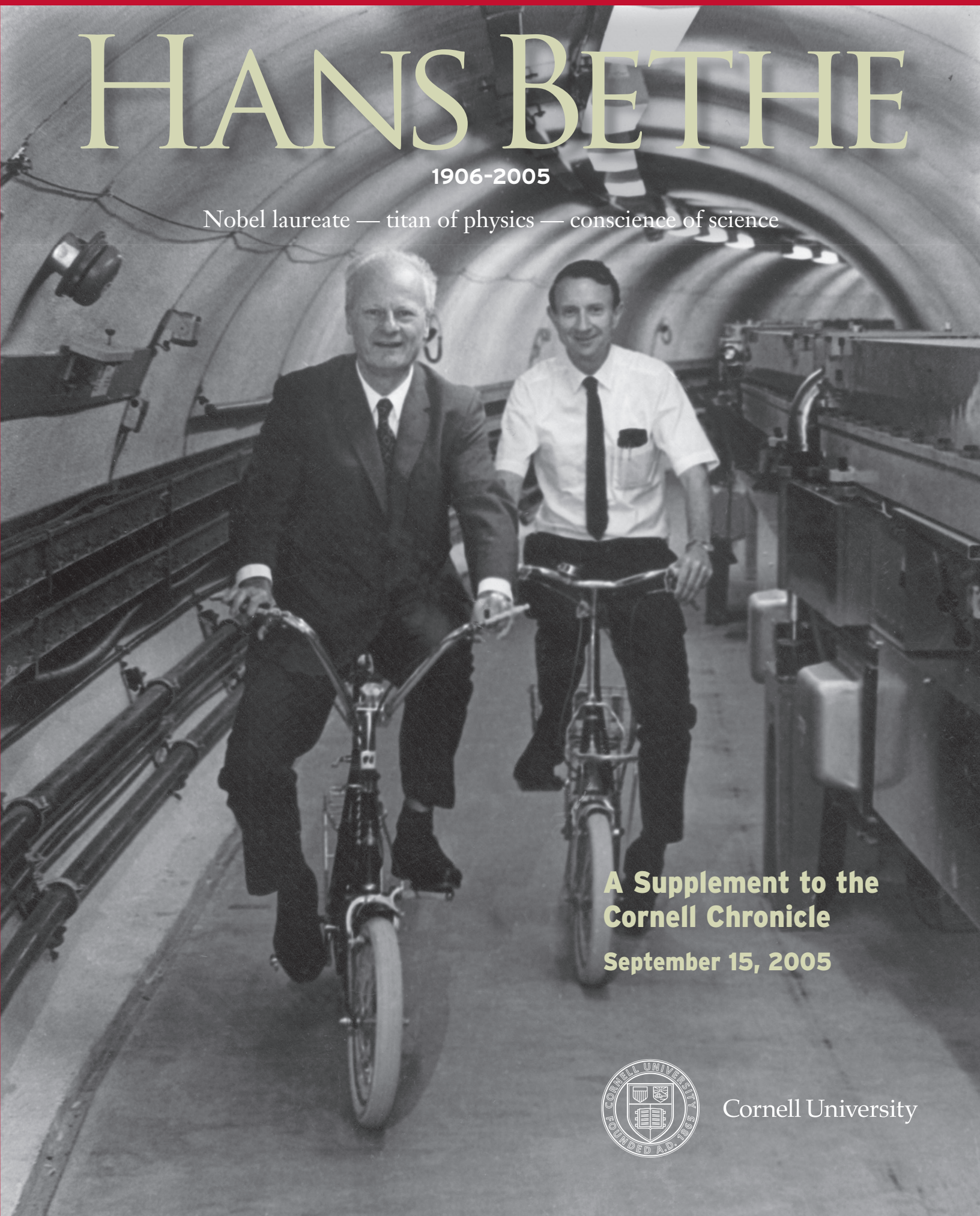
A CELEBRATION OF HIS LIFE AND TIMES

HANS BETHE

1906-2005

Nobel laureate — titan of physics — conscience of science



A Supplement to the Cornell Chronicle

September 15, 2005

Cornell University

Hans Bethe participated actively in many different communities: the world of physics, the university faculty, disarmament and national defense policy, science advice to the president. In every one of these communities his intellectual impact was enormous. In addition he was the moralist and the ethicist. He was the community's conscience.

Dale R. Corson
President Emeritus, Cornell University

Hans Bethe

"I CAME TO AMERICA EXPECTING TO BE AMONG STRANGERS," HANS BETHE SAID OF HIS 1935 MOVE TO CORNELL UNIVERSITY. "I CAME HOME TO ITHACA."

Nobel laureate Hans Bethe, the last of the giants of the golden age of 20th-century physics and the birth of modern atomic theory, was one of science's most universally admired figures. At his death in March at 98, Bethe was professor emeritus of physics at Cornell University, the institution he joined after fleeing Nazi Germany because his mother was Jewish. He was one of the most honored members of the faculty in the university's 140-year history for his work in revolutionizing perceptions of the real world. But he was equally admired for his reputation for integrity, humility and concern that made him the "conscience" of science.

In tribute, Sidney Drell, professor emeritus at Stanford University, said: "Hans Bethe was the last of the giants of modern quantum and nuclear physics. He was present at its creation and for more than seven decades contributed enormously to deepening our understanding of the physical nature of the Earth and the stars. Beyond his major contributions to advances in modern science and the development of the atom bomb, he became an important and actively engaged leader among scientists who felt the responsibility of our community to help governments and societies understand the potential impact of these achievements on the human condition. To this end he contributed prodigiously throughout most of his life. We are all going to miss him."

Bethe's fellow Nobel laureate, physicist Robert C. Richardson, who is Cornell's vice provost for research, said: "Hans Bethe was a giant of 20th-century science. He has been revered by his Cornell colleagues. He left profound and enduring marks of his intellectual leadership on Cornell, the United States and the entire world. Bethe had an important influence upon me as a young faculty member when I arrived at Cornell in 1966. He demonstrated a clarity of thought that I could only hope to emulate some day."

