

LETTERS

DID EINSTEIN ESPOUSE HIS SPOUSE'S IDEAS?

In the April 1988 issue (page 124) K. Suchy comments on Albert Einstein's statement in a letter to his then-fiancée, Mileva Marić: "How happy and proud I will be when the two of us together will have brought our work on relative motion to a successful conclusion." As John Stachel wrote in his "Einstein and Ether Drift Experiments" (May 1987, page 45), "this comment raises the intriguing question of the nature of Marić's role in their collaboration." For me this statement is the proof of something I had suspected ever since Ronald Clark's *Einstein: The Life and Times* (World, New York) appeared in 1971.

Clark tells us that "the men and women against whom [Einstein] was brushed by the chances of everyday life, were only too ready to admit that relativity was beyond them... with Mileva the situation was different, for was she not a physicist like her husband? Had she not, in fact, got just enough 'little learning' to enter the new world he had created if only he would spare the time to explain things? The answer was 'No,' but she would never believe it."

But what was this "little learning" Clark speaks of? As it happens, Mileva received essentially the same education in physics that her husband received. Both completed the course work at the Zurich Polytechnic Institute; Albert barely satisfied the requirements for the degree, while Mileva never completed a thesis—at least not one that carried her name. With or without her degree, Mileva Marić must have been a unique woman. To this day women do not come to physics in large numbers. When I was working on my doctorate at the University of Maryland in the early 1960s, though we had some 500 graduate students in physics, there were (most unfortunately) only about three who were women. But for a woman at the turn of the century, of apparently modest means, to have had the drive to seek out an education in physics, surely she must have been remarkable.

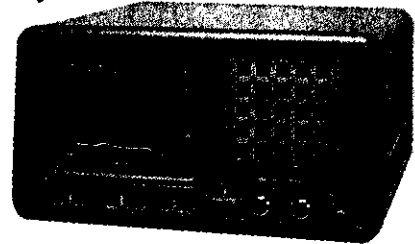
Stachel goes on to say that Ein-

stein's "letters to her contain references to joint study of books, requests for her to look up data, and one or two other mentions of joint work; but these letters give no indication of any ideas she contributed to their work." Yet only *ten* letters from Mileva to Albert Einstein from this period have been found. One may wonder if there were other letters that for some reason were not so carefully retained.

I cannot help but see Mileva and Albert Einstein working as a team, hoping together to achieve the kind of husband-and-wife recognition that had come to Marie and Pierre Curie. Mileva Einstein and Marie Curie were in fact good friends, sufficiently close that the two families went on holiday together in the Swiss Alps. I cannot imagine these four people together, considering Mileva's own drive to obtain an education in physics, without the idea of some shared fame coming to her mind. And yet one cannot watch theoretical physics easily, the way one could see the two Curies year after year at work on the chemical separation of radium from tons of pitchblende. Mileva undoubtedly would have seen the wisdom of building the reputation of her husband at her own expense, if need be, so that he could obtain a university post. But once he obtained such a post and such recognition, the lack of that shared dream could have come back to strain their marriage.

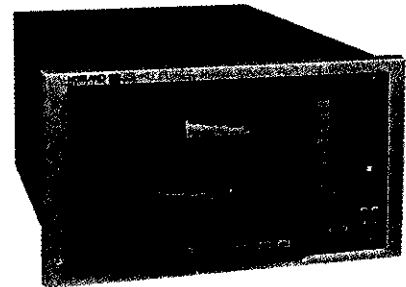
Albert Einstein and Mileva finally separated in the summer of 1914. Their years together saw Einstein's greatest achievements: His physics was filled with daring concepts of space and time distorted, of gravitation's being only a distortion of the space-time metric, of photons that truly were packets of energy—not just as a mathematical device, as Max Planck thought, but as a reality. And his work was filled with the immediate implications of the most recent and detailed findings of the current physics. But after his marriage to Mileva ended, his physics became conservative. He added the cosmological constant to his equations so that they would predict the physics every-

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one expected for the universe, and as a consequence he missed predicting the Big Bang. He became not the leader of avant-garde physicists, but in time the odd man out in his position against the new quantum theory. But more than all of this, he seemed never to be able to enjoy his own success the way other physicists have theirs. He spent the rest of his life working almost as if he still had to prove himself. I cannot help but feel that the literature searches, the background material and, most importantly, those most basic capricious ideas that were the turning points of relativity theory came from Mileva, while the mathematics and proofs came largely from Albert.

