

Mileva Marić

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Abstract In 1905 Albert Einstein, 26 years old, wrote several reports about special relativity. Some historians speculate that his wife, Mileva Marić, significantly contributed to elaborate the new theory of space and time, mainly in its mathematical component. Mileva did in fact study physics and mathematics with Albert at the Zurich Polytechnic. But Mileva never completed her studies, because she failed the mathematics examinations. In any case, there are no documents to prove her original contributions to special relativity.

Keywords Albert Einstein · Mileva Marić · Special relativity

Was special relativity completely Albert Einstein's own work? Or was it partly due to the scientific creativity of his first wife, Mileva Marić (Fig. 1)? The latter hypothesis caused quite a stir when it was suggested, in 1969, by a historian, Desanka Đurić-Trbuhović, in the book *U senci Alberta Ajnštajna* (In the shadow of Albert Einstein) [2], about the unfortunate wife of the great German physicist.

There are no documents that can answer these questions in a definitive way. However, if we reconstruct the relationship between Einstein and Marić, we may find an answer that is very likely true: the one given by all the main biographers of Einstein.

Albert and Mileva first met in Zurich in autumn 1896. He was not yet 18, having been born on 14 March 1879 into

a family of Jewish descent, in Ulm, Germany. The boy had obtained his school-leaving certificate the spring before, in Switzerland. In September, for the second time, he sat for the entrance examination to the Zurich Polytechnic, and this time failed just one subject: French. In all other subjects, including music and singing, he received high marks, and so he was admitted. On 29 October he finally enrolled as a resident in Zurich in section VI A of the Polytechnic, the one qualifying to teach physics and mathematics in secondary schools. Five people followed that course: Albert was the youngest, while a young woman, Mileva Marić, was the oldest (she was 21).

Mileva was a pretty girl, although she suffered from a congenital hip disability, which at the time could not be cured and caused her to limp all her life. She was born in Titel, in Vojvodina, then a Hungarian territory, now on the border between Serbia and Croatia, on 19 December 1875, into a Greek Orthodox Christian family. Her father, Miloš, was a middle-level public servant; her mother, Marija Ružić, was the daughter of a wealthy landowner. The couple had two other children: Zorka, a girl who, like Mileva, limped due to a similar congenital luxation, and Miloš, a boy who would become a doctor.

Mileva Marić arrived in Zurich just 19, in 1894, both because she intended to enrol in the university—and Switzerland was one of the few places in Europe when a woman could—and because her father desired for her a higher education, which, in Miloš Marić's opinion, could not be achieved in Vojvodina. She was admitted to the Höhere Töchterschule, a very famous, girls-only secondary school. She received her diploma, like Albert, in spring 1896 and in the summer she enrolled in the Medical School, the first in Europe where a woman had graduated, in 1867, and where two Croatian women had already completed their studies. But in the autumn Mileva had already changed her

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Fig. 1 Mileva Marić in a Serbian stamp [Source: <http://www.wnss-tamps.post/>]

mind: she was interested in mathematics and physics, and so she also enrolled in the section VI A of the Polytechnic, as had Albert Einstein.

The two young people liked each other and began going out together. In a few months, their relationship was already more than a typical one between two course mates. Indeed, 1 year later, towards the end of autumn 1897, Einstein received a letter from Heidelberg, where Marić had gone to take courses in mathematics and physics at the university there: “My father gave me some tobacco to take with me and I was supposed to hand it to you,¹ he wanted so much to whet your appetite for our little country of brigands. I talked with him about you, you absolutely must come with me someday. The marvelous conversations you would have here!”

We have no direct evidence of how the relationship between Albert and Mileva developed, in part because Einstein was always very unwilling to talk about his private life. However, we may reconstruct it, with large gaps, from their correspondence. We know that in February 1898 he wrote her a letter in which he described how things went at the Polytechnic and ended by hoping for a quick answer. In a later letter, Einstein was far less formal: he invited her to take part in a small party he would give in the boarding house where he lived. In March 1899 Einstein was in Milan and wrote Mileva to let her know that her photograph “made a great impression on my old lady”,² (his mother); so in this phase the relationship was known to both sets of parents.