Bethe's deep and abiding belief in science was unaffected by his work on developing the first atomic bomb. "The intellectual achievements of pure research are one of the things that make life worth living," he once said. Even when he had just witnessed the blinding flash from the detonation of the first

FOND MEMORIES

Hans Bethe was a collective mentor to Cornell's Department of Physics. Among his friends and colleagues in the department were David Mermin, the Horace White Professor of Physics; Saul Teukolsky, the Hans A. Bethe Professor of Physics and Astrophysics, and chair of the department; and Kurt Gottfried, professor of physics, emeritus, whose third-floor Newman Lab office was for many years just down the hall from Bethe's. In the following pages they recount anecdotes about the humanity and humor for which Bethe is warmly remembered.

A little over two years ago I received a phone call from Rose Bethe asking if I would be willing to interview Hans on the early history of solid state physics and his role in its development, with the resulting videotape to be shown at the March 2003 meeting of the American Physical Society. My field of physics for much of my career has been in solid state theory. Hans, though, said goodbye to the field in 1933, lured into nuclear physics by the discovery of the neutron.

Because Hans and I worked in different fields, I had few direct scientific interactions with him during my 40 years at Cornell. Until he retired, 30 years ago, there were wonderful annual meetings of all the theorists in his office to decide who was teaching what courses for the coming academic year, which he presided over with great tact and efficiency, making everybody feel good about whatever they ended up with, whether or not they had thought that was what they wanted to be doing. And for decades, well into his retirement, he gave the first weekly physics colloquium of each new academic year, annually renewing our sense of his power, depth and scope, well on into his 90s. Twice he attended colloquia that I gave, asking a pertinent question after the first, and pronouncing a benediction after the second that I still treasure: "You must have had a lot of fun doing that."

I hadn't seen Hans for several years when I appeared at the Bethes' house for a planning session, and was delighted to find him, at 96, still surrounded by books and papers. We had a wonderful conversation about physics and about the growing perils an outspoken young physicist faced in Germany in the early 1930s.

What amazed me during the interview itself was the clarity and precision of Hans' memory of the scientific issues he was dealing with 75 years earlier, in a field of physics he had ceased to work in 70 years ago. Not only was he on top of his own contributions, but he was fully conversant with developments in the three quarters of a century since he had left the field. I – like, I suspect, most ordinary and even quite good physicists – have trouble remembering what I was up to 10 years ago and completely lose track of a field when I move to a different area.

At the end of the videotape I thank Hans for the conversation, and he replies, "It was fun." Fun was important to him. In 1931 he managed, to the subsequent fury of the editor, to get into a reputable physics journal a paper that was pure parody. After he retired in the 1970s, the lecture rooms on the seventh floor of Clark Hall were renamed in his honor, and a beautiful bust of Hans was installed opposite the elevators. One year at the physics department holiday party, a video was shown. The elevator door opened. Hans, playing himself, stepped out, looked furtively around, verified that nobody was there, stepped quickly to the bust, removed a feather duster from behind his back and gave it a thorough going over. Then he rushed back to the elevator and disappeared. Some people might get quite worked up about discovering how the stars burn, but to Hans Bethe, it was mainly a lot of fun.

– David Mermin

nuclear explosion at Trinity site in the New Mexico desert on July 16, 1945, he professed only to a concern about the atomic bomb's functioning. "I am not a philosopher," he explained.

Yet he was deeply committed to humanitarian values, as shown in his efforts to limit the use of nuclear weapons and his work to promote the peaceful use of nuclear energy. "Science is always more unsolved questions, and its great advantage is that you can prove something is true or something is false. You can't do that about human affairs –most human things can be right from one point of view and wrong from another," he once said.

Eminent astrophysicist Edwin E. Salpeter, who arrived at Cornell in 1949 to study under Bethe, said of his former mentor, "He brought clarity to an amazing number of fields of science – especially in astrophysics – where he had to work in the face of uncertainty."

Despite the turmoil of history, Bethe remained committed to the idea of physics as a thing of beauty leading to discovery and understanding, a quest that he called "the spirit of physics." It was a spirit enunciated by his famously optimistic phrase "I can do that," always said in the face of opposition or adversity. Salpeter noted that Bethe's

TIMELINE

Sources: Los Alamos National Laboratory; The Times, London

July 2, 1906

Hans Albrecht Bethe is born in Strasbourg, Alsace, to Albrecht and Anna Bethe.

1924-26

Bethe attends the University of Frankfurt, then transfers to the University of Munich to study under Arnold Sommerfeld.

optimism sprang from knowing how to use the minimum mathematical complexity compatible with each problem he faced. "In his hands, approximations were not a loss of elegance but a device to bring out the basic simplicity and beauty of each field," he said.

