I. I. Rabi and the Birth of CERN

CERN was created in part to help restore a great European scientific tradition. But the establishment of a European laboratory also advanced US scientific and foreign policy aims.

John Krige

Fifty years ago, in September 1954, CERN officially came into being. The European Organization for Nuclear Research, as it was then called, welcomed Felix Bloch back to Europe as its first director general. The Stanford University physicist, a Nobel Prize winner with dual Swiss and American citizenship, personified what CERN's founders hoped the laboratory would achieve. They hoped it would play a fundamental role in rebuilding European physics to its former grandeur, reverse the brain drain of the brightest and best to the US, and continue and consolidate postwar European integration.

Today, CERN has more than fulfilled the goals of its founders. It is one of the outstanding high-energy physics laboratories in the world. Home to thousands of European physicists and engineers, the lab is an essential resource for thousands of others the world over who build and run experiments there. And it is a model of European integration. From its original 12 member states, CERN has now grown to 20, including a number of countries (Bulgaria, Hungary, the Czech and Slovak republics, and Poland) of the new Europe.

Although US scientists make intensive use of CERN, their country is not among its member states. That is not to say that the US administration was uninterested in CERN; on the contrary, it played a major role at a key turning point in the lab's history. The vector for that initiative was Isidor I. Rabi, Columbia University physicist, Nobel laureate, and scientific statesman.[1] Indeed, the leading European physicists associated with the project, including Niels Bohr and Werner Heisenberg, deemed Rabi's role to be so important that they bestowed paternity of the laboratory on their American colleague.

The story of CERN's conception and gestation[2] has been told so often—by me, by other historians, and by its founders—that one may wonder what is the point in telling it again. Much of what has been said and written, however, has concentrated on the measures taken in Europe to get the laboratory going. Other points of view are possible. As in all empirical sciences, including history, rich data are always thick with meaning. My aim is to read the birth of the laboratory through the lens of US foreign policy—to explore Rabi's initiative and to situate it squarely in the context of the cold war. I bring to the fore, not the great importance that CERN had for Europeans, but its place in the promotion and protection of American scientific and political interests in the European theater.[3]

After the cancellation of the Superconducting Super Collider in 1993, many particle physicists believed the future of their field lay in building a world accelerator laboratory modeled on CERN. The story of CERN's origins brings home just how crucial it is that such a project, if it is to have any hope of success, dovetail with US and European scientific interests and foreign policy.

Rabi's initiative

Rabi has been honored as the father of CERN in recognition of a pathbreaking intervention he made as a member of the US delegation to a United Nations Educational, Scientific and Cultural Organization (UNESCO) meeting in Florence, Italy, in June 1950. During that meeting, Rabi had an enabling resolution passed, after authorization by the US State Department, and after consultation with some European physicists. In essence, the resolution called for the establishment of regional research centers grouping together countries—above all, in Western Europe—that had previously made major contributions to science: countries like France, West Germany, and Italy. By pooling their human and financial resources, member nations could acquire the expensive instruments of modern research that they could not afford alone. As for the fields that ought to be explored at such centers, Rabi specifically mentioned physics, biology, and computing, with accelerator physics as the initial priority. The box on page 47 includes part of the UNESCO press release announcing the resolution and describes Rabi's vision for the Western European research centers.

Why did the initiative matter so much to European physicists that they bestowed the paternity of CERN on Rabi, an American? Because it was taken as a sign that the US would not impede the creation of a physics research laboratory in Western Europe. In the late 1940s, remember, high-energy physics had not yet emerged as a field distinct from nuclear research or as a field of basic research whose findings were remote from immediate industrial or defense applications. To speak of physics was to conjure up the civilian and military atom, power reactors and bombs, economic competition and state secrets. It was also to bring to mind the limitations imposed on the circulation of researchers and the sharing of scientific and technological information between physicists in the US and in Western Europe, and within the countries of Europe themselves.

