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The 150 Women Project - Holding Series

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150 Years of Women at Berkeley Physics

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Author

Wittmer, Sarah

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Compiled and edited by Sarah Wittmer with help from Claudia Trujillo, Maria Hjelm, and Frances Hellman.

October 3, 2020, marks the 150th anniversary of the UC Regents' unanimous approval of a resolution by Regent Samuel F. Butterworth: "That young ladies be admitted into the University on equal terms in all respects with young men." We've come a long way since then. In celebration of this important anniversary, Berkeley Physics is highlighting 12 of the many pioneering women whose contributions have impacted the world of physics at UC Berkeley and beyond.

Melba Phillips



One of the first doctoral students of J. Robert Oppenheimer at the University of California, Berkeley, Phillips completed her Ph. D. in 1933, a time when few women pursued careers in science.

She continued to work with Oppenheimer to develop the theoretical solution to experiments in particle acceleration that created radioactive elements. Their findings, published in 1935, became known as the Oppenheimer Phillips Process, still considered an important contribution to quantum theory.

Phillips forged a career in science at a time when few women did so, and even took on leadership roles among her peers both as an educator and as a scientist with a social conscience. In 1945, representing a group called the Association of New York Scientists, she helped organize the founding of the Federation of American Scientists at a meeting in Washington, D.C.

In 1938, Phillips accepted a faculty position at Brooklyn College. She also began working part-time in 1944 at the Columbia University Radiation Laboratory. She lost both jobs in 1952 for refusing to testify before the U.S. Senate's Internal Security subcommittee, chaired by Nevada Sen. Pat McCarran to investigate alleged communist activities.

Her membership in the Federation of American Scientists, among other organizations, brought her to the attention of groups caught up in the hysteria of McCarthyism. In 1952, she was called before the McCarran Committee, a U.S. Senate subcommittee. She refused to "name names," or accuse others of communist involvement to protect herself, and thus lost her university positions. Before again finding employment, she wrote several physics textbooks which served as staples in physics classrooms. Among her many awards and achievements, she served as president of the American Association of Physics Teachers. She retired from the University of Chicago in 1972.

Mary K. Gaillard



In 1982, Mary K. Gaillard became the first woman to join the Berkeley physics faculty. At the same time, she became a faculty senior staff member at Lawrence Berkeley National Lab (Berkeley Lab), serving as head of its Particle Theory Group from 1985-87. Retired since 2009, she is now a professor of the Graduate School at UC Berkeley and a visiting scientist at Berkeley Lab.

Mary K. Gaillard has been a trailblazer for her entire career, and she has served as a role model to many female scientists in the Berkeley Physics Department and throughout the world. Her career as a theoretical physicist has spanned the period from the inception, in the late 1960s and early 1970s, of what is now known as the Standard Model of particle physics and its experimental confirmation, culminating with the discovery of the Higgs particle in 2012. She has taught physics to thousands of students and conducted ground-breaking research in the field of theoretical particle physics. By predicting the mass of the charm quark (with Benjamin W. Lee), 3-jet events (with John Ellis and G.G. Ross), and b-quark mass (with Mike Chanowitz and John Ellis), Mary K has blazed a trail of research and discovery. Her significance in the field has been recognized through the E.O. Lawrence Memorial Award and the J. J. Sakurai Prize for Theoretical Particle Physics. She is a fellow of the American Academy of Arts and Sciences, a member of the National Academy of Arts and Sciences, and a member of the American Philosophical Society.

Her importance to the Physics Department at the University of California, Berkeley starts in 1982 when she was recruited by Department Chair and renowned high energy physicist, Dave Jackson. Together with Marjorie Shapiro and Persis Drell, then graduate students with no female role models on the faculty, they convinced Mary K. to come to Berkeley. Since then, she has been and remains an active member of the faculty. Her research interests today have to do with addressing the problems of supersymmetry breaking and electroweak symmetry breaking, as well as other aspects of particle physics and cosmology, in the context of superstring theory. She is one of the founding members of the Berkeley Center for Theoretical Physics (BCTP), one of the world's strongest centers for particle physics.

