Melba Phillips: Leader in Science and Conscience

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Indiana History Blog

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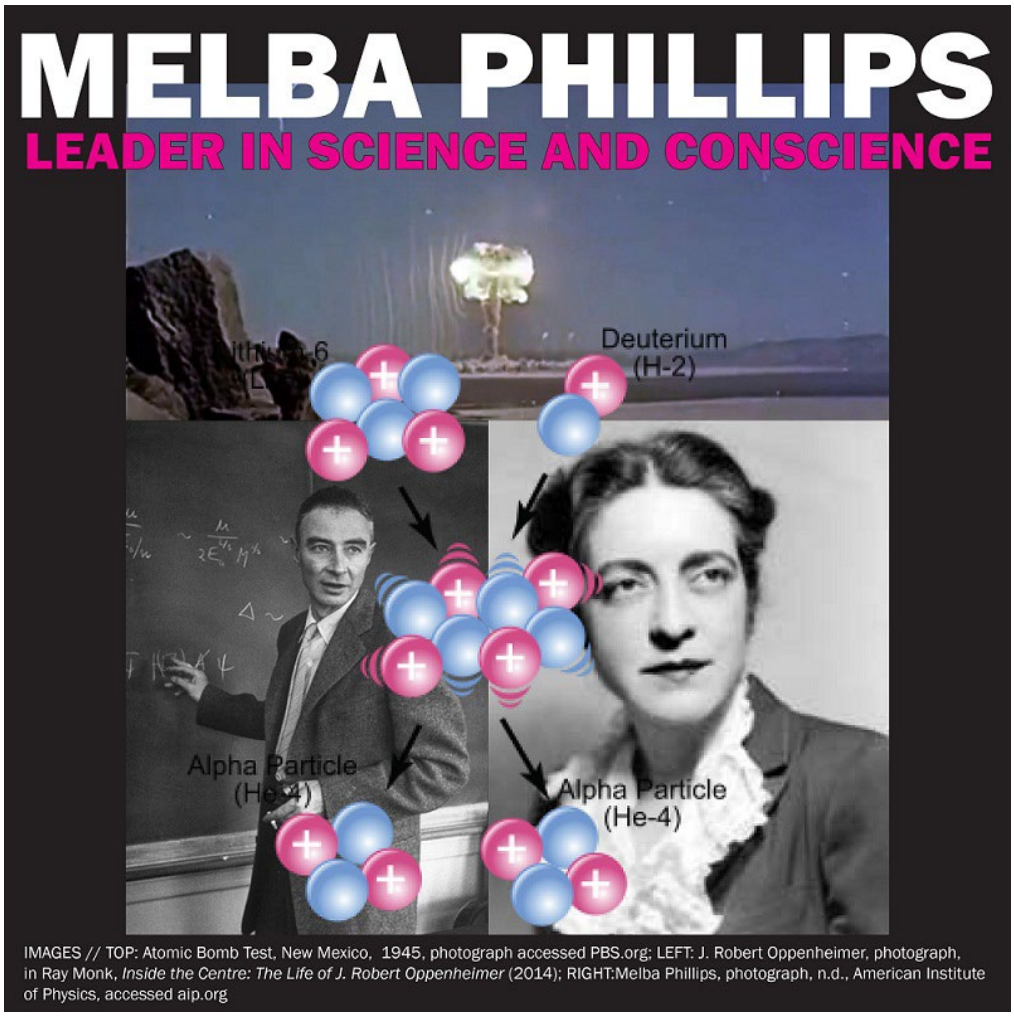


