



FEYNMAN AT CORNELL

Personal letters written about Feynman when he was a young professor at Cornell recount his adventures with friends and paint a picture of a uniquely brilliant physicist.

Freeman J. Dyson

I lived in the same town as Richard Feynman for only one year, the academic year 1947–48, when he was a professor at Cornell and I was a graduate student. After that year I saw him only occasionally, mostly among crowds at scientific meetings. My most vivid memories of Feynman come from that first year, now 40 years ago, when I was 24 and he was 30. I had the good luck to know him when he was at the height of his creative powers, furiously struggling to complete the theory he called the “space-time approach,” which afterwards became the standard approach for everybody doing calculations in particle physics.

Being a dutiful son, I sent my parents in England a weekly letter recording my adventures in America. My parents preserved the letters and I now have them in my hands. Instead of writing fake recollections of Feynman for this issue, I decided to use direct quotes from the letters in which he appears. These extracts are fragmentary and do not tell us much about Feynman’s inner thoughts. Their virtue is that they are authentic, written within a few days of the events they describe, without editing and without hindsight.

I arrived in America in September 1947 to do graduate work in physics under the direction of Hans Bethe. So far as I can tell from the records, I had never heard of Feynman before I came to Cornell. It took me quite a while to discover what a great man he was.

I begin with the letter in which Feynman makes his first entrance, written two months after my arrival in America.

Cornell University
19 November 1947

Just a brief letter before we go off to Rochester. We have every Wednesday a seminar at which somebody talks about some item of research, and from time to time this is made a joint seminar with Rochester University. To-day is the first time this term that we are going over there for it. It is a magnificent day, and it should be a lovely trip; Rochester is due north of here, and we go through some wild country. I am being taken in Feynman’s car, which will be great fun if we survive. Feynman is a man for whom I am developing a considerable admiration; he is the brightest of the young theoreticians here, and is the first example I have met of that rare species, the native

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Assembled in the front row of a lecture hall at the Rochester Conference of January 1952 are (front row, from left) Pierre Noyes, the author, Jack Steinberger, Richard Feynman and Hans Bethe.

American scientist. He has developed a private version of the quantum theory, which is generally agreed to be a good piece of work and may be more helpful than the orthodox version for some problems; in general he is always sizzling with new ideas, most of which are more spectacular than helpful, and hardly any of which get very far before some newer inspiration eclipses them. His most valuable contribution to physics is as a sustainer of morale; when he bursts into the room with his latest brain-wave and proceeds to expound it with the most lavish sound effects and waving about of the arms, life at least is not dull. [Victor] Weisskopf, the chief theoretician at Rochester, is also an interesting and able man, but of the normal European type; he comes from Munich, where he was a friend of Bethe from student days.

The event of the last week has been a visit from [Rudolf] Peierls, who has been over here on government business and stayed two nights with the Bethes before flying home. He gave a formal lecture on Monday about his own work, which was very well received, and has been spending the rest of the time in long discussions with Bethe and the rest of us, at which I learnt a great deal. On Monday night the Bethes gave a party in his honour, to which most of the young theoreticians were invited.

When we arrived we were introduced to Henry Bethe, who is now 5 years old, but he was not at all impressed, in fact the only thing he would say was "I want Dick. You told me Dick was coming," and finally he had to be sent off to bed, since Dick (alias Feynman) did not materialize. About half an hour later, Feynman burst into the room, just had time to say "So sorry I'm late. Had a brilliant idea just as I was coming over," and then dashed upstairs to console Henry. Conversation then ceased while the company listened to the joyful sounds above, sometimes taking the form of a duet and sometimes of a one-man percussion band.

Peierls was shown around the new and lavishly built Nuclear Laboratory, which will be opened formally with a party on Saturday. Feynman remarked that it was a pity to think that after all the work that the builders had put into building it, so little would probably be done by the people who lived in it; and Bethe said that only because of the steel shortage is any nuclear physics worth mentioning done in the United States. This may well be true; at any rate the most outstanding experiments in the world are at present being done at Bristol by [Cecil] Powell with no apparatus more elaborate than a microscope and a photographic plate.

Next a brief item one week later.

27 November 1947

The trip to Rochester last week was a great success. I went there and back in Dick Feynman's car with Philip Morrison and [Edwin] Lennox, and we talked about everything from cosmic rays downward.