To emphasize the significance of Mary K's hire in 1982, the following is some context: women were first admitted to Berkeley almost 150 years ago in 1873. That means that the

Physics Department hired its first woman 109 years later! And after Mary K's hire in 1982, it took 8 years to hire Marjorie Shapiro; 20 years to hire Alessandra Lanzara in 2002; 22 years to hire Mina Aganagic in 2004; and 23 years to hire Frances Hellman, in 2005. The women on the physics faculty and its female students feel strongly that Mary K opened doors for each of them.

In 2015, a memoir describing Gaillard's career, *A Singularly Unfeminine Profession: One Woman's Journey in Physics*, was published by World Scientific. Gaillard says she wrote the book *"because I wanted to convey the difficulties I had as a woman in such a male-dominated field. And I wanted to convey the joy of doing physics. I have the good luck that my career spanned the entire period of the standard model from its inception to its verification with the discovery of the Higgs particle. And I had a lot of fun."*

Chien-Shiung Wu



Chien-Shiung Wu was born and raised in China and came to America at the age of 24 where she studied at the University of California, Berkeley. During her graduate studies, Wu worked at the Radiation Laboratory, directed by Ernest O. Lawrence. While at Berkeley, she also worked closely with Emilio Segrè. Wu completed her PhD in June 1940 with honors. In spite of Lawrence and Segrè's recommendations, she could not secure a faculty position at a university, so she remained at the Radiation Laboratory as a post-doctoral fellow.

In March 1944 Wu joined the Manhattan Project, where she helped develop the process for separating uranium into uranium-235 and uranium-238 isotopes by gaseous diffusion.

She is best known for conducting the Wu experiment, which proved that parity is not conserved. This discovery resulted in her colleagues Tsung-Dao Lee and Chen-Ning Yang winning the 1957 Nobel Prize in Physics. Wu's role in the discovery was not publicly honored until 1978 when she was awarded the inaugural Wolf Prize.

In 1946, she served in the Physics Department of Columbia University as a research associate until 1952. From 1952-58, Wu was an associate professor and then became a professor until she retired in 1981 as a Michael I. Pupin Professor of Physics. In her research at Columbia, Wu also worked to develop improved Geiger counters for measuring nuclear radiation levels. As a professor, Wu taught at both Princeton and Columbia Universities.

Professor Wu was the recipient of numerous awards for her work, including eight honorary degrees, the National Medal of Science (1975), and the first person selected to receive the Wolf Prize in Physics (1978). She is also the first female President of the American Physical Society.

"She was very influential," said Herbert Steiner, a professor emeritus in physics at UC Berkeley and senior faculty scientist at Lawrence Berkeley National Laboratory. "She was a pioneer and did a lot for women's rights."

Wu earned many nicknames for her expertise, including the “Chinese Madame Curie,” the “Queen of Nuclear Research” and the “First Lady of Physics.” In 2021 the US Postal Service revealed a new stamp design honoring her significant contributions in the field of nuclear physics.

Ling-Lie Chau



Ling-Lie Chau (喬玲麗) Ph.D. '66 graduated from Berkeley in 1966 with a Ph.D. in theoretical physics — amongst the earliest of Berkeley's female graduates in that facet of the discipline.

Her love of physics and her path to Berkeley began in 1949 when at the age of ten, she and her family were forced to flee Shanghai for Taiwan. In a fortunate turn, this brought her to the Tainan Girls' High School in Taiwan, where similarly uprooted elite intellectuals taught many classes. Her attraction to physics was cultivated in the classroom of an outstanding science teacher: "I still remember my joy when I could understand centrifugal force!" She went on to earn her

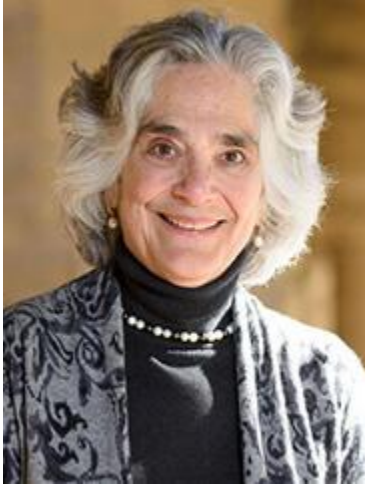
bachelor's degree in physics in 1961 from National Taiwan University — and to gain admission as a graduate student at Berkeley.