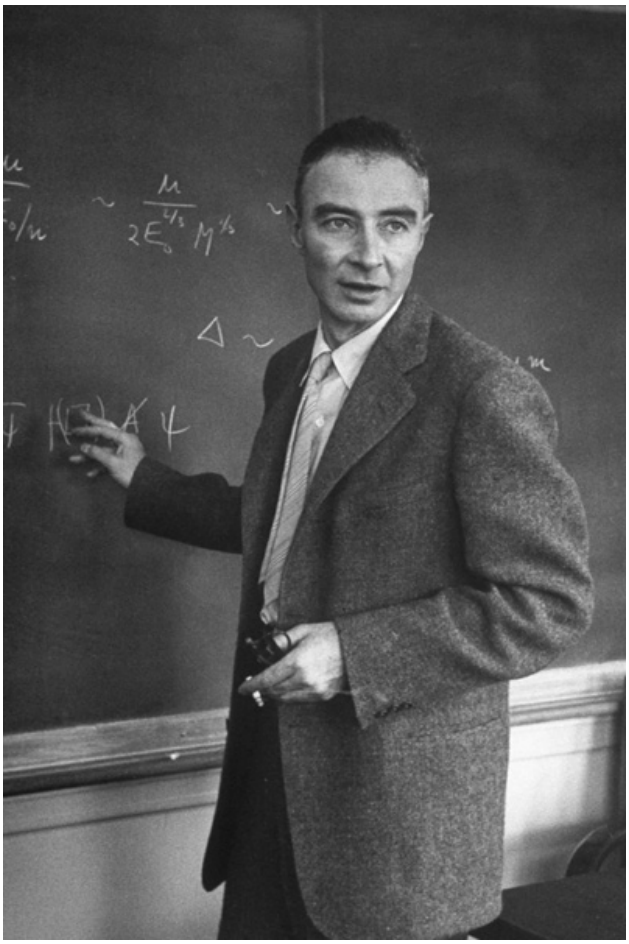
IMAGES // TOP: Atomic Bomb Test, New Mexico, 1945, photograph accessed PBS.org; LEFT: J. Robert Oppenheimer, photograph, in Ray Monk, *Inside the Centre: The Life of J. Robert Oppenheimer* (2014); RIGHT:Melba Phillips, photograph, n.d., American Institute of Physics, accessed aip.org

Part One

Indiana native Melba Newell Phillips pioneered new physics theories, studied under the famous J. Robert Oppenheimer, worked passionately to improve science education, and advocated for women's place at the forefront of science research. After the U.S. dropped atomic bombs on Japan at the end of World War II, Phillips and other scientists organized to prevent future nuclear wars. She took a great hit to her career during the Cold War as she stood up for the freedom to dissent in the oppressive atmosphere of McCarthyism. Colleagues and students have noted her "intellectual honesty, self-criticism, and style," and called her "a role model for principle and perseverance."

Phillips was born February 1, 1907 near Hazleton, Indiana. According to *Women in Physics*, Phillips graduated from high school at 15, earned a B.S. from Oakland City College in Indiana, taught for one year at her former high school, and went on to graduate school. In 1928, she earned a master's degree in physics from Battle Creek College in Michigan and stayed there to teach for two years. In 1929 she attended summer sessions on quantum mechanics at the

University of Michigan under Edward U. Condon. When she sought Condon's help on a physics problem, her solution, rather than his, ended up being the correct one. This led to a lifelong friendship and Condon recommended Phillips for further graduate study at the University of California, Berkley. Here she pursued graduate research under Oppenheimer and earned her Ph.D. in 1933. Within a few years she was known throughout the physics world because of her contribution to the field via the Oppenheimer-Phillips effect.