¹ They used, at least when corresponding by letter, the *Sie*, the formal form of ‘you’ for addressing each other, then in use among even young German-speaking people.

² This and the other letters quoted in the rest of the paper can be found in the volumes 1 and 5 of [3].

Actually, Einstein’s mother did not approve of the affair, but he could not admit this to her, and added: “I had ... to endure quite a lot of teasing for this and for similar things, but I don’t find this the least bit disagreeable”.

In August of the same year, they were each on holiday with their families, and corresponded. This time, Albert’s letter begins with “L. D.”, that is, *Liebes Doxerl*, dear little doll, in the Swabian dialect spoken in Württemberg. But there is more: Einstein recalls the happy hours they spent together while studying, and in “what a marvelous household ... !” He recounts next the first disagreements with Pauline and Maja, his mother and his sister.

Einstein was quite an outgoing young man, and his interest in women was not limited to Marić. In his mind, for instance, there was place for Marie Winteler too, the daughter of the principal of the secondary school in Aarau where he had completed his schooling. And in that same August 1899, when the degree of intimacy with Marić seems to have deepened significantly, he dedicated to Anna Schmid, sister-in-law of the owner of the hotel where he was staying, a verse in which he promised her “a kiss on the tiny little mouth” of that “girl small and fine”.

But let us go back to the more serious affair, that with Marić. In the next letter, sent the week after, we have the first document in which Einstein talks of physics with his *Doxerl*, his little doll: “The introduction of the term ‘ether’ into the theories of electricity led to the notion of a medium of whose motion one can speak without being able, I believe, to associate a physical meaning with this statement”. In her reply to “L. H. E.”, *Lieber Herr Einstein* (dear Mister Einstein), she discloses that “from the succession of our joint experiences a peculiar feeling has formed surreptitiously” and signs as “your D[oxerl]”.

Neither here, nor in other letters sent to Einstein that have come down to us, does Marić so much as mention physics.

In autumn 1899 the correspondence between them shed any remaining trace of formality. Even though he still addresses her as *Sie*, Einstein called her now “my sweet little doll” and again mentions “our household”. Later, in an undated note, she invited him to use a nicer address and, for the first time in a written text, she greeted him on first-name terms, calling him “Mei liebs Johones!”, “My dear little Johann” (Johann was a pen name Einstein often used in his letters) and closed with an unambiguous “Thousand kisses from your D[oxerl]”.

Apparently their relationship had reached a peak; in fact, from 1900 on, the terms of endearment were plentiful in the letters between the two love birds and the style of the Einstein-Marić correspondence became, in the words of Abraham Pais, “increasingly cloying” ([5], p. 7). They seemed to be engaged by now.

Einstein's family liked this situation less and less, especially his mother, Pauline, who, as Maja will recall, had very different plans for her son.

The years at the Polytechnic were happy years for Einstein, in part because his family, who lived in Pavia, Italy, had freed themselves from financial hardship and he felt a bit less the burden of his economic dependence. He concluded his quite personal university curriculum in August 1900, when he took the final examination, receiving good, but not the highest possible, marks. The fact was that, as Pais explains, the university exams "under orders imposed by others were an ordeal to him" ([4], p. 44); Albert could not stand them. It took him a year to regain a taste for physics after the final exam at the Zurich Polytechnic. All the students in his class passed, but one: Mileva, who failed in mathematics.

This state of things did not change anything in the relationship between the two of them, but strengthened Einstein's mother's dislike for Marić. When he reached his mother in the Melchtal, where she was on holiday, she asked him point-blank: "So, what will become of Dokerl?" Albert's answer was curt: "I will marry her". This is what his mother never wanted to hear; enraged, she lost her control and warned her son: "You are ruining your future and blocking your path through life". And, not to be misunderstood: "That woman cannot gain entrance to a decent family"; and, even more clearly: "If she gets a child, you'll be in a pretty mess". Albert could no longer stand this and, as he wrote in a letter to Mileva: "I rejected the suspicion that we had been living in sin with all my might".