"Berkeley's physics department was at the top of the world," says Professor Chau. In the midst of her time at Berkeley, the Free Speech Movement galvanized the campus. She was "an alert observer" during the crux of the Free Speech activities in 1964, and the movement further shaped her own spirit, fueling a career that would simply not acknowledge the possibility of boundaries.

As a first-year graduate student at Berkeley, she was awarded the IBM Fellowship — a pivotal moment in her education enabling her to live in International House and fully concentrate on her studies as she transitioned from life in Taiwan to Berkeley.

Ling-Li Chau was a member of the Institute for Advanced Studies from 1967-1969, a Senior Physicist at Brookhaven National Laboratory from 1969-1986, and she is a Professor of Physics at the University of California, Davis since 1986.

Persis Drell



Persis Drell arrived at Berkeley in the Fall of 1977 from Wellesley College where she completed her bachelor's degree in mathematics and physics. She was the only woman in the first-year class that year. She joined the Eugene Commins research group in the summer of 1978, and spent the summer working with Gene's senior postdoc, Steven Chu, before Steven left for Bell Labs.

Along with several others, she started a tradition of potluck suppers among the women grad students. Her lab was in the second basement of Birge in the research and lab areas where there were no women's bathrooms. After several years working in Birge, she lobbied to get the bathroom in the second basement converted to gender-neutral.

After completing her Ph.D. and staying on for a year in the Commins group as a postdoc to complete her experiment (Parity non-Conservation in Atomic Thallium), she was a postdoc for George Trilling at LBNL. In 1988 she went to Cornell as a junior faculty member, and returned to the Bay Area in 2002, taking the position of Associate Director and then Director at SLAC. As SLAC lab director, she worked again with Steve Chu, first while he was LBNL Lab Director and then when he became Secretary of Energy.

Persis Drell is the James and Anna Marie Spilker Professor in the School of Engineering, a professor of materials science and engineering, and a professor of physics. She is the former dean of the Stanford School of Engineering and the former director of the U.S. Department of Energy's SLAC National Accelerator Laboratory at Stanford. She became the Stanford Provost in 2014. Drell is a member of the National Academy of Sciences and the American Academy of Arts and Sciences and is a fellow of the American Physical Society. She has been the recipient of a Guggenheim Fellowship and a National Science Foundation Presidential Young Investigator Award.

Marjorie Shapiro



Professor Marjorie Shapiro is an experimental particle physicist whose interests lie in probing the most basic interactions in nature. She is currently a collaborator on two collider experiments: the Collider Detector at Fermilab (CDF) and the Atlas experiment at CERN. Both of these experiments have substantial Lawrence Berkeley National Laboratory involvement.

She serves as the Faculty Advisor for Graduate Student Instructor (GSI) Affairs. She is committed to the teaching mission of our Department both as a mentor to GSIs and teaching undergraduates, from introductory physics classes to more advanced courses in quantum mechanics and particle

physics.

She has led the charge on aligning Physics with campus Data Science Initiatives serving as Chair of that Committee last year. In 2019, she was awarded the Presidential Chair Fellows Curriculum Enrichment Grant Program with the goal of “Enhancing Undergraduate Research Opportunities in Physics Using Data Science Techniques for Data.” The grant allowed the “opportunity to define and articulate undergraduate Discovery Learning and redesign key courses to create sequential intentional learning experiences for your undergraduate students.” This year, she is serving on a campus-wide committee to advise the integration of physics courses with foreign universities via the Education Abroad Program. Prof Shapiro was Chair of the Physics Department from 2004 through 2007. She was the first woman to serve in that position.