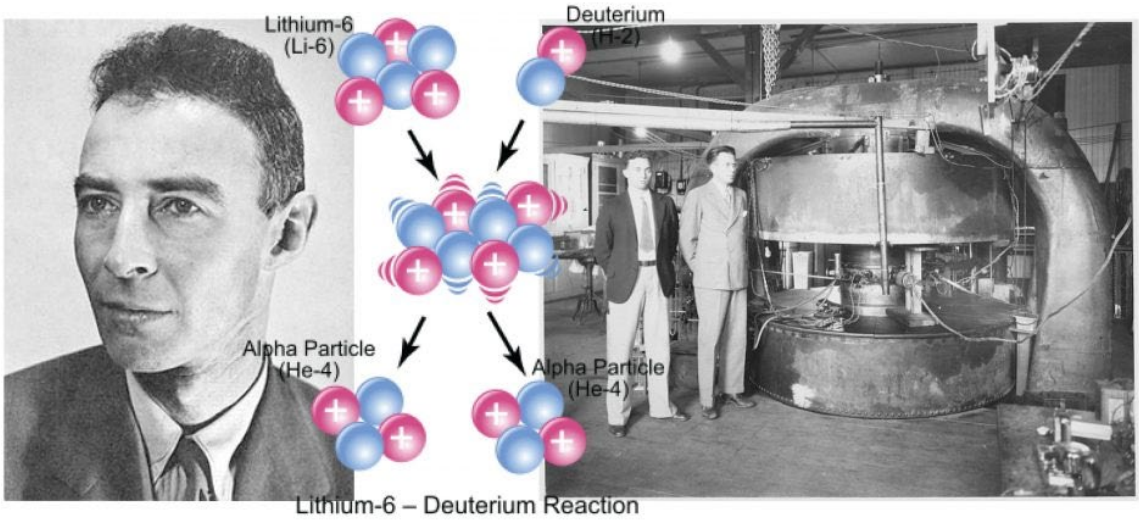


J. Robert Oppenheimer, photograph, in Ray Monk, Inside the Centre: The Life of J. Robert Oppenheimer (2014).

The 1935 Oppenheimer-Phillips Effect explained "what was at the time unexpected behavior of accelerated deuterons (nuclei of deuterium, or 'heavy hydrogen' atoms) in reactions with other nuclei," according to a University of Chicago press release. When Oppenheimer died in 1967, his *New York Times* obituary noted his and Phillips's discovery as a "basic contribution to quantum theory." Manhattan Project scientist and professor emeritus of chemistry at the State University of New York, Stony Brook Francis Bonner explained in the release that normally such an accomplishment, now considered "one of the classics of early nuclear physics, "would have meant a faculty appointment. However, Phillips received no such appointment, perhaps due in part to the Great Depression, but also likely because of her gender.

OPPENHEIMER-PHILLIPS EFFECT

The Oppenheimer–Phillips process or strip reaction is a type of deuteron-induced nuclear reaction. In this process the neutron half of an energetic deuteron (a stable isotope of hydrogen with one proton and one neutron) fuses with a target nucleus, transmuting the target to a heavier isotope while ejecting a proton.
The process allows a nuclear interaction to take place at lower energies than would be expected. This is because, as the deuteron approaches the positively charged target nucleus, it experiences a charge polarization where the "proton-end" faces away from the target and the "neutron-end" faces towards the target. The fusion proceeds when the binding energy of the neutron and the target nucleus exceeds the binding energy of the deuteron and a proton is then repelled from the new, heavier, nucleus.



DEFINITION: "Oppenheimer-Pjillips Process," Revolvy, accessed revolvy.comIMAGES: Melba Phillips, photograph, American Association of Physics Teachers, accessed www.aapt.org; J. Robert Oppenheimer, photograph, Revolvy, accessed revolvy.com; "Nuclear Reaction" chart, Revolvy, accessed revolvy.com; "University of California, Berkley, cyclotron," Atomic Heritage Foundation, University of California, Berkley, accessed: atomicheritage.org

Instead, Phillips left Berkley to teach briefly at Bryn Mawr College (PA), the Institute for Advanced Study (NJ), and the Connecticut College for Women. On February 16, 1936, the *New York Times* reported that she was one of six women to receive research fellowships for the 1936-1937 academic year as announced by the American Association of University Women. The announcement read: "Melba Phillips, research fellow at Bryn Mawr, received the Margaret E. Maltby fellowship of $1,500 for research on problems of the application of quantum mechanics to nuclear physics."

SIX WOMEN GET FUNDS FOR STUDY

All of Fellowships for 1936 and 1937 Are Designed to Promote Research.

SPECIFY VARIED COURSES

Awards Made by Decision of Eight Women Scholars for Work Here and Abroad.