On Saturday we had our great inaugural party for the Synchrotron Building. It was a great success; I played my first game of poker and found I was rather good at it; I won 35 cents. The synchrotron itself does not arrive for some time yet, so the building is still empty. The party consisted chiefly of dancing and eating; Bethe and Trudy Eyges danced together for about an hour, very beautifully, while Rose Bethe and Leonard Eyges exchanged disapproving glances.

Leonard Eyges was another graduate student working with Bethe. Trudy was his wife.

Now we jump three months.

8 March 1948

Yesterday I went for a long walk in the spring sunshine with Trudy Eyges and Richard Feynman. Feynman is the young American professor, half genius and half buffoon, who keeps all physicists and their children amused with his effervescent vitality. He has, however, as I have recently learned, a great deal more to him than that, and you may be interested in his story. The part of it with which I am concerned began when he arrived at Los Alamos; there he found and fell in love with a brilliant and beautiful girl, who was tubercular and had been exiled to New Mexico in the hope of stopping the disease. When Feynman arrived, things had got so bad that the doctors gave her only a year to live, but he determined to marry her and marry her he did; and for a year and a half, while working at full pressure on the Project, he nursed her and made her days cheerful. She died just before the end of the war. [Actually, as I later learned, Feynman and his first wife had met long before his Los Alamos days.]

As Feynman says, anyone who has been happily married once cannot long remain single, and so yesterday we were discussing his new problem, this time again a girl in New Mexico with whom he is desperately in love. This time the problem is not tuberculosis, but the girl is a Catholic. You can imagine all the troubles this raises, and if there is one thing Feynman could not do to save his soul it is to become a Catholic himself. So we talked and talked, and sent the sun down the sky, and went on talking in the darkness. I am afraid that at the end of it poor Feynman was no nearer to the solution of his problems, but at least it must have done him good to get them off his chest. I think myself that he will marry the girl, and that it will be a success, but far be it from me to give advice to anybody on such a subject.

Then, a week later, the shape of things to come begins to emerge.

15 March 1948

My own work has taken a fresh turn as a result of the visit of Weisskopf last week. He brought with him an account,

rather garbled in transit, of the new Schwinger quantum theory which [Julian] Schwinger had not finished when he spoke at New York. This new theory is a magnificent piece of work, difficult to digest but with some highly original and undoubtedly correct ideas; so at the moment I am working through it and trying to understand it thoroughly. After this I shall be in a very good position, able to attack various important special problems in physics with a correct theory while most other people are still groping. One other very interesting thing has happened recently; our Richard Feynman, who always works on his own and has his own private version of quantum theory, has been attacking the same problem as Schwinger from a different direction, and has now come out with a roughly equivalent theory, reaching many of the same ideas independently; this makes it pretty clear that the theory is right. Feynman is a man whose ideas are as difficult to make contact with as Bethe's are easy; for this reason I have so far learnt much more from Bethe, but I think if I stayed here much longer I should begin to find that it was Feynman with whom I was working more.

On the road to Albuquerque

But three more months go by without any mention of Feynman. He reappears only in the last letter from Cornell.

11 June 1948

Although our society is breaking up and many old friends have already departed, these last days are not at all lonely; the experimentalists are still hard at work on their synchrotron, and in the last week we have had one supper-picnic, one swimming expedition and one sailing expedition, all of which were very enjoyable. However, this week I start out for the West, and no doubt that will be great fun too. Incidentally, the American "picnic" is not exactly what we understand by the term; it starts out with fried steak and salads, cooked on an open-air grille, and served with plates, forks, and other paraphernalia; this sort of thing, like the elegance of the average American home and of the women's clothes, seems to me rather a rebirth of the Victorian era, flourishing over here by virtue of the same conditions that nourished it in England. Not only in manners, but also in politics and international affairs, I often feel that Victorian England and modern America would understand each other better than either understands its contemporaries.

I don't remember how much I have told you about my plans; they were greatly helped by an offer of a ride across the country by Feynman, the bright young professor of whom I have often spoken. He is going to visit his (Catholic) sweetheart at Albuquerque, New Mexico, and is driving across the country starting this week; I am to go to keep him company on the way out, and I shall leave him and make my own way to Ann Arbor as soon as I (or we) feel I have had enough. It should be a fine trip, and we shall have the whole world to talk about. On this visit Feynman intends to make up his mind either to marry the girl or to agree to part; most people are prepared to wager for the former alternative.