Those limitations lost much of their meaning in August 1949. The explosion of the first Soviet atomic bomb shattered any hope that the US could retain its near monopoly on the power of the atom. The Soviet test led to a greater willingness in Washington to share information with allies and to enroll them in the construction of the West's nuclear capability and defense. Rabi's intervention in Florence was taken as symptomatic of that new willingness to

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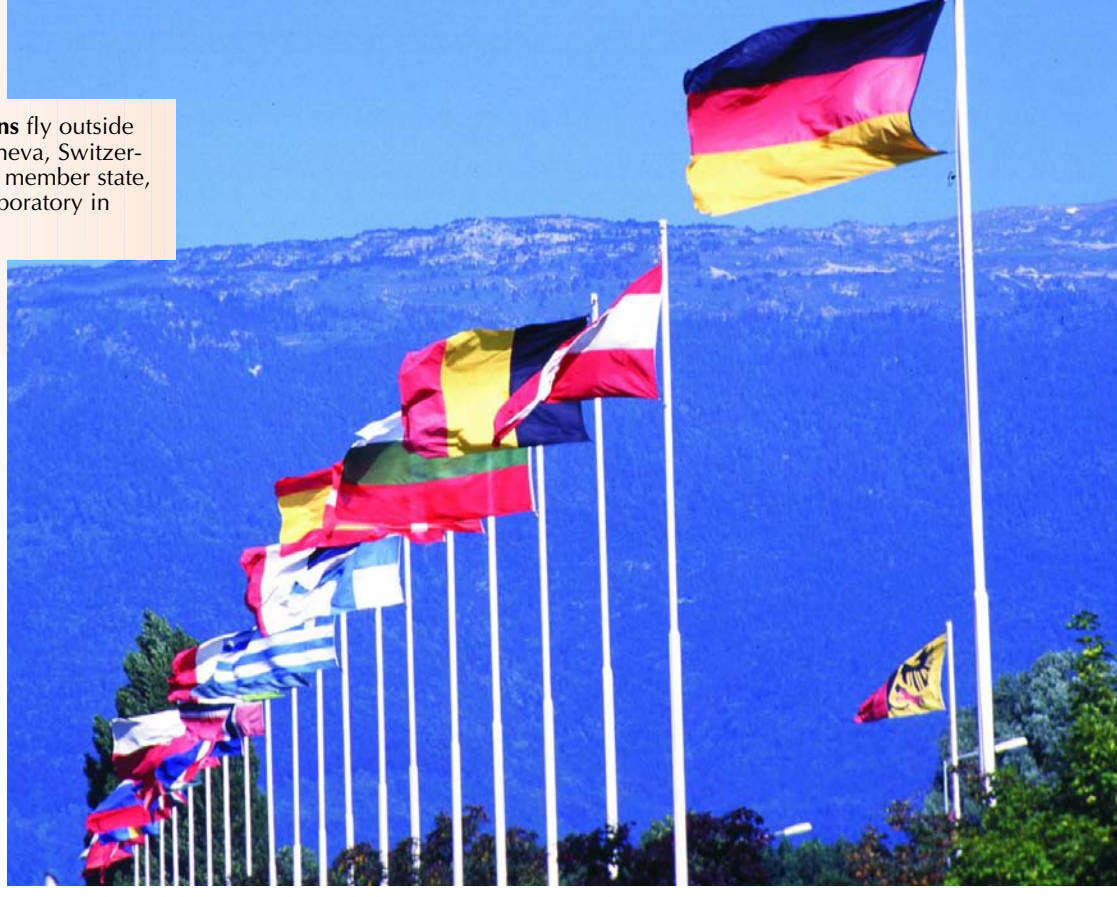


Flags of 20 member nations fly outside CERN headquarters in Geneva, Switzerland. Bulgaria, the newest member state, joined the international laboratory in 1999. (Courtesy of CERN.)

encourage and collaborate; it reassured European scientists and governments that the US would not try to undermine efforts on the continent to build up a research capability in nuclear science.

What kind of equipment did Rabi have in mind for the new regional European laboratory? The press release announcing his initiative mentioned accelerators and enumerated various installations in American university laboratories. Many Europeans were excited about Rabi's resolution because they originally interpreted it as suggesting that the laboratory build both an accelerator and a pile for low-energy nuclear physics. Rabi may have inadvertently fueled that interpretation, because in many subsequent interviews, he said that his point of reference in Florence had been the Brookhaven National Laboratory (BNL) in New York. He had been one of the chief proponents for that research facility, which was collectively funded by nine East Coast universities, including his own Columbia. BNL was equipped, almost from its inception, with both the giant 3-GeV Cosmotron, which was being assembled even as Rabi spoke in Italy, and a 10-megawatt graphite research reactor, which went critical a few months later, in August 1950.[4] Was Rabi suggesting that Europe build a multinational laboratory for high- and low-energy physics modeled on BNL, a center endowed with both a powerful accelerator and a pile?