According to my speculative picture of these events, when they separated, there was nothing more that she could do with whatever ideas still haunted her mind. And he, for all his ability, had to be content with continuing to sift through all the old ideas, forever searching for originality to come out of slight changes in his equations.

In February 1919 the marriage of Albert and Mileva ended in an amiable divorce. Mileva received custody of the children, child support and alimony. And in an added clause of the divorce decree, Albert Einstein agreed to pay Mileva every krona of any future Nobel Prize he might be awarded. He could keep the glory, but (in a settlement that would make an LA divorce lawyer blush) she had the prize. I find it difficult to resist the conclusion that Mileva, justly or unjustly, saw this as her reward for the part she had played in developing the theory of relativity. It would have been a good bargain for her to make, for who would ever believe that she had anything to do with the development of the theory? It might have been a good deal for Albert as well, for had she made such a claim, the scandal could have curtailed his career. For whatever reason, he kept this agreement secret for many years.

Hardly anything remains now to help us piece together what did occur then. There are only the odd statements that suggest that Albert was himself too poorly informed about matters he should have regarded as the most exciting ideas of his time, considering his interest. How could he have pursued his interest in relativity for years with no knowledge of the Michelson-Morley experiment or (until quite late) of the work Hendrik A. Lorentz had done? What were the things that Mileva researched? What discoveries did she make? I doubt we will ever know, yet perhaps, perhaps

the theory of relativity did begin in the mind of Mileva Einstein.

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STACHEL REPLIES: Mileva Marić was certainly a "unique woman," who must have possessed the considerable "drive" needed around the turn of the last century to take a young woman from a small town in the Balkans to the physics section of the Swiss Federal Polytechnical School (ETH). The real problem is to characterize accurately what made her unique, and to understand what happened to that drive after she got to the ETH—a problem that I certainly will not attempt to solve here. However, two points should be borne in mind in approaching this problem:

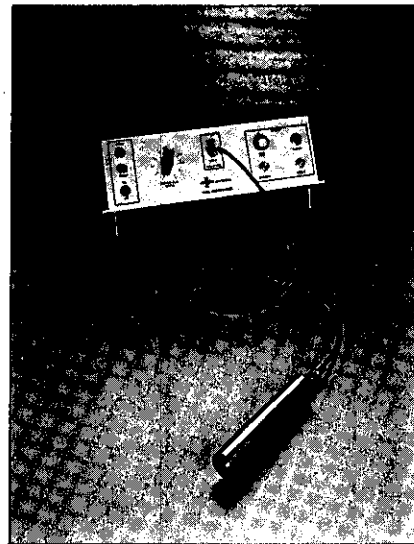
▷ The cause of Einstein-Marić (as she was known according to Swiss custom after her marriage), and, more generally, of understanding in greater depth the problems that confronted women trying to start a career in science at the turn of the century, is not well served by exaggerated claims for her abilities. She was not the first woman who studied physics (to say nothing of other subjects) at the ETH. A number of women graduated before 1900. Marić did not graduate because she twice failed to pass the final examinations.

▷ To rescue Einstein-Marić from the obscurity to which she has been consigned so long and unjustly, it is not necessary to deprecate Einstein's intellectual abilities. Rather, one must try to understand the role of each in the other's life on the basis of a careful study of all available evidence, taking into account all relevant factors in their relationship, including its psychological, sociological and intellectual aspects.

Einstein certainly will not emerge from such scrutiny as a plaster saint, but there is no evidence to indicate that he will emerge as an intellectual plagiarist. On the basis of their early correspondence, I think it is clear that she played a crucial role in his emotional life—as he did in hers. But up to now, at least, there has been no evidence that she played a similarly crucial role in his intellectual development or scientific accomplishments.

Indeed, there is at least one significant piece of contrary evidence. Aside from one comment on a course she took, none of Marić's letters to Einstein touches on any substantive point in physics, while his to her are chock-full of substantive comments on books and articles on physics he

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has read, as well as on his own theoretical ideas and experimental proposals. It is true that only ten of Marić's letters to Einstein from 1902 or earlier have come to light, compared with 43 of his. (All of this correspondence was preserved in Einstein-Marić's papers, by the way; in general, Einstein appears to have saved practically no early letters, while other people later tended to save his, for obvious reasons.) But one could not select ten of Einstein's letters to Marić that would be as devoid of references to physics as are hers to him.

