

Personality, Place and Physics

Princeton is a wonderful little spot, a quaint and ceremonious village of puny demi-gods on stilts. Yet by ignoring certain special conventions, I have been able to create for myself an atmosphere conducive to study and free from distraction.

— Albert Einstein

BY DIETRICK E. THOMSEN

A visitor to Princeton climbs up from the “dinky” station where it is traditional to arrive in the town. (The dinky is the electric car that brings people from the trains at Princeton Junction.) The first impression is that if Princeton has changed a stick or a brick in 30 years, that change has been well and carefully hidden.

Princeton is dominated physically by its university. The entire length of Nassau street is piled up on one side with the university’s collection of architecture, mostly 19th century fake Gothic and 20th century gothico-Bauhaus. But Nassau street seems strangely devoid of the hurly-burly of student life that characterizes campus side streets in other places: Telegraph avenue, Harvard Square, even Pacific avenue in Santa Cruz. Where are the shops catering to student needs (mostly second-hand), the surplus stores, the cafes where the rock bands or folk singers perform, the bulletin boards and wall posters, offering, supporting, denouncing, advertising everything from abortion marches to Zen meditation? Princeton is a 19th century self-made American magnate’s idea of what Oxford should look like, an Oxford with fake 18th century storefronts.

In the early 1930s Albert Einstein came to this academic museum piece to take up what was to be his permanent U.S. residence. A lady who had inherited part of New Jersey’s largest department store had wished to use her fortune to help advanced scholarship, and so Mrs. Bamberger Fuld founded the Institute for Advanced Study. Einstein was invited to the new institute, in no small part to lend it some of his prestige.

And great prestige he had. We must remember that his last significant scientific publication, the general theory of relativity, had come in 1916. In the years since, his fame had grown instead of slowly diminishing as usually happens to people who do not pile up new triumphs. In the days when the media made personalities of scientists much more readily than they do today, he was the chief of the media scientists. If one did not know that Dahlem was a long-settled upper-crust suburb of Berlin, one would swear that its position was established when Einstein built a villa



Bohr and Einstein: The best of friends despite a basic disagreement.

there in the 1920s.

Many years later there was the famous letter to President Roosevelt. Einstein was not a nuclear physicist. His opinion on nuclear physics was not very much better than that of the average physicist in the street. Yet the best nuclear physicists in the country persuaded Einstein to sign the letter that carried weight because of *their* judgments. They knew the value of a media name, and they knew the character of the recipient of the letter.

It is said that when Einstein came to Princeton he was already out of the mainstream of physics. In a certain sense that is true. Princeton was also out of the mainstream. In the 1860s, when the Pennsylvania Railroad doubletracked its main line between New York and Philadelphia, it took the opportunity to straighten the section between New Brunswick and Trenton. That act left Princeton two miles off the main line, and that’s where it has been since. The place is a kind of space-time warp.

It is interesting to speculate whether Einstein would have returned to what was then the mainstream of physics if he had taken up residence in a more exposed position, say in Pasadena, where Caltech had offered him the first opportunity to get out of Germany. Probably not. If his life can be read as a kind of Greek tragedy involving extreme early success followed by decades of intellectually lonely frustration, it is truly Greek in that the cause of both success and frustration came from the fundamental aspects of his personality. He probably chose his environment according to his temperament. At the Institute for Advanced Study he could go his own way, and he did. And it was there during the first week in March that a large group of colleagues celebrated the centennial of his birth.

What had he done for physics? Two revolutions and a lot else. He found the theory of electrodynamics in disarray and put it

on a reasonable and logical foundation that incidentally revolutionized our notions of matter and energy and physical dimensions. At the centennial symposium there was much debate over whether the theory of special relativity would have developed without Einstein. The consensus was that it would have. Many others were working in the same direction — Einstein operated here right in the stream of things — and such a theory would have come out though it might have looked different.

General relativity, they all say, was entirely his. He reformulated the theory of gravity and in so doing changed our view of space and time, of the nature of force and of the structure of the cosmos. At this point he was not yet 40 years old. His desire then was to close the circle, to gather everything together, uniting his theories of electrodynamics and gravitation into a gigantic unified field theory, which in those days would have been a theory of nearly everything in physics. He worked 40 more years but did not succeed.

Meanwhile, the mainstream had gone into the channel called quantum physics. Einstein had participated in the beginnings of quantum physics. He won the Nobel prize formally for his paper on the photoelectric effect, which is an aspect of it. Indeed, at the centennial symposium the historian of science Thomas S. Kuhn proposed to credit Einstein with the very concept of the quantum of radiation, an idea usually attributed to Max Planck. This provoked a rebuke from Eugene Wigner (from Wigner a not-so-gentle rebuke) to the effect that people ought to be allowed to keep the credit they have justly earned. Not everything in physics need be annexed to Einstein. Some sections of the popular press might copy Wigner’s remark.

Einstein parted company with quantum physics when it became clear that the Heisenberg uncertainty principle was fundamental to physics on that level, that the

Paul Ehrenfest

acausal, statistical, dualistic aspects were basic to nature and not artifacts that arose from summing up a large number of instances. Einstein couldn't stand it. His remark about God not throwing dice is famous, but there is an emendation of that quote, which goes, "If quantum mechanics is true, God is playing dice according to rules known only to Him." There's the nub. God shall have no secrets from Einstein.