“Berkeley’s commitment to diversity and inclusion is central to its scientific vision. The broader our perspectives and experiences are, the more likely we are to make the out-of-the-box innovations that move us in new and exciting directions.”

Eleanor Crump



Eleanor Crump is former Facilities and Operations Manager and current Happy Helper

Eleanor has been on campus since 1959 as an undergrad, grad, and, since 1965, as a staff member, first as a lab tech and lab manager in the plant biology, followed in the 1980's by supporting the VC and Provost in the reorganization of the biological sciences, and in the 1990's the Academic Facilities Office where she managed lab renovations in the three new bioscience buildings. Eleanor has been in Physics for 21 years, first as Facilities and Operations Manager, and since her retirement as Happy Helper, serving her Physics Community, supporting facilities and construction projects and

equity and inclusion initiatives.

Eleanor represented the Physics Department on the design and construction teams for the renovation of Physics South (then known as Old Le Conte) in the early 2000's, followed by the design and construction of Campbell Hall, and the Birge Infrastructure Improvement Project, but she is most proud of her work with Physics faculty to design and build labs to support their awesome research. Soon after she came to Physics Eleanor established the Physics Support Services unit and managed the stellar Support Services team, to whom she owes so much: Anthony Vitan, Katalin Markus, Stephen Pride Raffel, and Carlos Bustamante. At that time Support Services included purchasing, a large storeroom of research and office supplies, shipping and receiving, access control, and facilities and construction services. Eleanor founded the Physics Safety Committee, loves working with the Physics Space Planning Committee, and greatly appreciates the good work we do together.

As this blurb is part of the celebration of 150 Years of Women at Berkeley, Eleanor acknowledges with the gratitude the women in her family who preceded her as graduates of UCB: her grandmothers in 1897 and 1908, followed by her mother and all of her aunts. Go Mama Bears!

Claudia Tujillo



Claudia Trujillo is the Director of Student Services and the Berkeley Physics International Education Program in the Department of Physics at UC Berkeley. She oversees the graduate and undergraduate programs, curriculum budgeting, planning, and implementation. She has been in Physics for 23 years and has proudly dedicated herself to supporting students' academic missions and the academic mission of the department by providing trustworthy and genuine leadership that focuses on individualized attention, the development of visions and strategies to support, improve and directly impact academic and personal experiences.

Her mission is to advocate for and to empower the educational and personal growth journey in an unbiased, supportive manner and to contribute to and facilitate the path to an individual's academic goals and success.

She is the recipient of campus awards recognizing her work in developing key plans and strategies for the department's Equity and Inclusion Plan, for identifying, planning, developing and launching the Physics Transfer Course (now a permanent part of the department's teaching curriculum) and also for her leadership in developing, launching and recruiting students for the Berkeley Physics International Education Program (BPIE). She was selected by the UC Office of the President for the UC Women's Initiative for Professional Development in 2019.

Mina Aganagic



Mina Aganagic is a Professor of Mathematics and Physics. She applies dualities in string theory and quantum field theory to problems in pure mathematics. She is known for discovering novel approaches to knot categorification, for discovering a refinement of Chern-Simons theory, and for pioneering the topological vertex approach to enumerative geometry.

She has been the Simons Investigator since 2016, and she is also a fellow of the American Physical Society.

She has been a Miller Research Professor from 2016-2017. She was awarded Sloan Fellowship in 2004, and she became a DOE Outstanding Junior Investigator in 2003.

She received her BS (1995) and PhD (1999) degrees from the California Institute of Technology and held a postdoctoral appointment at Harvard University from 1999-2003. She was an Assistant Professor of Physics and an Adjunct Professor of Mathematics at the University of Washington, Seattle from 2003-4. She joined the faculty in 2004.