New York Times, February 16, 1936, N6, ProQuest Historical New York Times.

In October of 1937 Phillips served as a delegate to the fall conference of the association at Harvard, where the discussion centered around the prejudices against women scientists that halted not only their careers, but scientific progress more generally. According to a 1937 *New York Times* article, Dr. Cecelia Gaposchkin, a Harvard astronomer, detailed the "bitter disappointments and discouragements" that faced women professionals in the field of science. Certainly, Phillips related, as her career moved forward slowly despite her achievements in physics.

Pupin Physics Laboratory, Columbia University, "Short History of Columbia Physics," accessed http://physics.columbia.edu/about-us/short-history-columbia-physics.

Finally, in 1938, she received a permanent teaching position at Brooklyn College. In 1944, she also began research at the Columbia University Radiation Laboratory. Phillips was highly regarded as a teacher and Bonner noted she became "a major figure in science education" who "stimulated many students who went on from there to very stellar careers."

Meanwhile, the U.S. officially entered World War II with the December 7, 1941 bombing of Pearl Harbor. No previous war had been so dependent on the role of science and technology. From coding machines to microwave radar to advances in rocket technology, scientists were in demand by the war effort.

In July 1945, the Manhattan Project scientists successfully detonated an atomic bomb in the desert of Los Alamos, New Mexico. In August 1945, the U.S. dropped two atomic bombs on Japan, forcing the country to surrender and effectively ending World War II. Over 135,000 people were killed in Hiroshima and 64,000 in Nagasaki. Many thousands more died from fires, radiation, and illness. While a horrified public debated whether the bomb saved further causalities by ending the war or whether it was fundamentally immoral, scientists also dealt with remorse and responsibility.

Leslie Jones, "1st Atomic Bomb Test," photograph, Boston Public Library.

Henry Stimson, Secretary of War in the Truman administration, stated, "this deliberate, premeditated destruction was our least abhorrent choice." Oppenheimer, however, reflected, "If atomic bombs are to be added as new weapons to the arsenals of a warring world, or to the

arsenals of nations preparing for war, then the time will come when mankind will curse the names of Los Alamos and of Hiroshima." More bluntly, Oppenheimer told Truman, "Mr. President, I feel I have blood on my hands." Many physicists retreated to academia, but some became politically active, especially in regard to preventing further destruction through scientific invention.

Representing the Association of New York Scientists, Phillips and leading Manhattan Project scientists helped organize the first Federation of American Scientists meeting in Washington, D.C. in 1945. The goal of the Federation was to prevent further nuclear war. That same year Phillips served as an officer in the American Association of Scientific Workers, an organization working to involve scientists in government and politics, to educate the public in the science, and to stand against the misapplication of science by industry and government. On August 16, 1945 the *New York Times* reported that Phillips and the other officers of the Association signed a letter to President Truman giving "eight recommendations to help prevent the use of atomic bombs in future warfare and to facilitate the application of atomic energy to peacetime uses."

By the end of the 1940s, Melba Phillips's accomplishments in physics and science education were well-known throughout the academic physics community. However, by the early 1950s, she was accused of being affiliated with communist subversives and fired from her university positions. What happened to this Hoosier physics pioneer?

Part Two

Melba Phillips, photograph, n.d., University of Chicago News Office, accessed University of Chicago News Office.

The Second World War, particularly the use of the atomic bomb, gave way to the Cold War. Living in the shadow of the threat of a nuclear war with the Soviet Union induced anxiety among many Americans. While Senator Joseph McCarthy became the public face of fear of homegrown communists, many other paranoid and xenophobic senators participated in the witch hunts. In 1950, Nevada Senator Pat McCarran sponsored the McCarran Internal Security Act, which allowed for investigation of "subversive activities;" made an "emergency" allowance for detaining people suspected of such activity; and even made picketing a courthouse a felony if it "intended" to obstruct proceedings. The act also provided for a five-member committee with the Orwellian title of the Subversive Activities Control Board (SACB), which was headed by McCarran and tasked with rooting out communists, communist-sympathizers, and other "subversives." The SACB, or the McCarran Committee as it was more commonly called, went to work immediately.