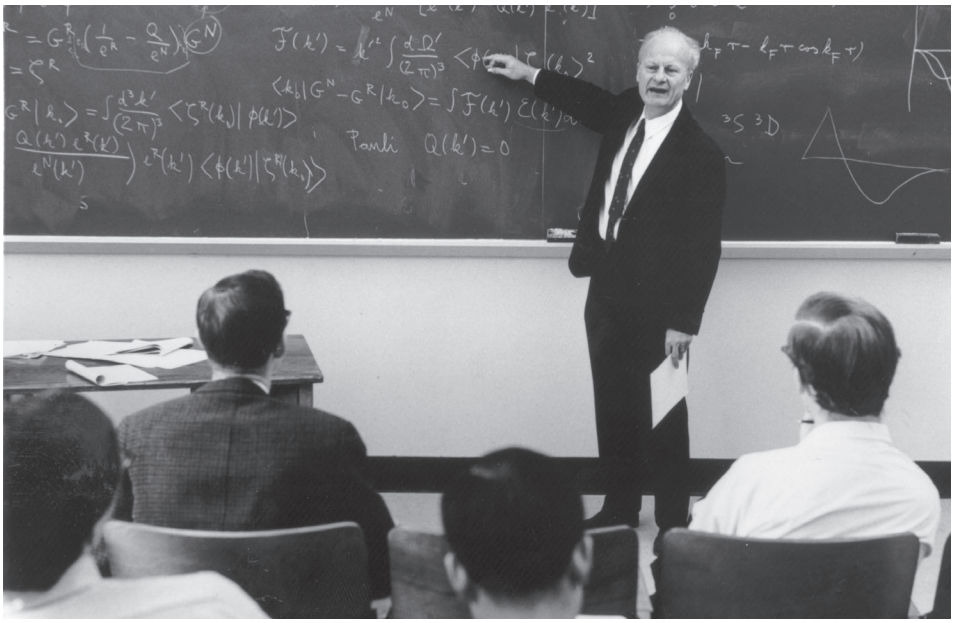
During World War II Bethe was a key figure in the building of the first atomic bomb as head of the theoretical physics division at Los Alamos. Bethe would later recall how "two elder statesmen" told J. Robert Oppenheimer, director of the Manhattan Project, "'Look here, you can't run the theoretical division if you run the laboratory at the same time, and there has to be a theoretical division. It has to be organized. And so the obvious person to put in charge of the theoretical division is Bethe.'"

But after World War II, Bethe became a persistent champion of nuclear arms control, helping to persuade the White House to ban atmospheric nuclear tests in 1963 and antiballistic missile systems in 1972. And he stood firm in his opposition to President Ronald Reagan's Strategic Defense Initiative, the missile defense system known as Star Wars. "The Star Wars system involved impossible tasks to make lasers of unheard of power [and then] to deploy them on satellites in space," he argued.

Bethe also was a deeply committed, even

Thank you for sharing your thoughts on nuclear weapons with me, and for the tremendous service you have rendered this nation and the world for well over half a century. Your efforts to develop the atomic bomb during a grave period of national emergency, and your subsequent courageous and principled efforts in support of international agreements to control the awesome destructive power of these weapons, have made our country more secure and the entire world a safer place.

Bill Clinton
June 2, 1997



Hans Bethe at the blackboard at Cornell University in 1967.

1928

Earns a Ph.D. in physics from the University of Munich.

1930-31

Works with Enrico Fermi in Rome and as a research associate for Sommerfeld in Munich.

1932

The University of Tubingen offers Bethe a faculty position. Less than a year later, he is dismissed under Hitler's racial laws.

1933

Publishes "Elektronen-theorie der Metalle" in the *Handbuch der Physik*. At 27, Bethe is already regarded as one of the greatest physicists of his generation.

1935

From a new post at Bristol University, Bethe accepts an invitation from Cornell University. With Robert F. Bacher and M. Stanley Livingston, publishes three seminal articles on nuclear physics. The articles later became known as the "Bethe Bible."

Bethe steps in productively whenever a new phenomenon is discovered. He is among the first with an exhaustive explanation on the basis of the latest theoretical ideas; or whenever a new theoretical method is conceived he is among the first with an exhaustive application to some yet unexplained observations. He has his own personal way of simple and direct approach to theory and experiment and his typical trademark of thoroughness. It is all "handmade." He does not take the experimental results for granted. He analyzes them himself, often making corrections for effects that had been overlooked, and taking great pains, in numerical work, in fitting curves and in estimating errors. . .

"We live in an industrial age today wherein craftsmanship is becoming a lost art. Specialization is the order of the day. Where is the man who can work with his own hands on any kind of material and create a finished product which reflects his insight and knowledge and bears his personal mark? The great craftsman of our profession, the master of the trade, is Hans Bethe.

R.F. Bacher, professor emeritus, Caltech, and V.F. Weisskopf, professor emeritus, MIT, in "Perspectives in Modern Physics," a book written for Bethe's 60th birthday.

Timeline

1938

Describes the carbon cycle, which explains the energy production and long life of stars and later earns him the Nobel Prize in physics. The article is published in 1939.

1939

Hitler's armies invade Poland; Bethe joins the National Defense Research Committee and the Massachusetts Institute of Technology's Radiation Laboratory. Bethe marries Rose Ewald, the daughter of X-ray physicist P.P. Ewald.

1941

Bethe becomes a U.S. citizen.

1942

Participates in the University of California-Berkeley summer study on the feasibility of an atomic bomb with J. Robert Oppenheimer and Edward Teller. That winter Oppenheimer names Bethe chief of the Los Alamos Theoretical Division.

1945

Bethe watches the detonation of the first atomic bomb in the Jornada del Muerto desert near the Trinity site in the White Sands Missile Range.

sensitive, teacher, and from 1945 until his retirement from active teaching in 1975 he trained and inspired a large number of graduate students. One of them, Freeman Dyson of the Institute for Advanced Study at Princeton, once noted that Bethe would often continue classes over lunch, "and that's where most of the teaching was really done."

His presence at Cornell was a magnet that attracted a world-class faculty to the university's physics department. During the 20 years following the war he became more involved in what he called "political

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Hans Bethe, then the John Wendell Anderson Professor of Physics at Cornell University, meets with President John F. Kennedy.

1947

Bethe calculates the Lamb Shift, which explains an electron's changing energy levels in the hydrogen atom and lays the foundation for the development of modern quantum electrodynamics.

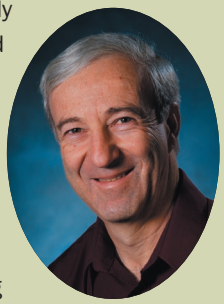
1951

After initially refusing, Bethe joins Teller and Stan Ulam in work to create a hydrogen bomb. "I was convinced that the thing could be done, and since it could be done we had to be afraid that the Russians could and would do it too," he said. The first hydrogen bomb is detonated on Nov. 1.

