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Marietta Blau in the history of cosmic rays

Per Carlson

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Per Carlson, in his article "A century of cosmic rays" (PHYSICS TODAY, February 2012, page 30), states that the investigation of cosmic rays opened up the field of particle physics. However, he neglects the importance of nuclear emulsions in the progress of particle physics, and he fails to mention a key figure, Austrian physicist Marietta Blau (1894–1970), who pioneered the development of photographic emulsions capable of reliably and quantitatively imaging high-energy nuclear particles and events, including reactions induced by cosmic radiation.[1]

Between 1923 and 1937, Blau contributed to essentially every aspect of emulsion physics. In 1925 she successfully distinguished the tracks of alpha particles, fast protons, and background events in commercial emulsions, and in 1927 she determined proton energies by measuring the distances between the exposed grains in their tracks. To record the long tracks of fast protons more accurately, she enlisted British film manufacturer Ilford to thicken the emulsion on its commercial film, and she experimented with every other emulsion parameter—grain size, latent image retention, development conditions—to improve the visibility of alpha-particle and fast-proton tracks.

Beginning in 1932 Blau and her assistant Hertha Wambacher determined neutron energies by measuring the tracks of recoil protons in the hydrogen-rich emulsions; in 1936 they began using emulsions for quantitative studies of cosmic radiation by exposing stacks of photographic plates for several months at an elevation of 2300 meters. As expected, they recorded the tracks of extraterrestrial protons and neutrons, but to their surprise they also discovered several "stars," which they realized could only have been formed by cosmic particles explosively disintegrating heavy nuclei in the emulsion. That discovery, in 1937, created a sensation among nuclear and cosmic-ray physicists worldwide, and by demonstrating that nuclear emulsions had come of age for recording rare high-energy nuclear events, it paved the way for further research in particle physics. Cecil Powell, for example, began using photographic film only in 1938 after he, like all others in the field, recognized the significance of Blau and Wambacher's discovery and the advantages of the emulsion method.[2] (See also the article by Peter Galison in PHYSICS TODAY, November 1997, page 42, and his response to letters in August 1998, page 81.)

In considering 20th-century history, one must be alert to the effects of racial persecution and forced emigration on the attribution and recognition of scientific work. Blau, a Jew, was forced out of Austria in 1938. For 10 years she led a fragile existence as a refugee in Oslo, Norway; Mexico City; and New York, unable to pursue her own research. Meanwhile, in Vienna, her former associates, all ardent Nazis (including Wambacher), expropriated her work and suppressed her name.[3]

Blau's marginalization is apparent in the decision process for awarding the 1950 Nobel Prize in Physics to Powell. Blau and Wambacher were also nominated that year, by Erwin Schrödinger. Although the 1936 physics Nobel for Victor Hess and Carl Anderson provided a precedent for dividing the award between a fundamental early discovery and one that came later, it is evident that the women were not objectively considered. Instead, the documentation shows that the Nobel physics committee prepared a blatantly inaccurate assessment that denied the importance and priority of Blau's and Blau and Wambacher's work. The women's names are entirely absent from the published Nobel texts for that year, although other scientists are mentioned who were never nominated and contributed far less. Powell himself did not cite Blau in his Nobel lecture.[4]

As a result, Blau was almost entirely written out of the history of 20th-century physics. Although recent research has helped to bring her back in, Carlson's article shows how persistent the established narrative can be. In the interests of basic accuracy and historical sensibility, Marietta Blau and her contributions deserve a prominent and permanent place in any history of cosmic-ray and particle physics. And I believe it is also important, given the much-discussed problem of the under-representation of women in physics, that PHYSICS TODAY take care not to overlook women who, like Blau, made major contributions to physics.

References

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■ **Carlson replies:** Ruth Lewin Sime correctly points out the important contributions to the nuclear emulsion technique by Marietta Blau, which are unfortunately often forgotten. Blau, together with Hertha Wambacher, observed cosmic-ray-induced "stars" in 1937. In my article, I pointed out that many results of fundamental importance were indeed obtained using nuclear emulsions, in particular the discovery of the pion that earned Cecil Powell the 1950 Nobel Prize in Physics.

In 1950 Blau and Wambacher were nominated for the Nobel Prize in Physics for the method of exposing sets of emulsion plates at high altitude and for observing cosmic-ray-induced stars.[1] Among the other 28 nominees that year was Cecil Powell, who received 16 nominations.

Contrary to what Sime says, the names of Blau and Wambacher are not absent from the "Nobel texts." In its 1950 recommendation to the Royal Swedish Academy of Sciences, the Nobel Committee for Physics included as an enclosure a nine-page detailed and accurate account, written by committee member Axel Lindh,[2] on the work by Blau and Wambacher. Lindh wrote that without any doubt Blau and Wambacher were the first to use plates of emulsions to study cosmic rays and the first to use the technique to observe cosmic-ray-induced stars, a phenomenon earlier observed in cloud chambers. Lindh noted that Wambacher, in a 1938 paper,[3] wrote that E. G. Steinke was the one who had proposed using emulsions to study cosmic-ray stars. In his conclusion, Lindh acknowledged the pioneering work by Blau and Wambacher but noted that it was not of sufficient significance for a Nobel Prize.

The committee report[4] discussing the nomination of Blau and Wambacher states that among the notable descriptions of progress made using the emulsion technique are a 1925 article in which Blau says that protons also can be observed and one by Blau and Wambacher in 1937 reporting cosmic-ray-induced stars. The report ends with the proposal to award the 1950 Nobel Prize in Physics to Powell.

References

1. Minutes of the Royal Swedish Academy of Sciences on Nobel Matters, Nobel Archives, Royal Swedish Academy of Sciences, Stockholm (1950), p. 391.
2. Ref. 1, p. 132.
3. H. Wambacher, *Phys. Z.* **39**, 883 (1938).
4. Ref. 1, p. 81.

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