Demonstrators demand repeal of the Smith and McCarran Acts, circa July 19, 1950, Los Angeles, Charlotta Bass / California Eagle Photograph Collection, 1880-1986, Southern California Library for Social Studies and Research.

In 1952, Melba Phillips was called to testify before the U.S. congressional committee on her political activity. According to an October 14, 1952 *New York Times* article, a witness claiming to be "a former Communist official" testified that "he helped set up secret units of Communist teachers" and that "300 of the 500 dues-paying Communist teachers in this city went into a secret set-up whose top unit consisted of leaders of the Teachers Union." Several prominent New York teachers refused to confirm or deny communist leanings, while outside of the courthouse students and teachers gathered in protest, chanting "Pat McCarran, hit the sack. We want our professors back!"

According Dr. George Salzman, a University of Massachusetts at Boston professor who was a student of Phillips's at that time,

"She let the Committee counsel know that her lineage went back to the Mayflower, and she wasn't about to take part in the witch hunt."

Phillips was subsequently fired from her university positions due to a law which required the termination of any New York City employee who invoked the Fifth Amendment. Bonner explained, "McCarran was a specialist at putting people in the position in which they had to invoke the Fifth Amendment. It was a deliberate expression of the McCarthyism of the time." In a 1977 interview, Phillips briefly discussed the incident (although she was reluctant because she was trying to keep the interviewer focused on her scientific accomplishments). She stated: "I was fired from Brooklyn College for failure to cooperate with the McCarran Committee, and I think that ought to go into the record . . . city colleges were particularly vulnerable, and the administration was particularly McCarthyite." Phillips stated that she wasn't particularly political. Her objection to cooperating had been a matter of principle.

EX-RED DESCRIBES CITY TEACHER BLOCS

Also Tells Senators Communist Led Army Intelligence Unit— N. Y. U. Suspends Professor