1956

Bethe joins President Dwight D. Eisenhower's Scientific Advisory Committee and argues to create a test ban treaty with the Soviets.

FOND MEMORIES



Hans Bethe was already an icon when I arrived at Cornell as a young assistant professor in 1974. He officially retired the following year but continued working in his office down the hall as if nothing had changed. Every few weeks the tranquility of our floor would be interrupted by the invasion of a TV crew to interview him about important issues of the day. The combination of being one of the scientific leaders of the Manhattan Project and projecting an air of reasoned confidence carried great weight.

Around 1982 a colleague and I wrote a textbook on astrophysics. We sent a draft of each of the 20 chapters to 20 colleagues who had agreed to review them for us. Nineteen responded either briefly or not at all. Hans had agreed to review the chapter on nuclear astrophysics. He had us make a two-hour appointment in his office. He then proceeded to take us, line by line, through the corrections. "On line 3 of paragraph 2, you used a value of 200 for the nuclear compressibility. Didn't you see the new value that came out a few months ago in the Physical Review?" It was a wonderful experience for us.

Just two weeks before he died, I visited him. Although he was very frail, he wanted to talk science. We discussed the recently discovered double pulsar system, which may lead to new tests of general relativity theory and give insights into the properties of neutron stars. Hans' almost childlike delight in the prospect of our learning something new in this way was infectious. It reminded me that despite all the honors and awards he had received, physics still gave him the greatest joy. I came away from my visit inspired, as so many others have before me.

– Saul Teukolsky

Photos, clockwise from left, a young Hans Bethe with his parents, Anna and Albrecht; with his wife, Rose, at the Nobel Prize ceremony; in his Cornell office; at a Cornell reception.

Timeline

1963

President Kennedy signs the Limited Test Ban Treaty, outlawing atmospheric tests.

1967

Bethe receives the Nobel Prize in physics for his work on energy production in stars. "I feel quite humble comparing myself with many of my predecessors who have made great and fundamental discoveries," he says. "You have given me the prize I believe for a lifetime of quiet work in physics rather than for any spectacular single contribution. I am very proud and very happy with this distinction.

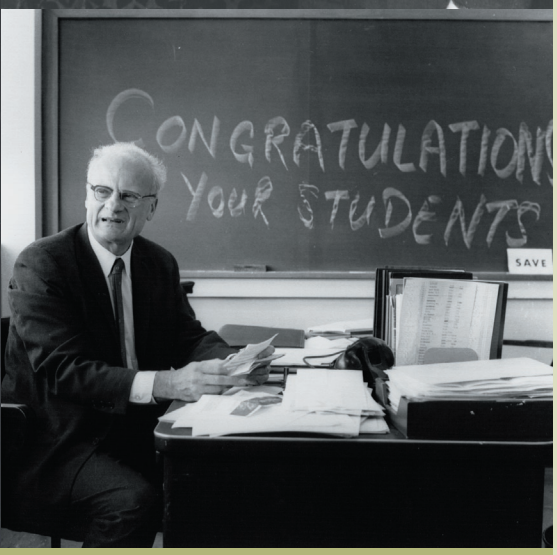
"We are all unhappy that nobody today will receive the Peace Prize. Unfortunately it is not surprising in the present world that the Norwegian Parliament could not find anybody who has contributed sufficiently to peace to merit the prize. I believe I express the hope of all of us that a Peace Prize can be given next year."

1975

Bethe retires from Cornell University but continues to advocate arms reduction and eventual disarmament.

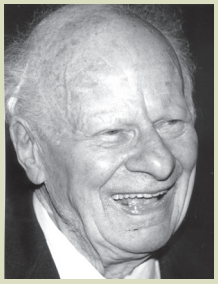
1999

At 93, Bethe argues in the U.S. Senate against the decision to reject the Comprehensive Nuclear Test Ban Treaty. Delivers a series of three lectures on quantum theory to his neighbors at Kendal at Ithaca.



2005

On March 9, three days after his death, Bethe is awarded the American Philosophical Society's Benjamin Franklin Medal. Cornell University President Emeritus Frank H.T. Rhodes presents the award to Rose Bethe.



Last Saturday, as my son was writing college transfer application essays, he spoke about the influence Dr. Hans Bethe had on him as a young man.

When he was in eighth grade, he studied the development of the atomic bomb. I suggested that we try to contact Dr. Bethe to ask some questions. Our phone call resulted in Dr. and Mrs. Bethe inviting my son to come to their home to conduct an interview.

In addition to treating my son as an intelligent and worthwhile individual, Bethe spoke to him about many aspects of the Manhattan Project and his experiences as a member of that group for over an hour.

Needless to say, my son was extremely impressed not only with what Bethe had to share with him, a mere eighth-grader, but also with the fact that he was invited into his home and treated with respect from one of the greatest physicists of the 20th Century.

My son still has the CD of that interview and sometimes, as he falls asleep, he listens again to Bethe's words.

I hope Dr. and Mrs. Bethe know what a profound effect that experience had on my son. It is always amazing to find that the best and the brightest are often the most down-to-earth and compassionate people. My son's experience proves that Bethe is no exception.