Evan Harris Walker has created a "speculative picture" that has more the flavor of a Hollywood script than of a serious evaluation. I find no evidence in his letter that he has read the 18 Marić letters (10 to Einstein, 8 to a friend), or Einstein's 43 to Marić, printed in volume 1 of the *Collected Papers of Albert Einstein*. I do find several items of misinformation in his letter. Considerations of space only permit me to list and comment very briefly on some.

According to Walker, Einstein "barely satisfied the requirements for the degree" at the ETH. There were just two sets of required examinations at the ETH. Of the five students who took the intermediate examinations in 1898, Einstein got the highest average grade (5.7 out of a possible 6). Marić, who took these examinations a year later, got an average grade of 5.05, the second lowest among students taking them that year. Einstein and Marić were the only students who took the physics final examinations in 1900. He passed with an average of 4.91; Marić failed with an average of 4.0. The following year she failed again with the same average, while two other students passed.

Walker states that Marić "never completed a thesis—at least not one that carried her name." (The implication of the last phrase is clear: Perhaps she wrote Albert's.) In fact, both Einstein and Marić completed the *Diplomarbeit*, a thesis necessary to receive a degree (*Diplom*) from the ETH. Einstein got a grade of 4.5 for his, and Marić received a 4 (again out of 6) for hers. It is true that Marić abandoned work on a doctoral thesis after her second failure to pass the ETH final examination. Einstein, on the other hand, completed a doctoral thesis during the fall of 1901 and submitted it to the University of Zurich late in 1901. Apart from a short visit, Einstein and Marić had been separated since she returned to her parents' home during the sum-

mer. From there she wrote to a friend, "I read it [the thesis] with great joy and real admiration for my darling"—curious words if she wrote it herself. Her admiration apparently was not shared by the university authorities, since Einstein's dissertation was withdrawn early in 1902. He got a doctorate in 1905 for an entirely different dissertation.

Walker states that "Mileva Einstein and Marie Curie were in fact good friends." While they met a few times, I know of no evidence of any real friendship between the two women. Their respective children, Hans Albert Einstein and Eve Curie, recollected conversations on physics between Curie and Albert Einstein during their walks in the Engadin; neither mentions any conversation at all between Curie and Einstein-Marić.

Walker states that Einstein "pursued his interest in relativity for years with no knowledge of the Michelson-Morley experiment or (until quite late) of the work Hendrik A. Lorentz had done." As I indicated in my *PHYSICS TODAY* article, the new letters prove Einstein was certainly aware of both by the beginning of the century, about five years before he published his first paper on the subject. Since he was only 21 in 1900, I don't see how he can be said to have acquired his knowledge of either "quite late."

Walker states that Einstein's and Einstein-Marić's "years together saw Einstein's greatest achievements. . . . After his marriage to Mileva ended, his physics became conservative." About a year after his separation from Einstein-Marić in 1914, Einstein surmounted the major conceptual difficulty that had prevented him for two years from completing the general theory of relativity—the theory that was surely his crowning intellectual achievement. Within about two years of the separation, he made one of his major contributions to the quantum theory by introducing the concept of transition probabilities between quantum states. The only conclusion that I draw from these achievements so soon after the separation is that Walker's statement is incorrect.

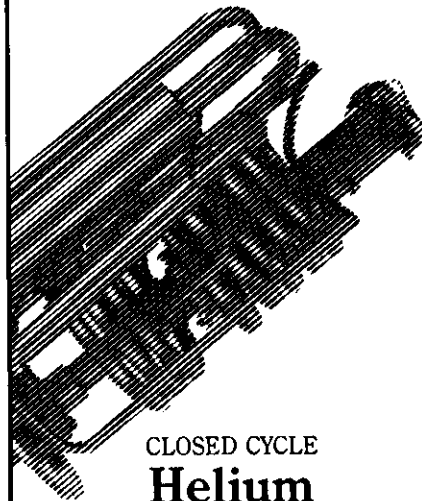
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over a subset of the problem, how few of these are native-born Americans.¹

The tears wept in the latter case seem to me to be of the crocodile variety. In my mind there isn't a trade union in the US that wouldn't identify the current scheme of hiring non-Americans to fill academic jobs with "scab labor." To a person from a developing country it is a godsend to be offered the opportunity to be employed—even at the current pitance—in an American university and to enjoy the freedom and luxuries of our open and democratic society: far better than returning to his or her native country to scratch out an existence, often under a repressive regime.