Emphatically not. Indeed, time and again he insisted that the association of reactors with atomic power would necessarily undermine any collaborative European effort. The centrifugal pull of national interest and the desire to maintain privileged bilateral relationships with the US in the field of atomic physics would overwhelm the will of scientists and governments alike to pool resources in a multinational laboratory that included a pile. If the regional European laboratory was to garner support, its research equipment had to be seen as contributing to the reconstruction of European physics without directly reinforcing the industrial or military strength of the collaborating nations. The pertinence of BNL thus did not lie in the range of equipment sprawled across its Long Island site: Its significance was essentially as an organizational model. It was an exemplar of how scientists and administrators from different, even rival, institutions could collaborate constructively in a joint venture around big research equipment.

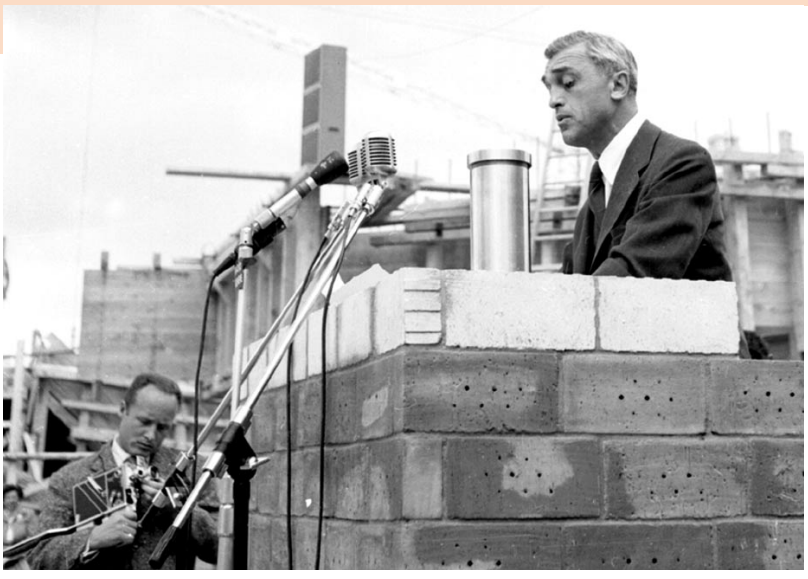
Rabi's intervention in Florence had, in sum, two key features. First, it suggested that European governments pool resources to build a costly accelerator in common. Second, by drawing on the BNL precedent, it affirmed support for European intergovernmental collaboration. As Rabi often liked to say, his model was BNL, but with European governments replacing American universities as the contributing members. Both suggestions were warmly welcomed by European scientists and quickly acted on by national administrations. Both also expressed important American interests in the region.

What's in it for US?

Rabi was undoubtedly moved by personal sentiment when he took the initiative in Florence. Like many US physicists of his generation, he had spent several years in Europe as a young man. (He was born in Europe as well.) There, he had rubbed shoulders with giants like Bohr, Heisenberg, Wolfgang Pauli, and Erwin Schrödinger. Rabi had done his first molecular beam experiments at the bench in Otto Stern's laboratory in Hamburg, Germany, where he acquired the basic skills that would later be rewarded with a Nobel prize. Rabi was moved by the appalling devastation of science in Europe after the war and by the lack of equipment and resources. He wanted to help rebuild the European scientific base so that the laboratories and countries that had given so much to him in the 1920s could once again do outstanding physics.

Broader considerations were also at work, however. In the early 1950s, American scientists were aware of the important contributions to US science and technology that had been made elsewhere. Alan Waterman, director of the new NSF, pointed out to the Commission on Immigration and Naturalization in 1952 that

> we benefited perhaps more than any other world power from scientific discoveries made elsewhere. The development of some of the most vital weapons in our armament stems from



Felix Bloch (1905–83) became the first director general of the European Organization for Nuclear Research (CERN's original name) in 1954. Here, he is seen speaking at the 10 June 1955 ceremony to lay the cornerstone. The steel cylinder in front of him holds a document to be laid in the concrete of the synchro-cyclotron building. (Courtesy of CERN.)