Peggy Moorhoff
Letter to the Editor, Tuesday, March 22, 2005
Reprinted with permission from The Ithaca Journal

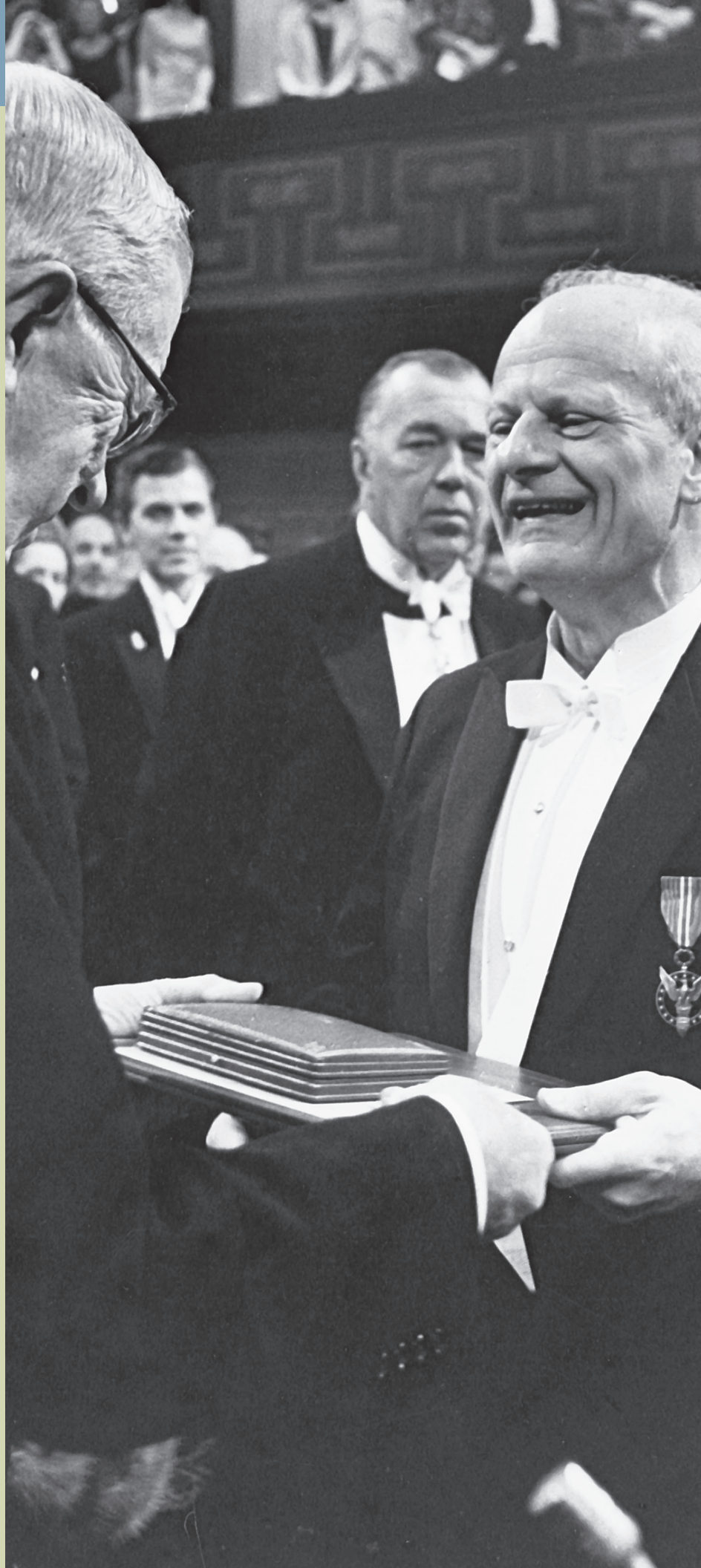
I collaborated a lot with Hans Bethe on arms control and related matters, especially in the 1980s, and was with him on many occasions in Washington. At that time, graduate students in our department organized a large teach-in in Bailey Hall at which Bethe was the lead speaker. A press conference was held for Hans before it started in the Newman Lab seminar room. The organizers (and I) were rather embarrassed when only three reporters appeared, one from the Cornell Daily Sun, one from the Cornell radio station and one from a local paper (not The Ithaca Journal). After waiting for some time, the conference began, and Hans, without a murmur, launched into his prepared remarks with the same gravity and thoroughness as if it were the National Press Club.

I also recall him recounting, on returning from Washington, where he had testified on nuclear arms control, that he had refused to have his appearance rescheduled for later in the hearing because he had a dinner appointment with a former student.

He was not in any sense a prima donna, despite all his astounding accomplishments, but he was aware of his powers. In his first public address opposing the antiballistic missile system, he told the audience, “I know you’re opposed to the ABM system, and I’m going to tell you why.” And in a talk at Victor Weisskopf’s 80th birthday, he said, “When I was young, I was rather arrogant – but I’ve learned how to hide it.”

He loved the mountains and was famous for having amazing endurance. Even in 1983, at the age of 77, I remember him descending from a high pass as much younger friends were climbing up, and at age 89, he used his walking stick like an ice axe on a narrow exposed trail on a Teton pass hike.

– Kurt Gottfried



On the announcement of Bethe's Nobel Prize:

This is wonderful news about a great man on our faculty. We all have the deepest respect and affection for Hans Bethe, and it is a pleasure to see such well-deserved international recognition come to a colleague whom we admire so much. Hans Bethe is an exceptional man who has been at the forefront of modern physics while maintaining a broad view of the world. We are proud of him and are honored by his presence at Cornell.

James A. Perkins
President, Cornell University, 1967

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physics," an attempt to educate the public and politicians about the consequences of the existence of nuclear weapons. He was on the President's Scientific Advisory Committee which gave advice to President Eisenhower and, later, to Presidents Kennedy and Johnson on such matters as ways to limit nuclear proliferation and further development of atomic weapons.

Bethe was truly indefatigable. In his 90s, with his left arm and shoulder wasted by a degenerative muscle disease, he continued to arrive regularly at his office at the Newman Laboratory on the Cornell campus although, he admitted, "not every day do I find anything interesting." Every day began with a 45-minute hot bath, because, he said, "You sleep, and things get somewhat unscrambled in your mind; then in the bath, I can become conscious of that." And he always carried with him his old slide rule on which he could with ease perform calculations to the sixth power.