Native-born Americans, however, don't have this motivation. They observe that qualifying for such jobs requires one to expend a decade or so of strenuous effort, only to then be pitched into a job pool that resembles a million barracudas pursuing a morsel of food, and offering salaries that are laughable if one is not independently wealthy. Other, greener fields beckon, and are these people to be blamed for heading for them?

One answer to the problem is an "American affirmative action program" that the "crocodiles" probably won't buy: Restrict a certain percentage of academic jobs in American academic institutions to native-born Americans. Then these institutions would be forced to offer a living wage to academics in order to attract Americans to these jobs, thereby bettering conditions for all, American or non-American.

Reference

1. For example, see R. C. Atkinson, *Science* 248, 425 (1990).

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Mileva Marić's Relativistic Role

In his rebuttal to my letter (February 1989, page 9), John Stachel, while acknowledging that Mileva Marić, Einstein's first wife, was certainly a "unique woman" with "drive," says that "the real problem is to characterize accurately what made her unique." That purpose has not been well served by Stachel's distortions of the historical facts that we have. I had hoped my letter would show that Mileva made significant contributions to physics, so that recognition would be accorded her to correct the unjust treatment she has suffered at

the hands of Einstein's biographers.

Stachel comments on rescuing "Einstein-Marić from the obscurity to which she has been consigned so long and unjustly," but in his rush to counter any suggestion that Mileva played a substantive role in the development of the theory of relativity, Stachel misrepresents both my statements and the information available to us.

For example, Stachel states: "Up to now, at least, there has been no evidence that she played a . . . crucial role in [Einstein's] intellectual development or scientific accomplishments. Indeed, there is . . . contrary evidence. . . . None of Marić's letters to Einstein touches on any substantive point in physics. . . . But one could not select ten of Einstein's letters to Marić that would be as devoid of references to physics as are hers to him." In this, Stachel is wrong. Eleven of Einstein's letters to Mileva have no reference to science at all.¹ (Unless otherwise noted, all references in this letter are to documents as listed in J. Stachel *et al.*, eds., *The Collected Papers of Albert Einstein*, vol. 1, Princeton U. P., Princeton, N. J., 1987.) Another eight letters² have only a single brief reference to science each, references that are no longer than can be found in four of Mileva's ten letters to him.³ This means that we cannot judge Mileva's contribution based on the very limited number of her letters that have survived.

(I find 18 clear references to recent letters from Marić in Einstein's letters to her. Fifteen of these references carry dates such that those letters from her could not have been among the ten that we have. Judging by Albert's complaints when he has not received a letter from Mileva after such short periods as four or even three days—"It's already the 4th day . . . [and she] has not uttered a single word"⁴ and "Three days have passed without my having received a letter"⁵—her custom must have been to write him about as often as he wrote her, rather than with the infrequency that ten letters over many months of separation during the five-year period involved might otherwise suggest.)

To determine what Marić's letters likely contained, we must instead examine Einstein's letters to her. It happens that by doing so we can tell that many of her lost letters make reference to her scientific work, to her comments on science and to their collaborative efforts. I find statements in 13 of his 43 letters to her⁶ that refer to her research or to an ongoing collaborative effort—for ex-

ample, in document 74, "another method which has similarities with yours."

In document 75, Albert writes: "I am also looking forward very much to our new work. You must now continue with your investigation." In document 79, he says, "we will send it to Wiedermann's *Annalen*." In document 96, he refers to "our investigations"; in document 101, to "our theory of molecular forces." In document 107, he tells her: "Prof. Weber is very nice to me. . . . I gave him our paper."

