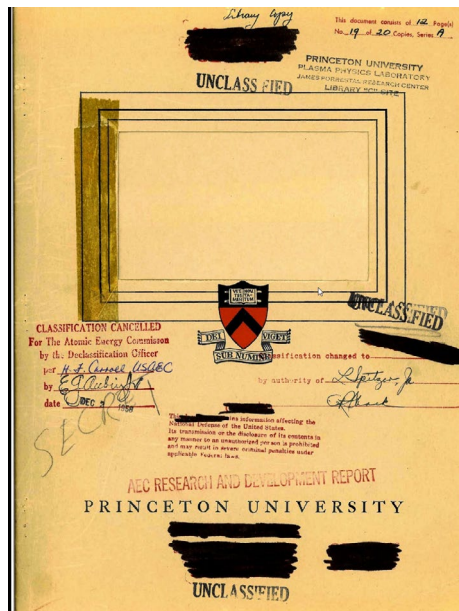


Figure 3. Project Matterhorn Report PM-S-2, NYO-994. Report written by Lyman Spitzer, Jr. "Survey of Possible Plasma Oscillations in the Stellarator", signed by L. Spitzer, Jr. and C.R. Shack, July 31, 1951

We urge all to read the transcript of the video interview of Shack done by The HistoryMakers [4]. Better yet, listen to the video. These items provide much more of the details of her family life and employment situations.

BTW: based on Shack's interviews [4,7], we are led to the conclusion that she was the Document Handler for both parts of the Matterhorn Project. There exists in the public domain many of these reports, now declassified, that she and Lyman Spitzer, jointly signed off on (See Figure 3.) However, we could locate none involving joint sign-offs with Shack and Wheeler. This may be due to the fact that such reports are still classified.

So finally, we now know who "the lady in the photo" is!

Acknowledgments

The authors thank Ms. Imani Beverly and Mr. Brian Briones, reference librarians at the Atlanta, University Center's Robert W. Woodruff Library for their help in obtaining copies of articles, books, and documents related to this project. Without their effective and timely actions, the completion of this essay would have been greatly delayed.

Comment

This essay is presented from the perspective of REM, mainly because REM was directly involved in locating Shack, interviewing her, and then informing the HistoryMakers of her existence. However, equal contributions were made by the two authors to the overall production of this work.

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2023 Pais Prize Awarded to Jürgen Renn

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default assumptions that are rooted in prior knowledge. A wonderful example is Galileo's interpretation of the blurry vision of the moon's surface viewed through his telescope. All of this constitutes a vast societal overview of Galileo's times.

I want to also briefly discuss the work of Jürgen and collaborators dealing with Einstein's development of the special and general theories of relativity. Prior to his appointment in Berlin in 1994 he served from 1986 to 1992 as one of the editors of the Collected Papers of Albert Einstein project. He contributed to Volumes 2 - 4 dealing with Einstein's Swiss years from 1900 to 1914 [5]. In Berlin he continued his exploration of Einstein's work in collaboration with numerous historians. Of particular significance is the four-volume set in which he and his partners analyzed the competing fields of nineteenth century mechanics, electromagnetism and



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thermal physics [6]. They illustrated how prior concepts were reinterpreted with shifted importance. A key element was the continuing interplay between physical and mathematical considerations that ultimately led to the first formulation of the general theory of relativity in November of 1915.

A detailed analysis of this latter development appears in a recent innovative collaboration with Michel Janssen [7]. The starting point is the so-called Entwurf (draft) theory that Einstein published in 1913 and reformulated in a review article in 1914. The origin is surprisingly the appearance with the aid of Einstein's collaborator Marcel Grossmann of the fully covariant Ricci tensor. It ultimately reappeared on the left-hand side of the general relativistic field equations. The manner in which this occurred is truly enlightening. It serves as a convincing example of a general scientific process that had been enunciated earlier by Janssen, namely the temporary scaffold and permanent arch construction [8]. Already the previous year Einstein had elaborated a static gravitation model in which the gravitational field appeared as a single spatial coordinate dependent component of a spacetime metric. His objective was to extend the notion of equivalent frames of reference beyond those that corresponded to Lorentz transformations. He proposed that the inertial particle mass that multiplies the acceleration due to gravity should be identical with the gravitational mass that fixes the force on the particle in a static gravitational field. In other words he promoted a principle of equivalence that asserted that the behavior of a particle in a gravitational field could not be distinguished from its behavior in an accelerating frame of reference. It seems clear here that he viewed the spacetime coordinates themselves as physically significant and this was the motivating factor in the rejection of a theory that assumed the same

form under arbitrary spacetime coordinate transformations. Hence the Einstein and Grossmann Entwurf theory selected just a part of the Ricci tensor by applying what Renn and Janssen have identified as a coordinate restriction. The idea was that all physical circumstances would conform with this same restriction and the remaining freedom would encode a resulting generalized relativity principle. This led, however, to unresolved problems. Among them were failures to include rotating frames of reference. Einstein attempted various means for coupling coordinate restrictions with energy-momentum conservation and a weak static gravitational field limit. The ultimate result in 1915 was the solid arch of the generally covariant general theory of relativity in which coordinate restrictions were discarded in recognition of the freedom to impose different coordinate conditions in distinct physical circumstances.

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FHPP Essay Contest Winners

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low temperature electron transport experiments. She is passionate about science outreach and diversity, equity and inclusion efforts in STEM. In her free time, she enjoys painting, writing poetry, singing, swimming, reading history and fiction, and volunteering for social causes. The essay is linked [here](#).



Jessica Schonhut-Stasik

Jessica Schonhut-Stasik's essay title is "The Transit of Venus, King Kalākaua, and Indigenous Knowing." It is a refreshing and important perspective on the history of the international telescopes at Hawai'i. It's a timely topic, eloquently described, illustrating that history is not just about the past, but also about the present. This account of King Kalākaua's advocacy of education, internationalism, and public astronomy is inspiring and a tribute to early way-finders who thoughtfully looked up at the stars. The protests against the Thirty Meter Telescope show that scientists, like colonizers, fail by disregarding the concerns of local communities.

Jessica Schonhut-Stasik is a Ph.D. candidate in astronomy at Vanderbilt University, specializing in Galactic Archaeology. After being diagnosed with autism, ADHD, and OCD at age 27, Jessica became a neurodivergent self-advocate and is the Program and Communications Manager at the Frist

Center for Autism and Innovation, housed in Vanderbilt's School of Engineering. She works remotely from her home on Hawai'i Island, where she lives with her husband, dogs, and cats. Jessica has become deeply rooted in the community since emigrating from the U.K. in 2015 to live and work in the Hawai'i astronomy community. She participates in outreach and education initiatives such as the Maunakea Scholars program. She hosts the AstronomerAND podcast, which interviews non-traditional astronomers to elevate the voices of marginalized communities. The essay is linked [here](#).