Hans Albrecht Bethe was born July 2, 1906, in Strasbourg, now in France but then part of Germany. He showed an early genius as a mathematician, studying physics at the University of Frankfurt and doing research in theoretical physics at the University of Munich, where he was a student of Arnold Sommerfeld, the teacher of Wolfgang Pauli and Werner Heisenberg, and where he received his doctorate in 1928. In 1930 and 1931 he received fellowships, first to the University of Cambridge and then to the Institute of Physics in Rome, where he worked with Enrico Fermi. He taught at Frankfurt and Munich. At the Technical University of Stuttgart he was assistant to Paul Ewald,

THE UNITED STATES OF AMERICA

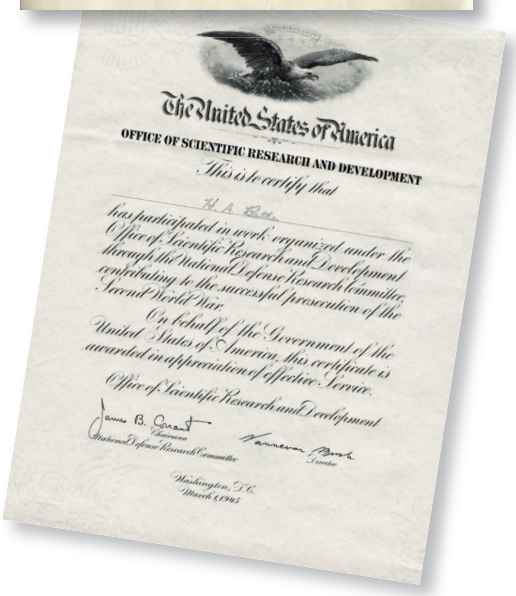
TO ALL WHO SHALL SEE THESE PRESENTS, GREETING:

THIS IS TO CERTIFY THAT THE PRESIDENT OF THE UNITED STATES OF AMERICA IN ACCORDANCE WITH THE ORDER ISSUED BY GENERAL GEORGE WASHINGTON AT HEADQUARTERS, NEWBURGH, NEW YORK, ON AUGUST 7, 1782, AND PURSUANT TO ACT OF CONGRESS, HAS AWARDED THE MEDAL

FOR MERIT
TO
DR. HANS ALBRECHT BETHE

FOR EXTRAORDINARY FIDELITY AND EXCEPTIONALLY MERITORIOUS CONDUCT

GIVEN UNDER MY HAND IN THE CITY OF WASHINGTON THIS TWELFTH DAY OF JANUARY 1946



The United States of America

OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

This is to certify that

H. A. Bethe

has participated in work organized under the Office of Scientific Research and Development through the National Defense Research Committee, contributing to the successful prosecution of the Second World War.

On behalf of the Government of the United States of America, this certificate is awarded in appreciation of effective service.

Office of Scientific Research and Development

James B. Conant
Chairman
National Defense Research Committee

Vannevar Bush
Director

Washington, D.C.
March 1, 1945

Left: Hans Bethe accepts the Nobel Prize for physics.
Right: Certificate of Merit awarded to Hans Bethe Jan. 12, 1946, signed by Secretary of State Dean Acheson and President Harry S Truman, and Certificate of Appreciation awarded March 1, 1945, by the United States Office of Scientific Research and Development.

In 1997 I was lucky enough to meet Dr. Bethe at Cornell University for a BBC Radio 4 documentary about the physicist Robert Oppenheimer. He was a delightful man. Charming, warm, friendly, with no trace of self-importance . . .

After the interview, talking very simply about his explanation of stellar and solar energy, he joked that he couldn't say he had found any traces of God up there — but then, shaking his index finger, he added seriously, "However, this does not affect a single iota of Christ's Sermon on the Mount." At the end, he said that what kept him going (he was about 91), was not the miracles of science so much as the incredible daily miracles of nature. He walked me to a window and pointed at a breathtaking sea of red and purple, russet and auburn covering the trees of the campus. "Seeing this miracle as it transforms itself every day, wouldn't you want to live forever?"

John Theocharis
Letter to The Times of London: timesonline
March 26, 2005


Hans Bethe at Cornell.


Hans and Rose Bethe at Cornell.

professor of theoretical physics, who would become his father-in-law a decade later when Bethe married Rose Ewald, then a student at Smith College in Massachusetts and who graduated from Cornell in 1941.

Bethe's father, a professor of physiology, was a Protestant, but his mother was Jewish. This brought him into conflict with Nazi race laws after Hitler came to power, and Bethe was dismissed from his post at the University of Tubingen. He left Germany, going first to England, then to the United States and Cornell in 1935.

It was Bethe who propelled Cornell's physics department into the top rank. And it was at Cornell during the late 1930s that he wrote his famous reviews of nuclear physics and, in 1938, published his seminal paper on the theory of energy production in stars that explained how the sun shines. The work was to win him the Nobel Prize in 1967.

During his years as a physicist, he published papers in every decade from the 1920s through the 2000s. In 1995 Bethe's colleagues, students and friends marked his 60 years at Cornell with a two-day tribute to his life and work. "If you know his work," the late John Bahcall of the Institute for Advanced Study, once said, "you might be inclined to think he is really several people, all of whom are engaged in a conspiracy to sign their work with the same name."

After World War II Bethe brought some of the most outstanding young physicists at Los Alamos to Cornell, among them Richard Feynman and Robert Wilson. Under their leadership Cornell became a world center for high energy elementary particle physics. Bethe

I first met Hans Bethe in 1947 in Birmingham, England, when I was a graduate student in theoretical physics there. Hans would visit occasionally and go from one graduate student to the next, like a chess master playing multiple boards, giving advice not only on physics itself but on questions about their future. I also met Rose Bethe, who was and continued to be an inspiration both to Hans and to us youngsters. His masterful help to graduate students who were not even his own already convinced me that I wanted to be a postdoc with him. I did indeed come to Cornell in 1949 to work with Hans, and I have been here ever since.