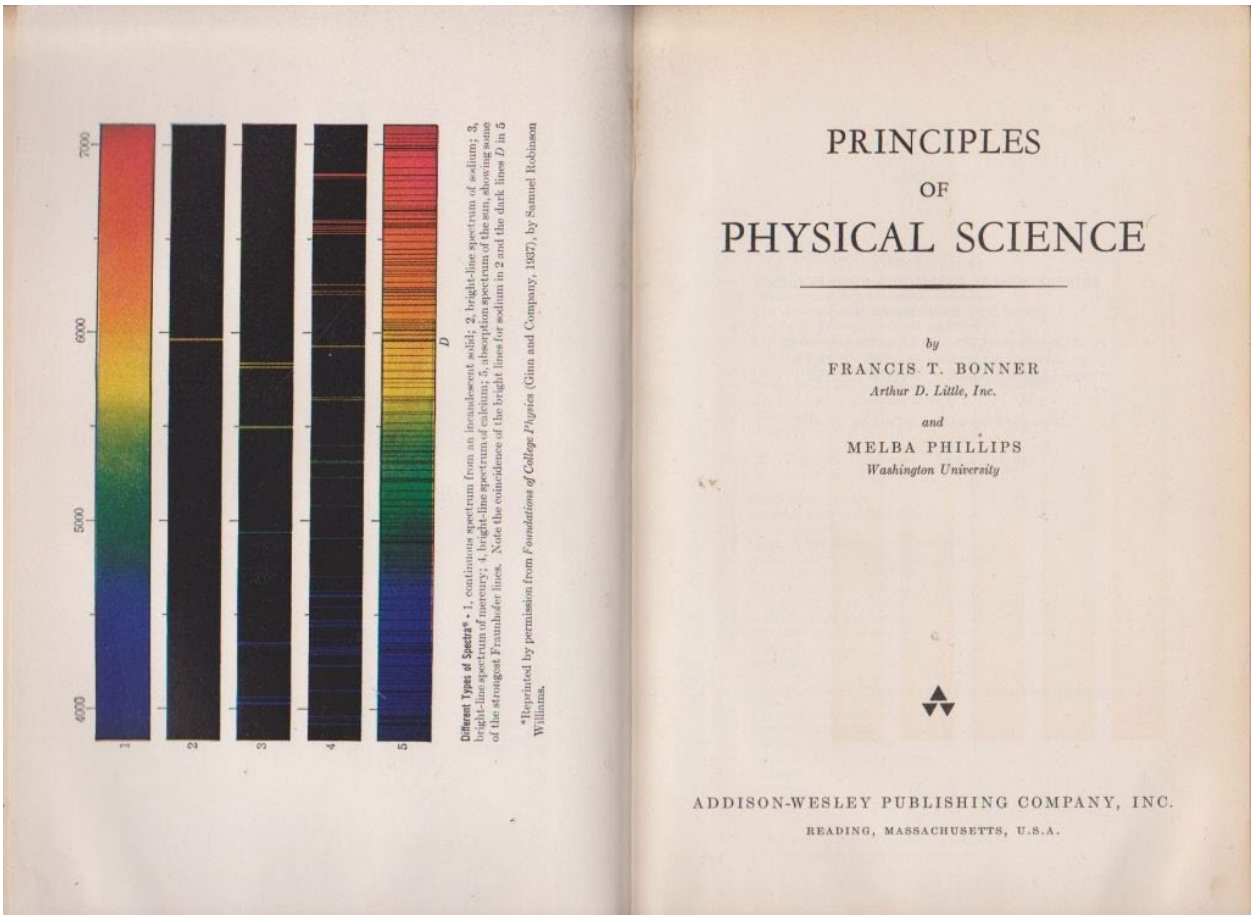
By CHARLES GRUTZNER

A former Communist official who was expelled from the party in 1950 as an informer testified here yesterday before a Senate Internal Security subcommittee that:

¶He helped set up secret units of Communist teachers in 1949 when the Communist party "went underground" and that 300 of the 500 dues-paying Communist teachers in this city went into a secret setup whose top unit consisted of leaders of the Teachers Union.

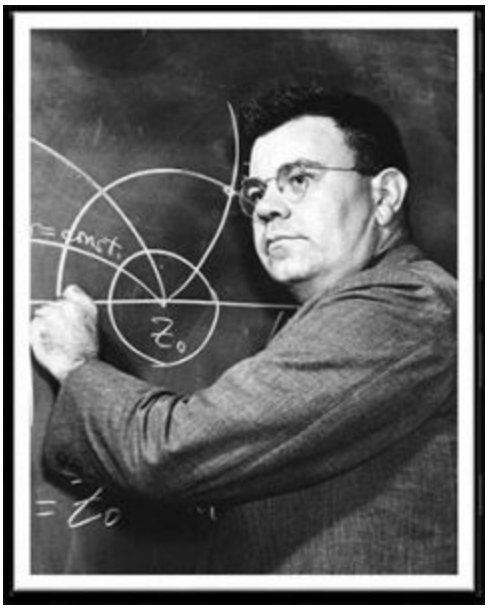
New York Times, October 14, 1952, 1, accessed ProQuest Historical Newspapers.

Phillips did not let her dismissal extinguish her passion for science education. While unemployed, she wrote two textbooks, which became university classroom standards: *Classical Electricity and Magnetism* (1955) and *Principles of Physical Science* (1957).



Melba Phillips and Francis T. Bonner, Principles of Physical Science (Reading, MA: Addison-Wesley Publishing Company, Inc., 1957).

In 1957, Phillips became the associate director of the Academic Year Institute of Washington University in St. Louis, a teacher-training school. Her appointment came at the behest of Edward Condon who had also been named as a security risk by the House Un-American Activities Committee in the early 1950s. On Condon's decision to hire her, Phillips stated, "there was much discrimination against people who had had any trouble of a 'political' kind, and it took a lot of courage, It took courage to hire any of the people in trouble during that time."