Gathered around a coffee table at the 1947 Shelter Island Conference are (standing, from left) Willis Lamb, John Wheeler, and (seated, from left) Abraham Pais, Richard Feynman, Herman Feshbach and Julian Schwinger. The 1947 conference is regarded as the birthplace of quantum electrodynamics.

Two weeks later comes the next extract, written from Santa Fe, New Mexico.

25 June 1948

Feynman originally planned to take me out West in a leisurely style, stopping and sight-seeing en route and not driving too fast. However, I was never particularly hopeful that he would stick to this plan, with his sweetheart waiting for him in Albuquerque. As it turned out, we did the 1800 miles from Cleveland to Albuquerque in $3\frac{1}{2}$ days, and this in spite of some troubles; Feynman drove all the way, and he drives well, never taking risks but still keeping up an average of 65 mph outside towns. It was a most enjoyable drive, and one could see most of what was to be seen of the scenery without stopping to explore; the only regret I have is that in this way I saw less of Feynman than I might have done.

At St. Louis we joined Highway US 66, the so-called "Main Street of America" which runs from Chicago to Los Angeles via Albuquerque. We thought that from there on would be plain sailing, as this is one of the best marked and maintained roads there is. However, at the end of the second day we ran into a traffic jam, and some boys told us that there were floods over the road ahead and no way through. We retreated to a town called Vinita, where with great difficulty we found lodging for the night, the town being jammed with stranded travellers. We ended up in what Feynman called a "dive," viz. a hotel of the cheapest and most disreputable character, and with a notice posted in the corridor saying "This Hotel is under New Management, so if you're drunk you've come to the wrong place." During the night it rained continuously, and the natives said it had been raining most of the time for more than a week.

The fourth day we drove the last 300 miles to Albuquerque before 1 pm. This was the most beautiful part of the trip, though I was surprised to find how little of it was typical New Mexico mountains; the prairie actually extends half-way across New Mexico, and only the last 20 miles of our journey were in mountains, the Sandia range immediately east of the Rio Grande valley in which Albuquerque lies. As we advanced into New Mexico the

prairie grew drier and drier, until a fair proportion of the vegetation was cactus, carrying at this time of year a profusion of large blood-red flowers. Coming down into Albuquerque, Feynman said he hardly recognised the place, so much has it been built up since he was there 3 years ago. It is a fine, spacious town of the usual American type; very little of the Spanish surviving.

Sailing into Albuquerque at the end of this Odyssey, we had the misfortune to be picked up for speeding; Feynman was so excited that he did not notice the speed limit signs. So our first appointment in this romantic city of home-coming was an interview with the Justice of the Peace; he was a pleasant enough fellow, completely informal, and ended up by fining us \$10 with \$4.50 costs, while chatting amiably about the way the Southwest was developing. After this Feynman went off to meet his lady, and I came up by bus to Santa Fe.

All the way, Feynman talked a great deal about this sweetheart, his wife who died at Albuquerque in 1945, and marriage in general. Also about Los Alamos, and life and philosophy in general. I came to the conclusion that he is an exceptionally well-balanced person, whose opinions are always his own and not other people's! He is very good at getting on with people, and as we came West he altered his voice and expressions unconsciously to fit his surroundings, until he was saying "I don't know noth'n'" like the rest of them.

QED

After leaving Feynman in Albuquerque, I spent the summer at Ann Arbor and Berkeley, and succeeded in understanding how the Schwinger and Feynman versions of electrodynamics fitted together. In September I arrived at the Institute for Advanced Study in Princeton. The next extract was written from Princeton, in response to my father's request for an explanation of what I had been doing. My father had called attention to a clause in the Athanasian Creed that says, "There is the Father incomprehensible, and the Son incomprehensible and the Holy Ghost incomprehensible, yet there are not three incompre-



Cécile DeWitt (née Morette) sitting with Victor Weisskopf at the Les Houches Summer School in 1952, the year after she founded the institution. Weisskopf was a lecturer there that summer.

hensibles but one incomprehensible." He remarked that this sounded a bit like Schwinger, Feynman and Dyson. Here is my reply:

4 October 1948

To-day came a fat letter from you. Concerning your remarks about the Athanasian Creed, I think what you say is very much to the point; but I must disappoint any hopes that Dyson-Schwinger-Feynman might prove an effective substitute. Seriously, I should like some time, now that I understand these theories properly, to try to write some intelligible semi-popular account of them; but it would be a difficult job, not to be undertaken in one afternoon. The central idea of the theories, in any case, is to give a correct account of experimental facts while deliberately ignoring certain mathematical inconsistencies which come in when you discuss things that cannot be directly measured; in this there is a close similarity to the Athanasian Creed. However, there is the important difference that these theories are expected to last only about as long as no fresh experiments are thought up, so they will hardly do as a basis for a *Weltanschauung*.