> open, unclassified fundamental scientific research abroad. Radar, the atomic bomb, jet aircraft, and penicillin were perfected in the United States on the basis of discoveries and research in foreign countries to which we were given ready access. (For Waterman's full statement, see PHYSICS TODAY, January 1953, page 6)

Others went further and suggested that Western Europe remained the cradle of scientific discovery, while America's strength lay in using Yankee ingenuity to organize and apply research. "American pre-eminence as demonstrated thus far is in the application of scientific discovery," said a May 1950 State Department report prepared by a panel that counted Rabi among its members and was chaired by Lloyd Berkner.[5] It was clear that a strong basic-science capability in Europe would be an invaluable input to American scientific and technological progress.

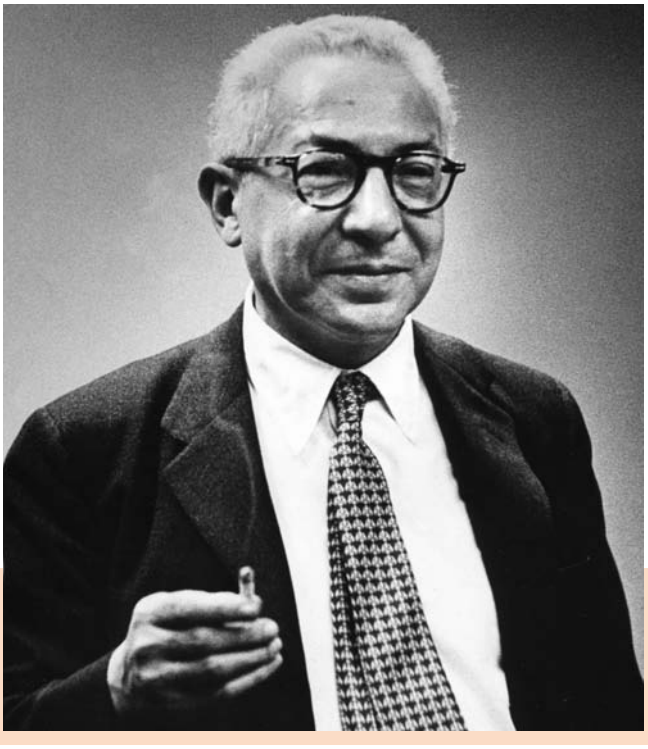
It was particularly important that Europeans do outstanding work in unclassified high-energy physics. President Harry S Truman had announced his backing for the development of the hydrogen bomb just a couple of months before Rabi went to Florence. Some physicists, notably Edward Teller, were jubilant, and pressured colleagues to get back to the weapons laboratories.[6] (For more on Teller, see the special focus in the August 2004 issue of PHYSICS TODAY.) Rabi, too, was pleased when he learned that Ernest Lawrence was mobilizing his outstanding laboratory in Berkeley, California, for work on the new weapon: "It is certainly good to see the first team back in," he said. "You fellows have been playing around with your cyclotrons and nuclei for four years and it's time you got back to work!"[7] The "honeymoon with mesons" was over, announced Teller. Weapons research was again a priority and at least 25% of US physicists should be engaged in war work, he said. The advantage in having basic high-energy physics research conducted in Europe was clear.

Of course, helping rebuild European physics was not without its dangers. There were fears of a resurgence of German militarism and nationalism. And France's Atomic Energy Commission included a strong Communist scientific presence. There were worries of security leaks to the Soviet Union. But a laboratory like CERN could serve a useful purpose in addressing such worries. It would bring the cream of European physicists together in a declassified zone where they could freely discuss their latest work. It would be an international focal point for planning new initiatives.

At CERN, one could learn what others were doing. As the Berkner report put it, international scientific exchange was invaluable because it enabled competent US scientists to discreetly try to establish the abilities of their colleagues in the Soviet Union and elsewhere through "collaborative and constructive discussion" about "content, procedures, and mechanisms of the science involved." In short, CERN could serve as a useful base for informal scientific intelligence gathering. That may sound excessively conspiratorial, but this was the cold war.[8]