Edward Condon, photograph, n.d., accessed National Institute of Standards and Technology.

At the institute she developed programs instructing high school teachers about how to teach elementary science and physics. She remained at Washington until 1962 when she joined the faculty of the University of Chicago. Among her accomplishments there, she worked to make science accessible to non-science majors. She also made laboratory work an important part of the student experience. She explained that "we worked very hard in our laboratory in Chicago . . . unless the students get 'hands on,' it seems they don't fully understand the material."

In 1966, she became president of the American Association of Physics Teachers, of which she had been a member since 1943. This respected organization was founded in 1930 as "a professional membership association of scientists dedicated to enhancing the understanding and appreciation of physics through teaching." Phillips became not only AAPT's first female president, but one of its most memorable and effective leaders. Phillips was proud of the work of the organization and wrote the official History of the AAPT. She worked to make physics more important to teachers at the high school level in addition to college. She stated,

"The people in the universities whose future depends on their writing more and more research papers have very little patience with the problems of education at a lower level. This has to do in part with why the Association of Physics Teachers ever got started."

Phillips remained at the University of Chicago until she retired as *Professor Emerita* in 1972. Even after her retirement from the University of Chicago, she continued to teach at other schools as a visiting professor. She taught at the State University of New York, Stony Brook from 1972 to 1975, and at the Chinese Academy of Science in Beijing in 1980. Phillips was awarded more honors than can be mentioned without compiling an extensive list. Notably, however, in 1981, the AAPT awarded her the first Melba Phillips Award, created in her honor, "for exceptional contributions to physics education."

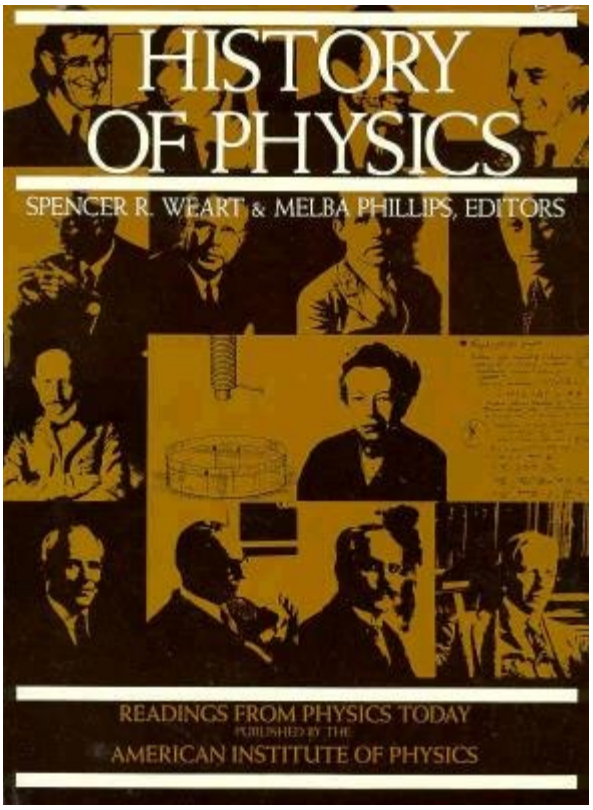


Image courtesy of alibris.com.

In 1987, Brooklyn College publicly apologized for firing Phillips, and in 1997 created a scholarship in her name. Melba Phillips died on November 8, 2004 in Petersburg, Indiana at the age of 97. The *New York Times* referred to Phillips in her obituary as "a pioneer in science education" and noted that "at a time when there were few women working as scientists, Dr. Phillips was leader among her peers." Her accomplishments helped pave the way for other women in the sciences. In a 1977 interview, Phillips addressed the problems women face in aspiring to science careers a 1977 interview, stating:

We're not going to solve them, but, as I've been saying all the time; if we make enough effort, we'll make progress; and I think progress has been made. We sometimes slip back, but we never quite slip all the way back; or we never slip back to the same place. There's a great deal of truth in saying that progress is not steady no matter how inevitable.