Stachel clearly distorts my statement that Einstein "barely satisfied the requirements for the degree" at the ETH. In 1895 Einstein failed his first try at the entrance examinations for the ETH. Though Einstein did well in the intermediate examinations in 1898, by 1899 he was having difficulties. In March 1899 he received the "director's reprimand for nondiligence in physics practicum."⁷ By 1900 Einstein's grades were down. Albert passed with a questionable 4.91 average, trailing well behind Jakob Ehrat, Marcel Grossmann and Louis Kollros, whom he had previously led.⁸

Moreover, Einstein had to withdraw his doctoral thesis in 1902. He did not receive his doctorate until 1905. To me, Einstein's initial difficulties in gaining entrance to the ETH, his low standing in the 1900 examinations and the withdrawal of his thesis in 1902 adequately justify my statement that he "barely satisfied the requirements for the degree."

One of the straw men that Stachel rebuts is based on my statement that Einstein and Marić's "years together saw Einstein's greatest achievements." Stachel abbreviates the quote so as to divert attention from the main point of the statement, which was not that Einstein made no further contributions, but that his physics after that time was no longer "filled with daring concepts." This is a fact well known to physicists. Einstein's completion of the general theory of relativity shortly after his separation from Marić involved nothing but the conclusion of work that was already eight years in development.

Stachel takes considerable exception to my statement that Einstein "pursued his interest in relativity for years with no knowledge of the Michelson-Morley experiment"—knowledge he needed to have if he were the author of the theory. Of course, the whole purpose of Stachel's *PHYSICS TODAY* article (May 1987, page 45) was to show that early letters between Marić and Einstein demon-

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strate that Einstein did know about Michelson-Morley.

But a careful reading of those letters shows only that Marić and Einstein *between them* had that knowledge. All the references that Stachel quotes to show that Einstein should have known of the Michelson-Morley experiment and been familiar with Hendrik Antoon Lorentz's work are taken from Albert's letters to Marić, and not from any of the other 99 documents in the first volume of the *Collected Papers*. The fact that we now know that Mileva and Albert between them had available the crucial information about the Michelson-Morley experiment and information about Lorentz's work, while at the same time we know that Einstein later professed little knowledge of these, suggests that Mileva supplied this information and she therefore was as capable of discovering the principles of special relativity as her husband!

It would seem then that Mileva Marić deserved to be a coauthor, and her name should have appeared on the original 1905 paper "Zur Elektrodynamik bewegter Körper" in *Annalen der Physik*. And in fact it did: Subsequent to the appearance of my letter in *PHYSICS TODAY*, I received a letter from Senta Troemel-Ploetz of the German department at Franklin and Marshall College, pointing out the following statement in *Im Schatten Albert Einsteins: Das tragische Leben der Mileva Einstein-Marić*, by Desanka Trbuhovic-Gjuric—a biography of Mileva Einstein cited by the editors of *The Collected Papers of Albert Einstein*:

The outstanding Russian physicist Abram F. Ioffe [also sometimes transliterated as "Joffe"] (1880-1960), director of the Applied Physics Institute, later the Institute for Semiconductors in the Academy of Sciences of the USSR, called attention in his *Remembrances of Albert Einstein* to the fact that Einstein's three epoch-making articles of 1905 were marked in the original "Einstein-Marić." Ioffe as an assistant to Roentgen, who belonged to the board of trustees of the *Annalen*, had seen the originals that the editor had forwarded for review. To this work Roentgen pulled in his *summa cum laude* student Ioffe, who had the opportunity thereby to see the manuscripts that are no longer available today.

I have found the paper of Ioffe's mentioned above in the Russian physics journal *Uspekhi Fizicheskikh*

Nauk (57(2), 187, 1955). There Ioffe states, referring to the 1905 papers, "Their author was Einstein-Mariti"—to which Ioffe added, believing that this referred to Albert Einstein alone—"an unknown clerk in the patent bureau in Berne (Mariti was his wife's surname, which [Ioffe incorrectly explains] was attached to the husband's surname by Swiss custom)." Ioffe's use of "Einstein-Mariti" ("Марити") agrees with Mileva's adoption of the Hungarianized spell-

ing of her Serbian name Marić, a fact that Ioffe would only have known had he seen the original signed by her, since this usage of "Mariti" apparently is not to be found in any of the Einstein biographies.

References

1. Documents 40, 41, 43, 68, 70-73, 106, 134 and 137.
2. Documents 45, 50, 69, 107, 112, 114, 119 and 126.
3. Documents 36, 53, 123 and 124.

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