Clearly, he had lied to his mother; even though young Einstein swore to her that he and Mileva had not lived *more uxorio*, the truth is that they were in love, and not just platonically. Finally, the contingency dreaded by Pauline came true: Marić became pregnant. To await the birth of the child, she returned back to Vojvodina in late autumn 1901, to her parents' home.

In the meantime, Albert was in Switzerland. In May he obtained a temporary teaching job at the technical institute in Winterthur: not a great position, but enough to allow Albert to write reassuringly to Mileva the end of that month: "Just be of good cheer, love, and don't fret. ... I am not leaving you and I'll bring everything to a happy conclusion", and then ask: "How [is] our little son ... ?"

The temporary teaching job ended in July, and the concerns were back. Einstein was about to become a father and, again, had no job and had to find one at any cost. He wrote: "But now, rejoice in the irrevocable decision that I have made! I decided the following about our future: I will look *immediately* for a position, no matter how humble. My scientific goals and my personal vanity will not prevent me from accepting the most subordinate role. The moment I have obtained such a position I'll marry you

and take you to me without writing anyone a single word before everything has been settled". Marić was happy, and encouraged him: "But of course, dear, it shouldn't be the worst possible position".

From 15 September Albert was employed, for a whole year, in a private school in Schaffhausen. In late autumn Marić went home to her parents' to await the birth of the child. Einstein wrote to his expectant lover, on 12 December: "Take good care of yourself and be cheerful and rejoice in our dear Lieserl, whom I in absolute secrecy, to be sure (so that Doxerl wouldn't notice it), prefer to think of as Hanserl". He went on to announce that he was close to solving their problems for good: he was about to obtain a permanent job at the Patent Office in Bern. Albert left his job in Schaffhausen and moved to the Swiss capital, by the first weeks of 1902.

Now he could write to his Mileva: "The only problem that would remain to be solved would be how to have our Lieserl with us; I wouldn't like for us to have to part with her". He suggested to her: "Ask your father, he is an experienced man and knows the world better than your impractical bookworm Johonzel". What he was "impractically" striving for, in all likelihood, were his studies about the electrodynamics of moving bodies.

These were months when Einstein and Marić exchanged many letters but saw very little of each other.

Even though Einstein seemed at times somewhat inattentive, with respect to his forthcoming fatherhood, Marić always was at the centre of his thoughts and was the main character in every plan for the future.

At the beginning of 1902, in Bern, Einstein learnt at last that he had become a father: Lieserl had born (and not Hanserl, as he was hoping). On 4 February he wrote to Marić: "But you see, it has really turned out to be a Lieserl, as you wished. Is she healthy and does she already cry properly? What kind of little eyes does she have? Whom of us two does she resemble more? Who is giving her milk? Is she hungry? ... I love her so much and I don't even know her yet! ... I would like once to produce a Lieserl myself, it must be so interesting! She certainly can cry already, but to laugh she'll learn much later. Therein lies a profound truth".

Thus, on 4 February 1902, Albert showed all his happiness for the birth of Lieserl. Let us say right away that what happened to this child is one of the few mysterious points of Einstein's life. All traces of her have been lost and even now we do not know what became of her. We do not even know whether Albert Einstein ever saw her. We only know that in 1903 she was in Vojvodina with her mother and that Albert wrote from Bern, uninformed and worried about her health (she had contracted scarlet fever) and about her registry status: "How is Lieserl

registered? We must take great care, lest difficulties arise for the child in the future”. Then there is nothing more.

Let us go back to year 1902. After the entrance examination, the Swiss federal council answered positively to his application and so, on 16 June 1902, Albert Einstein began his provisional job as a class 3 technical expert, with a yearly pay of 3500 francs, enough to set up a family.