This letter shows that in 1948 we all thought of the new quantum electrodynamics as a ramshackle structure, soon to be replaced by something better. We would never have believed it if anyone had told us that our theory would still be around 40 years later, the calculated effects of radiative reactions still agreeing with experiments to an accuracy of 10 or 11 significant figures. We would have been even more surprised to learn that the ugliest and most awkward features of our theory, the tricky renormalization of mass and charge, would remain as key features when the theory was eventually incorporated, first into the Weinberg-Salam-Glashow unified theory of electromagnetic and weak interactions, and later into the grand unified theories of weak and strong interactions. For Feynman, renormalization was not something to be proud of but something to be got rid of. He spent a lot of time trying to construct a fi-

nite-electron theory that would make renormalization unnecessary.

Cécile Morette

In the next letter a great woman appears, whose name was then Cécile Morette and is now Cécile DeWitt. She was in 1948 a member of the Institute for Advanced Study, having arrived from France via Dublin and Copenhagen. She was the first of the younger generation to grasp the full scope and power of the Feynman path integral approach to physics. While I was concerned with applying Feynman's methods to detailed calculations, she was thinking of larger issues, extending the path integral idea to everything in the universe including gravitation and curved space-times.

Boston

1 November 1948

After my last letter to you I decided that what I needed was a long week-end away from Princeton, and so I persuaded Cécile Morette to come with me to see Feynman at Ithaca. This was a bold step on my part, but it could not have been more successful and the week-end was just deliriously happy. Feynman himself came to meet us at the station, after our 10-hour train journey and was in tremendous form, bubbling over with ideas and stories and entertaining us with performances on Indian drums from New Mexico until 1 am.

The next day, Saturday, we spent in conclave discussing physics. Feynman gave a masterly account of his theory, which kept Cécile in fits of laughter and made my talk at Princeton a pale shadow by comparison. He said he had given his copy of my paper to a graduate student to read, then asked the student if he himself ought to read it. The student said "No" and Feynman accordingly wasted no time on it and continued chasing his own ideas. Feynman and I really understand each other; I know that he is the one person in the world who has nothing to learn from what I have written; and he doesn't mind telling me

so. That afternoon, Feynman produced more brilliant ideas per square minute than I have ever seen anywhere before or since.

In the evening I mentioned that there were just two problems for which the finiteness of the theory remained to be established; both problems are well-known and feared by physicists, since many long and difficult papers running to 50 pages and more have been written about them, trying unsuccessfully to make the older theories give sensible answers to them. Amongst others, [Nicholas] Kemmer and the great [Werner] Heisenberg had been baffled by these problems.

When I mentioned this fact, Feynman said, "We'll see about this," and proceeded to sit down and in two hours, before our eyes, obtain finite and sensible answers to both problems. It was the most amazing piece of lightning calculation I have ever witnessed, and the results prove, apart from some unforeseen complication, the consistency of the whole theory.

The two problems were, the scattering of light by an electric field, and the scattering of light by light.

After supper Feynman was working until 3 am. He has had a complete summer of vacation and has returned with unbelievable stores of suppressed energy.

On the Sunday Feynman was up at his usual hour (9 am) and we went down to the physics building, where he gave me another 2-hour lecture on miscellaneous discoveries of his. One of these was a deduction of [James] Clerk Maxwell's equations of the electromagnetic field from the basic principles of quantum theory, a thing which baffles everybody including Feynman, because it ought not to be possible.

At 12 on the Sunday we started our journey home, arriving finally at 2 am and thoroughly refreshed. Cécile assured me she had enjoyed it as much as I had.