That Hans could give advice simultaneously on technical and social issues is just one example of his being able to combine disparate or even opposite abilities. In physics research he was able to combine rigorous mathematics he learned from one of his two teachers (Sommerfeld) with the light touch of intuition and shortcuts he learned from the other (Fermi). Although it sounds confusing, most of us disciples were able to absorb his advice: "Know advanced mathematics, but use only the minimum necessary for any particular problem." In some fields such as quantum mechanics, his thoroughness and precision led to monumental books. He wrote one such on quantum mechanics of hydrogen and helium atoms when quantum mechanics was still fairly young. I helped bring this book up-to-date (in English) 25 years later, and it is remarkable how little needed to be changed or added, since he had already worked out most things in the first place.

On the other hand, his light touch enabled him to make breakthroughs in fields which were full of uncertainties, as was the case in nuclear astrophysics. He started that field just before the Second World War by showing how energy is produced in the sun and other main sequence stars. He was modest enough to say that he did not work in astrophysics for about 30 years after the war, but in fact he had a tremendous indirect influence by inspiring and advising Willy Fowler at Caltech, who built nuclear astrophysics into a science of its own. Hans also "lent" postdocs to Willy occasionally, and I spent the summer of 1951 at Caltech, applying the things I had learned from Hans personally and from the "Bethe Bible," a set of three monumental review articles on all that was known about nuclear physics in 1937.

In addition to building up Cornell as a major research institution, Hans also had a subtler but important influence on his younger colleagues and on university administrators, both by teaching them directly and by being a role model for sensible attitudes. Again, his toughness and light touch helped: Cornell physics has had a department chairman and two laboratory directors plus Hans without any administrative title, but Hans would manage committee meetings informally and smoothly. Although he did classified work elsewhere, he had a strong influence on Cornell presidents and staff on the principle of not allowing any classified work to be carried out on campus. This principle has been kept all these decades and has been quietly passed on to some (but not all) other universities. Again, in the Joe McCarthy era Hans quietly strengthened Cornell's resolve to shield local victims of the McCarthy witch hunts.

Soon after the Second World War, Hans got involved in public policy issues, all toward making the world a safer place. Although he lost a few important battles, such as the building of the hydrogen bomb, there was admiration for his unwavering strength of character. His pronouncements against the hydrogen bomb helped to alert the general public against the utterly insane weapons build-up during the Cold War. The eventual decrease of the nuclear weapons arsenal and the two test ban treaties are greatly to his credit. His statement "I am a dove–but I am a TOUGH dove" partly explains his great influence.

Hans was a thoroughly happy man most of his life, not only for his own achievements but for having enthused us youngsters to speak out and get involved in public policy issues ourselves (I still have fond memories of going to Washington with other young scientists to try and persuade senators of the importance of test ban treaties). However, Hans told me more recently that current political developments left him very frustrated. Just when speaking out is becoming particularly important, he felt that his younger colleagues (and intellectuals in general) were not getting involved as their older colleagues had in the past.

Hans Bethe's legacy will be with us for a long time to come, and I hope we will be inspired to speak out more, not only on technical issues, but on moral and political ones as well.

Of all the places in the world one might go to be a postdoctoral candidate, Cornell was the one and only place I wanted to go because of Hans Bethe.

Edwin Salpeter
Distinguished Professor Emeritus, Cornell University

On Hans Bethe's desk at Cornell University, where he lived and taught for almost 70 years, there was always a pad of paper which he used for calculations. His door was usually open. Students and colleagues came in constantly to discuss a wide variety of problems. Bethe would instantly switch his attention from his own problem to theirs. As soon as they left the room, he would instantly switch his attention back and continue his calculation where he had left off. He continued to pour out a stream of research papers while carrying a full load of teaching and taking care of an army of graduate students. When I was one of his graduate students, he came every day to eat lunch with us at the student cafeteria, sharing our problems and telling stories of his adventures in Germany and in Los Alamos. We learned even more at the lunches than we did at his lectures. Everyone called him Hans. He told us that one of the best things about moving from Germany to America was that nobody in America called him "Herr Professor". . .

Bethe carried in his head all the numbers that play an important role in physics or in engineering. Given any question, he could estimate a numerical answer with lightning speed. His estimates were amazingly accurate. He put this skill to good use helping Robert Wilson to design a succession of particle accelerators at Cornell. The same skill made him an ideal leader for the theoretical division at Los Alamos, designing the first atomic bomb during World War Two and helping to design the first hydrogen bomb in 1952. For the 60 years that he lived after, he worked hard to educate the public about the facts of nuclear weaponry and the impossibility of winning a nuclear war. He was actively engaged in fighting for arms-control treaties and against escalations of the arms race. At the age of 90, he wrote a letter to President Clinton, saying: "The time has come for our nation to declare that it is not working, in any way, to develop further weapons of mass destruction of any kind. You might consider making a suitable pronouncement along these lines, to discipline the bureaucracy, and to reassure the world that it is vigilant in its desire to ensure that new kinds of nuclear weapons are not created."

Now that he is dead, it is up to us to continue to fight the good fight that he fought, for nuclear sanity, for moderation and for common sense.

Freeman Dyson
Professor Emeritus, Institute for Advanced Study, Princeton University
Science, 8 April 2005; 307:1719

HANS BETHE: A CELEBRATION OF HIS LIFE AND TIMES

Parts of this publication previously appeared in the Cornell Chronicle.

Editor: David Brand
Writer: Lauren Gold
Designer: Dennis Kulis
Copy Editor: Karen Walters

Cornell Chronicle
Publisher: Thomas W. Bruce
Editor: Joe Wilensky

Produced by Cornell News Service and Cornell Publications and Marketing, units of the Division of University Communications.