Einstein, having overcome the resistance put up by his free spirit, actually intended to marry Marić, but was opposed by his mother, who still loathed the young Hungarian woman. In the meantime, Einstein’s father Hermann became ill; apparently, his heart could not withstand the dizzy emotional ups and down to which he was subjected. Soon his condition worsened, and Albert rushed to Milan to look after him while he was dying. On his father’s deathbed, Albert asked for and obtained his consent to the marriage with Mileva.

Meanwhile, their relationship continued. To live together, the couple had waited for him to have a stable job, at the patent office. So they reunited, going to live in Bern after their wedding, celebrated on 6 January 1903; the witnesses were Maurice Solovine and Conrad Habicht. That night, after a small party, the couple returned to their furnished room in Archivstrasse 8, their nest. But Einstein had forgotten his keys and had to wake up their landlord.

Since being in Bern, Albert had decided, together with Habicht and Solovine, to study in depth some cultural topics; thus, they created the “Akademie Olympia”. The name was humorous, but their activity was relentless.

It was not a closed clique; they were often joined by Paul Habicht, brother of Conrad, in charge of making Turkish coffee, and later, attending regularly, Michele Angelo Besso, the engineer friend who Einstein managed to have hired at the patent office.

It goes without saying that, from 1903 on, Marić took part in the meetings of the group.

“Mileva, intelligent and reserved, listened intently but never intervened in our discussions”, Solovine recalled ([6], p. 13). Actually, she was not alone: the partners of the other male members of the Akademie took part in the meeting too, and somehow did Grossmann and Adler, who had stayed in Zurich, but were still in touch with Einstein.

In short, the aims of the Akademie were broad and not rigidly defined. They met daily for lunch or dinner and the discussions took place between mouthfuls of sausage or cheese and draughts of tea. They spoke mainly about Mach and Poincaré (as regards science), but also Mill and Hume (in philosophy), and Marx and Engels (in politics). A largely incomplete list of their reading includes such literary masterworks as Sophocles’ *Antigone* (challenging authorities) and Cervantes’ *Don Quixote* (tilting at windmills), and milestones of natural philosophy such as David Hume’s *A Treatise of Human Nature*, Ernst Mach’s *Analysis*



Fig. 2 Albert Einstein and Mileva Marić in 1912 [ETH-Bibliothek Zürich, Bildarchiv]

of *Sensations* and *The Science of Mechanics*. A critical and historical account of its development, Baruch Spinoza’s *Ethics* and Henri Poincaré’s *Science and Hypothesis*.

The married life went on peacefully too (Fig. 2). The relationship between Einstein and Marić apparently worked—the Lieserl mystery notwithstanding. Did the child go to Bern? Did her father meet her? In the opinion of Abraham Pais, one of the greatest biographers of Einstein, the answer is no. As we have seen, in the summer 1903 the child and her mother were in Serbia, and we also know that in the same letter in which Albert anxiously asked for news about his daughter he also showed his enthusiasm for a pleasant new development, reassuring Mileva that he was not at all irate at her being again pregnant; in fact, he had “already been pondering whether I should not see to it that you get a new Lieserl”; after all, he wrote, she is not to “be deprived of that which is every woman’s right”.

In that same summer 1903 the Einstein family moved to a new home in Kramgasse 49, in one of the finest parts of Bern. On 14 May 1904 there was the happy event: the second child, Hans Albert, was born. And Lieserl? Where was she?

1905 arrived at last. And, in the words of Louis De Broglie, Albert Einstein launched three “blazing rockets which in the dark of the night suddenly cast a brief but powerful illumination over an immense unknown region” ([1], p. 110) of physics. There were in reality six papers regarding three topics: in the first set, Einstein gave a molecular explanation to Brownian motion; in the second set, he provided an explanation of the photoelectric effect by showing the dual nature, as a wave and as a particle, of the “quanta of light” (today called photons); with the third set, about the electrodynamics of bodies in motion, he shelved the concepts of absolute space and time and suggested that matter and energy are different forms of a single entity.

It is here that the historical debate concerning Marić's contribution is focussed.