Feynman's proof of the Maxwell equations is still unpublished and still after 40 years as baffling as ever. He refused to publish it then because he claimed it was only a joke. I am not so sure. The proof is mathematically rigorous and does exactly what I said in the letter. He starts with the commutation relations between position and velocity of a single nonrelativistic particle obeying Newton's law of motion and deduces the existence of electric and magnetic fields satisfying the equations of Maxwell. Expressed in modern language, the proof shows that the only possible fields that can consistently act on a quantum mechanical particle are gauge fields. I am sorry I never succeeded in persuading Feynman to publish it.

The next letter gives us another glimpse of Cécile Morette.

14 November 1948

Cécile amused us all yesterday by bringing down a French millionaire to see the institute (an industrial magnate of some kind). She said she hinted to him fairly strongly that France could do with an institute of a similar sort; she said if she were made director of the French institute she would invite all of us to come and lecture there. It will be interesting to see if anything comes of it.

The man Cécile brought to see the Princeton institute was Léon Motchane. Motchane later became the founder and first director of the Institut des Hautes Etudes Scientifiques at Bures-sur-Yvette in France. The IHES is a flourishing institution that has made a major contribution to the support of mathematics and theoretical physics in France. Cécile was 26 when she brought Motchane to Princeton and planted the seed that grew into IHES. A few years later she founded the Les Houches summer school, which is also a flourishing institution and has been a training ground for generations of European students.

My last extract from the year 1948-49 describes a visit by Feynman to the institute at Princeton. Those who have read "Surely You're Joking, Mr. Feynman!" will know that Feynman hated the institute. J. Robert Oppenheimer offered him an institute professorship and Feynman turned it down flat. Feynman considered the institute to be snobbish, stuffy and scientifically sterile. He was invited many times to visit but he almost never came. He did come once, as the next extract records.

Chicago

28 February 1949

On Thursday we had Feynman down to Princeton, and he stayed till I left on Sunday. He gave in 3 days about 8 hours of seminars, besides long private discussions. This was a magnificent effort, and I believe all the people at the institute began to understand what he is doing. I at least learnt a great deal. He was as usual in enthusiastic mood, waving his arms about a lot and making everybody laugh. Even Oppenheimer began to get the spirit of the thing, and said some things less sceptical than is his habit. Feynman was obviously anxious to talk, and would have gone on quite indefinitely if he had been allowed; he must have been suffering from the same bottled-up feeling that I had when I was full of ideas last autumn. The trouble with him, of course, is that he never will publish what he does; I sometimes feel a little guilty for having cut in in front of him with his own ideas. However, he is now at last writing up two big papers, which will display his genius to the world.

A letter from an infrequent correspondent

That is the end of my meager record of the young Feynman. The next item in my file is the one and only letter written by Feynman to me. Since Feynman letters are even rarer than Feynman papers, I am glad to put this one on record.

Cornell University

15 May 1950

Dear Freeman:

I have heard that Cornell University is offering you a position. I was very glad to hear that because I think you would like it here very much. Of course you have been here a year and know how good it is to work with Bethe, etc., so there is no point in going into all these things, but I did want to tell you that the administration of the physics department of Cornell is excellent. It is completely free of politics and petty quarrels, etc., which makes it an ideal place to work. If a man wants to do mostly research in pre-

ference to teaching or vice versa either way is arranged. I have been very happy here.

My main point in writing to you is to assure you that I did not leave Cornell for any reason that had to do with the failure of the university, it is just that I have no family or anything to tie me down and the wanderlust set in, so I thought I would like to live for a while in California, that is all there is to it. I hope my doing this has gotten you a real good job.

Sincerely yours,
R. P. Feynmann [sic]

Knowing how much it cost Feynman to write a letter, I was deeply grateful for his encouragement. I went back to Cornell in the fall of 1951, after he had moved to Caltech. Cornell treated me well, but without Feynman the place seemed sad and empty. The next encounter with Feynman in my file is 29 years later.

Princeton
21 December 1979

The best thing that happened was a supper with Dick Feynman at his home in Pasadena. The first time we had met for about 12 years. He had in the meantime had a big cancer operation 1½ years ago. Rumor had said he was dying but I found him in bouncing health and spirits. He is still the same old Feynman that drove with me to Albuquerque 30 years ago. He said they took a 6-pound lump out of him but since it was all fatty tissue (liposarcoma) there is a good chance it was contained and will not recur.