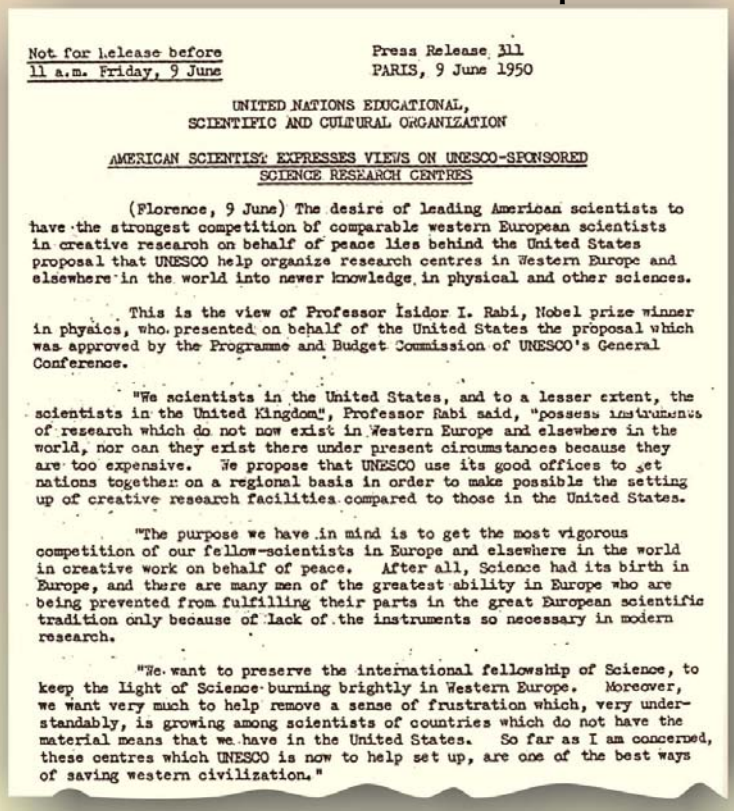
An instrument of European unity

In advocating a regional laboratory for physics in Western Europe, not only was Rabi working for European scientific collaboration, but he was also promoting European politi-



I. I. Rabi (1898–1988), was instrumental in the founding of CERN. This photograph shows Rabi at a press conference that was part of the 1955 United Nations conference on the peaceful use of atomic energy. (Courtesy of AIP Emilio Segrè Visual Archives.)

"To Preserve the International Fellowship of Science"



Not for release before
11 a.m. Friday, 9 June

Press Release 311
PARIS, 9 June 1950

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

AMERICAN SCIENTIST EXPRESSES VIEWS ON UNESCO-SPONSORED SCIENCE RESEARCH CENTRES

(Florence, 9 June) The desire of leading American scientists to have the strongest competition bf comparable western European scientists in creative research on behalf of peace lies behind the United States proposal that UNESCO help organize research centres in Western Europe and elsewhere in the world into newer knowledge in physical and other sciences.

This is the view of Professor Isidor I. Rabi, Nobel prize winner in physics, who presented on behalf of the United States the proposal which was approved by the Programme and Budget Commission of UNESCO's General Conference.

"We scientists in the United States, and to a lesser extent, the scientists in the United Kingdom", Professor Rabi said, "possess instruments of research which do not now exist in Western Europe and elsewhere in the world, nor can they exist there under present circumstances because they are too expensive. We propose that UNESCO use its good offices to get nations together on a regional basis in order to make possible the setting up of creative research facilities compared to those in the United States.

"The purpose we have in mind is to get the most vigorous competition of our fellow-scientists in Europe and elsewhere in the world in creative work on behalf of peace. After all, Science had its birth in Europe, and there are many men of the greatest ability in Europe who are being prevented from fulfilling their parts in the great European scientific tradition only because of lack of the instruments so necessary in modern research.

"We want to preserve the international fellowship of Science, to keep the light of Science burning brightly in Western Europe. Moreover, we want very much to help remove a sense of frustration which, very understandably, is growing among scientists of countries which do not have the material means that we have in the United States. So far as I am concerned, these centres which UNESCO is now to help set up, are one of the best ways of saving western civilization."

The birth of CERN may be traced to a United Nations Educational, Scientific and Cultural Organization (UNESCO) meeting held in Florence, Italy, in June 1950. At that meeting, I. I. Rabi, on behalf of the US, offered a proposal that research centers be created—above all in Western Europe. The reproduction above includes the first five paragraphs of the press release that announced the American initiative. (Courtesy of UNESCO.)

cal integration. In addition to bringing scientists together in a shared research effort, the laboratory that he foresaw would bring governments together and make them relinquish some sovereignty in return for the benefits of a joint undertaking. It would symbolize a new kind of Europe, a Europe that had put national rivalry and war behind it, a Europe based on intergovernmental collaboration and integration.

It is highly significant that Rabi specifically mentioned West Germany in the list of potential member states of the new laboratory. That signaled a possible further relaxation in US policy toward the rehabilitation of physics in that country, which had only just gained a measure of sovereignty and was not yet even a member of UNESCO.