Alessandra Lanzara



Alessandra Lanzara is the Charles Kittel Professor in Physics and a Senior Faculty Scientist at the Materials Sciences Division of Lawrence Berkeley National Laboratory since 2002. She is a member of the Kavli Energy Nanoscience Institute at Berkeley and the Director of the Center for Sustainable Innovation. She was elected Chair of the American Physical Society, Far West Section in 2018, and is now the Acting Chair since 2019.

Lanzara is a condensed matter experimentalist whose work centers on light-driven novel phases of matter and study of cooperative phenomena in quantum materials. She is a strong believer in the needs of a diverse and inclusive scientific community to drive real breakthroughs and innovation in science. She has supported and mentored over the years several women, who have moved on into successful careers both in research and industry. Her commitment to this cause is witnessed by her broad involvement over the years. Examples include chairing the LBNL Materials Sciences Division Equity and Diversity Committee, serving on the Chancellor's Advisory Committee on Work and Family, and on the Diversity, Equity, and Campus Climate Committee for more than 3 years. She has been an advisor for the Society for Women in Physics for over 10 years (since her arrival at Berkeley) and is a member of the Diversity and Equity Committee for the Physics Department. She has led one of the chapters for the Diversity and Equity Strategic Plan at LBNL.

Frances Hellman

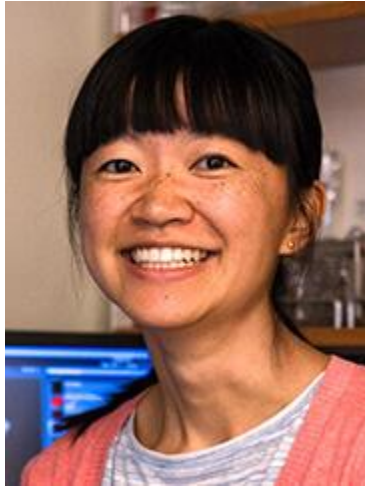


Professor Frances Hellman's research involves the physics of novel magnetic, semiconducting, and superconducting materials especially in thin-film form, where her recent work on amorphous dielectric materials led to her joining LIGO, the gravitational wave observatory. She joined the Berkeley Physics faculty in 2005 and served as Chair of the Department for 6 years, until 2013. She currently serves as Dean of the Division of Mathematical and Physical Sciences at UC Berkeley and has recently been elected as President of the American Physical Society. In addition to her work in the Physics Department, she has an appointment in the UCB Materials Science and Engineering Dept. as well as at LBNL in the Materials Sciences Division.

She has been on a large number of national and local science boards, including the APS Committee on the Status of Women in Physics, the APS Panel on Public Policy, the Elementary Institute of Science (in San Diego), COSMOS, a statewide math and science summer program for high school students, and as visiting scientist at the SF Exploratorium.

"I genuinely believe that science is better when a diverse group of people comes together to make discoveries. Riding the coattails of [Mary K. Gaillard](#) and [Marjorie Shapiro](#), [Mina Aganagic](#), and [Alessandra Lanzara](#), I am proud to be just the fifth woman in the department's faculty. I am even prouder to have helped the department triple its women faculty since then and to have fostered amazing female physicists in my own lab!"

QinQin Yu



QinQin Yu is a fourth-year physics grad student studying microbial evolution. She combines wet lab experiments with statistical mechanics models to understand how microbes evolve in space and time. She was the People's Choice winner of the 2019 UC Berkeley Grad Slam, a UC campus-wide competitive speaking event. In 2019 she traveled to Washington DC along with 3 other PhD students to meet with congressional offices to advocate for sustained levels of funding for fundamental research. QinQin has been selected to join the National Science Policy Network SciPol Scholars spring cohort in 2021. She is a member of the UC Berkeley Science Policy Group and the Society of Women in the Physical Sciences (SWPS).

"I love studying microbial evolution because I get to be a part of multiple scientific communities and learn from different people: statistical physicists, biophysicists, microbiologists, and population geneticists. I learn something new every week, and it's very exciting to make connections between ideas. I believe a lot of creative science can come out of collaboration between people with different backgrounds."