There is something Jobian about Einstein railing at heaven, demanding that nature should be straightforward, deterministic, logical, if you will, kosher. His great opponent in these debates took a more conciliatory attitude. Niels Bohr was willing to accept the uncertainty principle and the wave-particle duality as fundamental to nature. If heaven had secrets, heaven could have secrets. Bohr's motto (actually on his coat of arms) was *Contraria sunt complementaria*, contraries are complementary. He comes across as more Solomonic, willing to accept things as they are and philosophize from there. Or perhaps he could be reminiscent of the fathers of the Council of Chalcedon, who, in describing a mystery they could not fathom, contented themselves with saying what it was not rather than trying to say what it was.

Yet Bohr and Einstein were personally close. Helen Dukas, Einstein's secretary for many years, says "*Sie haben sich herzlich und innig geliebt*," a phrase that is hard to translate without sounding smarmy, which it does not sound in German. If there is something biblical in this clash of prophets, something mythopoetic in this clash of titans, it is fitting that it should have occurred against this background of personal affection — *herzlich und innig geliebt*.

As Einstein's life went on, he withdrew more and more from quantum physics. One might speculate what might have happened to the science and to his objections to it if he had borne a hand. That would probably have been out of character.

He did express the hope that someday a formulation would arise that would contain quantum mechanics as an incomplete part the way his own general relativity contains Newtonian mechanics. This, he hoped, would unify, harmonize and explain away the contradictions.

There is some hope. Unified field theories are all the rage now. These are quantum field theories — not the kind Einstein worked on — and they contain in their foundations such things as spontaneous symmetry breaking, which would have appalled him. But there are recent developments based on a mathematical principle called supersymmetry that show promise of solving the problems and providing the grand synthesis Einstein hoped for. A number of participants in the centennial symposium expressed the belief that this is the way to go for those who would extend the work of Einstein. □

The Quotable Einstein

☛ *For us believing physicists the distinction between past, present, and future is only an illusion, even if a stubborn one.*

☛ *(T)his world is so enormously interesting if one looks at it objectively, and not as we believe it ought to be — and is not.*

☛ *I have little patience with scientists who take a board of wood, look for its thinnest part, and drill a great number of holes where drilling is easy.*

☛ *The only thing which the individual can do is to give a fine example and to have the courage seriously to stand up for ethical convictions in the company of critics.*

☛ *To punish me for my contempt for authority, fate made me an authority myself.*

☛ *There is nothing in the world which I could not dispense with at a moment's notice.*

☛ *I lived in solitude in the country and noticed how the monotony of a quiet life stimulates the creative mind.*

☛ *For the most part I do the thing which my own nature drives me to do. It is embarrassing to earn so much respect and love for it.*

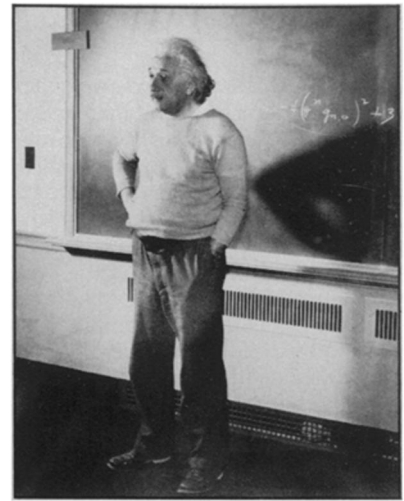
☛ *In a long life I have devoted all my faculties to reaching a somewhat deeper insight into the structure of physical reality.*

☛ *Never have I made any systematic effort to ameliorate the fortunes of men, to fight injustice and oppression or to improve the traditional forms of human relations.*

☛ *I do not at all believe in human freedom in the philosophical sense. Every one of us acts not only under external compulsion but also in accord with inner necessity.*

☛ *Heroism on command, senseless violence, and all the loathsome nonsense that goes by the name of patriotism — how intensely I hate them, how vile and despicable war appears to me; I would rather be torn limb from limb than take part in such business.*

☛ *My relationship to the Jewish people has become my strongest human bond, ever since I became fully aware of our precarious situation among the nations of the world.*



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☛ *If one studies too zealously one easily loses his pants.*

☛ *Is not the handful of diligent men of thought the only fatherland which the likes of us can take at all seriously?*

☛ *What is essential in the existence of a man of my type is what he thinks and how he thinks, and not what he does or suffers.*

☛ *I'm a real loner, who has never belonged with his whole heart to his state, his homeland, his circle of friends, or, indeed, even to his immediate family.*

☛ *It is strange to be known so universally and yet be so lonely.*

☛ *To inquire after the meaning or object of one's own existence or that of all creatures has always seemed to me absurd from an objective point of view.*

☛ *It seems to me that the idea of a personal God is an anthropological concept which I cannot take seriously. . . . My views are near those of Spinoza: admiration for the beauty of and belief in the logical simplicity of the order and harmony which we can grasp humbly and only imperfectly. I believe that we have to content ourselves with our imperfect knowledge and understanding*

and treat values and moral obligations as a purely human problem — the most important of all human problems.

☛ *Strenuous intellectual effort and the contemplation of God's creation are the angels which will lead me, reconciling, strengthening, and yet with uncompromising rigor, through all disquiet and conflicts of this life.*

☛ *God is subtle, but he is not malicious.*