Feynman has been married for about 20 years to an English wife called Gweneth. He enjoys the domestic life and they have a menagerie very much like ours, 1 horse (for the 12-year-old daughter), 2 dogs, 1 cat, 5 rabbits. But they have temporarily outdone us, for the next few months, by taking on a boa constrictor who belongs to some neighbours on a leave of absence.

Another editorial comment here. I heard later from Feynman that this affair with the boa constrictor ended badly. Feynman was responsible for the care and feeding of the boa constrictor. The trouble was that the boa constrictor was supposed to eat live white mice, but when Feynman fed him the mice he was too stupid or too lazy to catch them. Instead of the boa constrictor eating the mice, the mice began eating the boa constrictor. So Feynman had to sit up at night to stop the mice from nibbling holes in the boa constrictor's skin. And then, when the owner of the boa constrictor came back, she scolded Feynman for taking care of the animal so badly. He said he had learned something from this experience. In the future, if he was asked to baby-sit for a boa constrictor, he would say no. It was a no-win situation. He said it's all right to say yes once to a dumb idea, to try it out and see if it is any good. But you are a fool if you say yes twice to the same dumb idea. After things turn out badly the first time, you say no.

Feynman in later years, unchanged

Now comes the last letter in my collection, written to Sara Courant. Sara had been at Cornell in 1948 when her husband Ernest was a postdoc.

Urbana, Illinois
9 April 1981

Dear Sara:

I just spent a marvelous three days with Dick Feynman and wished you had been there to share him with us. Sixty

years and a big cancer operation have not blunted him. He is still the same Feynman that we knew in the old days at Cornell.

We were together at a small meeting of physicists organized by John Wheeler at the University of Texas. For some reason Wheeler decided to hold the meeting at a grotesque place called World of Tennis, a country club where Texas oil millionaires go to relax. So there we were. We all grumbled at the high prices and the extravagant ugliness of our rooms. But there was nowhere else to go. Or so we thought. But Dick thought otherwise. Dick just said: "To hell with it. I am not going to sleep in this place," picked up his suitcase and walked off alone into the woods. In the morning he reappeared, looking none the worse for his night under the stars. He said he did not sleep much, but it was worth it.

We had many conversations about science and history, just like in the old days. But now he had something new to talk about, his children. He said: "I always thought I would be a specially good father because I wouldn't try to push my kids into any particular direction. I wouldn't try to turn them into scientists or intellectuals if they didn't want it. I would be just as happy with them if they decided to be truck-drivers or guitar-players. In fact I would even like it better if they went out in the world and did something real instead of being professors like me. But they always find a way to hit back at you. My boy Carl for instance. There he is in his second year at MIT, and all he wants to do with his life is to become a god-damned philosopher!"

As we sat in the airport waiting for our planes, Dick pulled out a pad of paper and started to draw faces of people sitting in the lounge. He drew them amazingly well. I said I was sorry I have no talent for drawing. He said: "I always thought I have no talent either. But you don't need any talent to do stuff like this. Just a few years ago I made friends with an artist and we had an agreement. I would teach him quantum mechanics and he would teach me drawing. We both did quite well, but he was a better teacher than I was."

So I left him there in the airport at Austin, Texas, happily talking about Michelangelo and Raphael and Giotto with all the enthusiasm of a teenager. He said, "You know, I went in there to look at the Sistine Chapel in Rome, and I could see at once that one of those panels wasn't as good as the others. It just wasn't good. And then afterwards I looked in the guide-book and it said that particular one was painted by somebody else. That made me feel good. I always thought Art Appreciation was a lot of hokum, but now I found out I can do it myself."

That was not the last time I saw Feynman, but it is the last glimpse of him recorded in my letters. Fortunately, we have a much more complete picture of Feynman in his own words, recorded by Ralph Leighton and published in the two books "Surely You're Joking, Mr. Feynman!" and "What Do You Care What Other People Think?" If you look carefully at the chapter "Hotel City" in the second book, you will find Feynman's version of the night he and I spent together in the hotel in Vinita in 1948. His version is very different from the version I wrote in my letter to my parents. In deference to my parents' Victorian sensibilities, I left out the best part of the story. Feynman always remembered what his first wife, Arlene, had written to him from her hospital bed before he went to Los Alamos: "What do you care what other people think?" Her spirit stayed with him all his life and helped to make him what he was, a great scientist and a great human being. ■