Photography by University Photography, Division of Rare and Manuscript Collections, Robert Barker, *Bundesbildestelle,* Sol Goldberg, Russ Hamilton, Michael Okoniewski

Printed on recycled paper.
9/05 ADNet 3M 060051

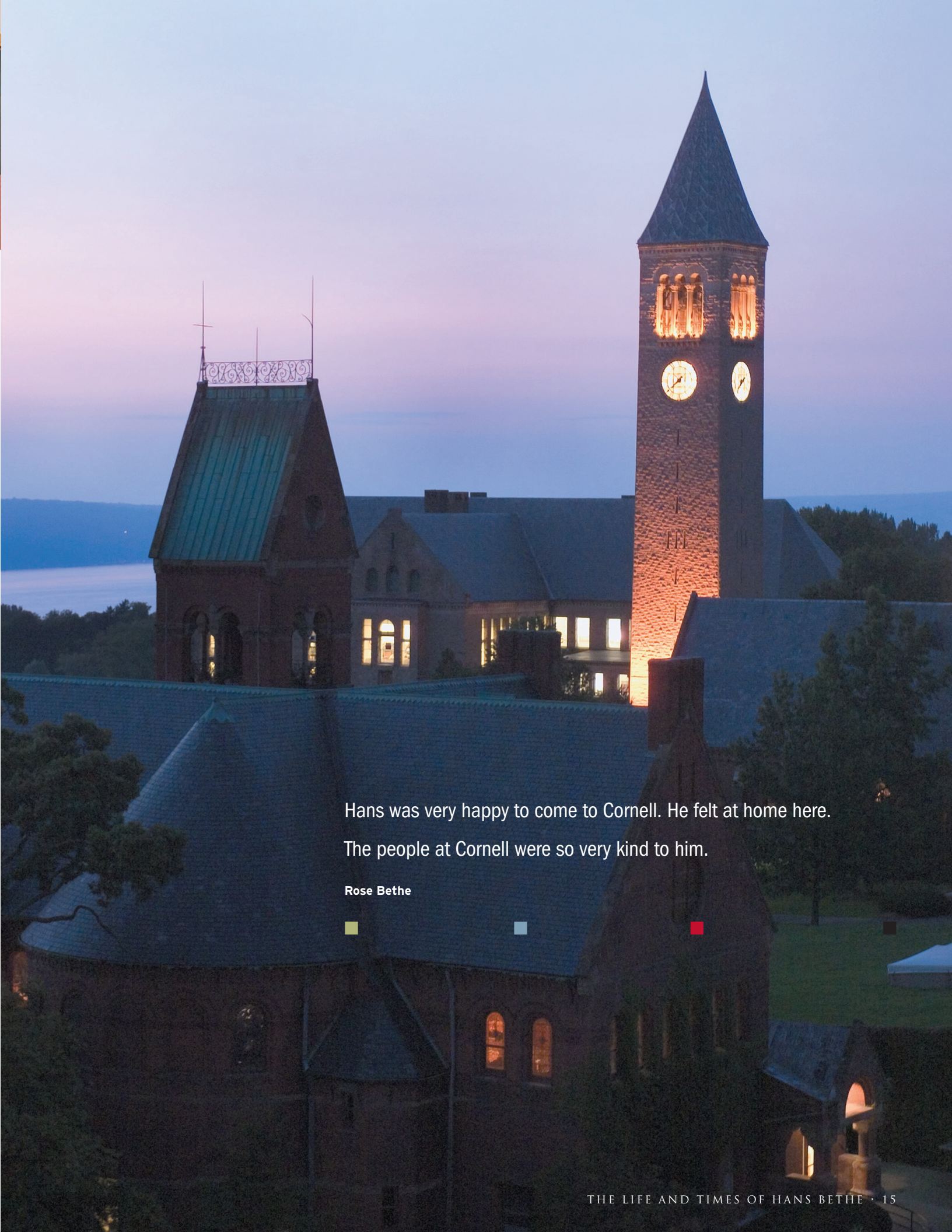
Frank H.T. Rhodes, president emeritus of Cornell and now the president of the American Philosophical Society, presents the Benjamin Franklin Medal to Rose Bethe, widow of physicist Hans Bethe, March 10, 2005.

and Feynman played a central role in developing quantum electrodynamics, work for which Feynman shared the Nobel Prize in 1965.

After his retirement from teaching, Bethe devoted much of his time to astrophysics and wrote papers with Bahcall trying to explain why the sun produced fewer particles called neutrinos than predicted by Bethe's theory of stellar energy production. And at the age of 83 he apprenticed himself to Gerald E. Brown of the State University of New York at Stony Brook in order to learn lattice gauge theory. The theory, which predicts how nuclear matter is transformed at extremely high temperatures into a plasma of particles called quarks and gluons, is one of the most challenging in all of physics. "I'm interested in learning new things," Bethe explained. The two scientists went on to publish numerous papers together on astrophysics.

He was deeply in love with the mountains, spending at least two or three weeks every summer walking in the U.S. Rockies or the Swiss Alps. He was also a stamp collector, a hobby he took up in his teens and resumed in his late 40s and continued until his death. "It was the one place in the world where all countries sat together peacefully," he said. He also was passionately interested in history.

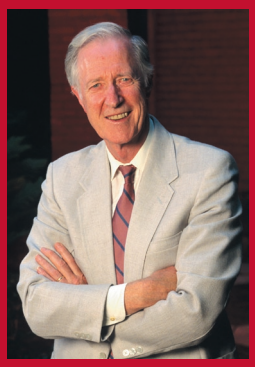
In addition to his wife, he is survived by two children, Henry, of Ithaca, and Monica, who lives near Kyoto, Japan, and three grandchildren.



Hans was very happy to come to Cornell. He felt at home here. The people at Cornell were so very kind to him.

Rose Bethe

"He was also a wonderful statesman of science; somebody who advised three presidents; somebody who was a public advocate for the social conscience of science, for defense, for energy, for nuclear power and especially for human welfare in the broadest sense. And it was to him that so many of the rest of the scientific community looked, and still look, for leadership and inspiration. His was a rich life, nobly and generously lived. I don't know how you do justice to all the greatness that is Hans Bethe."



Frank H.T. Rhodes
President Emeritus, Cornell University

Front cover photo: Hans Bethe rides a bike through the underground tunnel of the Cornell Electron Storage Ring, accompanied by Boyce McDaniel, then director of the Wilson Synchrotron.