Desanka Đurić-Trbuhović claims that Marić made a crucial contribution to the launch of the third rocket, that of special relativity, and more in general to all the works of the *annus mirabilis*.

Her thesis relies on three elements.

1. The testimony of the physicist Abraham Joffe, who in those years was privy to the manuscripts submitted to the *Annalen der Physik*, where Einstein published five of his works. According to Joffe, the original articles were signed Einstein-Marity (the official Swiss version of the Slavic surname Marić).
2. A letter written by Einstein to Marić between 1900 and 1901 in which he wrote: "I am also looking forward very much to our new studies. You must now continue with your investigation—how proud I will be when maybe I'll have a little doctor for a sweetheart while I am myself still a totally ordinary man". And in another letter: "How happy and proud I will be when the two of us together will have brought our work on the relative motion to a victorious conclusion! When I see other people then it really strikes me how much there is to you".
3. An indirect testimony according to which Mileva Marić admitted to a girlfriend: "We finished some important work that will make my husband world famous".

Most historians consider these three clues insufficient to support Mileva's collaboration to 1905 Einstein's papers. Of Joffe's testimony there is no proof: no one found the Einstein-Marity manuscripts. Moreover, only women used a double surname, so if Joffe were right, the manuscript would be signed just by Marić!

The 1900 and 1901 letters date to a time still very far from the actual formulation of special relativity and the other works. Some think that Marić helped Einstein to do the maths for those papers, but she twice failed her mathematics examination at the Polytechnic, and did not graduate precisely due to this gap in her education. Moreover, in the years after 1900–1901 the two had been often separated, so that a coordinated work together would be almost impossible. Finally, the three blazing rockets of 1905, including that of special relativity, involve a not especially complex mathematics, which Albert mastered perfectly.

Lastly, the alleged sentences by Marić. There are no documents confirming them, and in any case they do not say a lot about her actual part in the elaboration of Albert's physics.

Summing up, we may say that there is not sufficient evidence to corroborate Đurić-Trbuhović's thesis. What can be claimed as a fact—as stressed by two reliable historians

such as John Stachel and Gerald Holton—is that certainly, between 1896 and 1905, Einstein and Marić talked about physics and that the young woman was an important component of the cultural milieu in which, between Zurich and Bern, Einstein had his formation.

The vicissitudes of the couple after 1905 are well known. On 6 July 1909, now quite famous, Albert Einstein resigned from the Bern Patent Office. Two days later he was in Geneva to receive his first *honoris causa* degree. The same year, on 15 October, he was officially appointed to the chair of theoretical physics at Zurich Polytechnic and on 22 he was registered, together with Marić and their young son Hans Albert, as a resident of the city, at the number 12 of Moussonstrasse.

In a few months the family was enlarged. On 28 July 1910 Marić gave birth to another son, Eduard. Now in their home there were two "little bears", as they called them.

After a few months, the family moved to Prague. Neither Einstein nor Marić felt comfortable in that city, probably for different reasons. In any case, in August 1912 the family was already back in Zurich. A few months later the Einsteins were ready for a new move. Walther Nernst and Max Planck had persuaded Einstein to come to Berlin, an opportunity he leaped at: it would be useful to create the premises to separate from his wife and end a relationship that was undergoing a real crisis.

The operation was successful: Marić did not follow her husband to Prussia and shortly afterwards the two divorced. Einstein signed a paper in which he committed himself to pay her the whole amount of the Nobel prize, if it were to be awarded to him, to support their sons, who had stayed in Zurich with their mother. The prize arrived in 1922, when it was awarded (as Nobel prize for 1921) to Einstein for his 1905 work on the photoelectric effect (but not that on special relativity).

Meanwhile, in 1919, Albert Einstein had married his cousin Elsa.

Mileva Marić died on 4 August 1948, probably without ever forgiving her "Johonesl". But she never laid claim to those discoveries—or, better, to those "free inventions of the human mind"—that made her "husband world famous".

Translated from the Italian by Daniele A. Gewurz.

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