Immediately after the war, Allied policy on Germany was one of retribution and repression. Any installation that could possibly serve for rearmament was dismantled. Laboratories and factories were plundered. Not only military, but also commercially important information and equipment were summarily removed.[9] In 1945, Roger Adams, an organic chemist and chairman of the chemistry department at the University of Illinois, was asked by the National Academy of Sciences to set up a blue-ribbon panel to draft an appropriate policy for controlling postwar German science. The recommendations of the panel, whose members included Rabi, were eventually embodied in Allied Control Law 25, promulgated in Germany in April 1946.

Law 25 brought some respite. Although it retained the prohibition on all research in eight areas deemed to be of military significance, including applied nuclear physics and reactor construction, the law allowed for the limited rehabilitation of "peaceful" basic science and technology in academic and industrial settings. Yet it was only in 1947 that German physicists were allowed to restart their only cyclotron, a small machine built as part of the wartime fission program at the University of Heidelberg. In August 1948, the American Military Government in Germany denied a request by scientists in Göttingen to have Siemens & Halske (now Siemens) build a 30-MeV betatron. In short, Rabi's suggestion in Florence that West Germany be allowed to participate fully in a major European accelerator laboratory was part and parcel of a radical shift in US policy on Germany that had been maturing for several years and that was accelerated by the Marshall Plan.

US Secretary of State George Marshall announced his "plan" at Harvard University in June 1947.[10] It was intended to rebuild a Europe that was down and out economically, a Europe in which postwar poverty and despair were creating conditions conducive to social unrest and to Communist takeovers of democratic societies. Washington was convinced that the reintegration of West Germany into Europe and the Atlantic community was essential if Europe was to get back on its feet again and the sting taken out of the Communist threat. Retribution and repression had to give way to reconstruction and reinsertion. Germany's immense scientific, technological, industrial, and economic capacity had to be released to provide a bulwark in the heart of Europe against Communism, but in such a way as to contain the German nationalism and militarism that had led to two world wars.

The solution was to build an integrated Europe that included West Germany in supranational structures and institutions in which its sovereignty, like that of the other partners, was constrained and in which limits were placed on its freedom to rearm. When he suggested in Florence that Germany be part of the new regional physics laboratory, Rabi was both enabling the recovery of German physics and confining it in an intergovernmental structure in which it would be restricted to nonmilitary research. Not surprisingly, in the brief debate on his resolution, it was suggested (by the British delegation) that Marshall Plan funds be used to get the laboratory project off the ground. In fact, after the UNESCO meeting, Rabi stopped by the appropriate office in Paris to see if such funds could be released, but to no avail.

The French government and scientific community were among the first to take action after Rabi's initiative. That was partly because Rabi's regional scheme dovetailed

The Villa de Cointrin at the Geneva Airport (whose control tower is visible at right in the background) was CERN's original headquarters. (Courtesy of CERN.)

perfectly with the emerging policy of then French Foreign Minister Robert Schuman. Because the French government feared that the nation would once again be overrun by its powerful neighbor, France had been deeply hostile to US plans to revitalize Germany and to make it the core of an independent Europe. The compromise adopted by the French, with US support, was to allow for a German recovery in which the production of coal and steel, the sinews of a modern economy, were under supranational control. The Schuman Plan, announced on 9 May 1950—five years to the day after the end of World War II—achieved that objective. It was a crucial step toward European regional integration in two key economic sectors.[11] Rabi's initiative a month later resonated institutionally and politically with the Schuman Plan in a scientific sector, atomic physics, that had implications for energy production.

A noble purpose of science

When Rabi called for regional laboratories in Western Europe, he was quick to add that they would help produce "creative work on behalf of peace," thereby "saving western civilization" (see the box). Was that just empty rhetoric produced by temporary euphoria? Perhaps not. To his dying day, Rabi insisted that one of his prime objectives in taking the initiative was to promote European unity. Many years later at a ceremony in Geneva, he said that CERN was "an organization dedicated to a common effort in science on the part of countries which had been locked in mortal combat in the first half of this miserable century."[12] For Rabi and the US administration, especially the State Department, the new European laboratory was overwhelmingly important because it aligned with the aims of the Marshall Plan to reintegrate West Germany into Europe and to combat the Communist offensive. It also relaxed the controls imposed by the Allies on German physics, although not so far as to give German scientists access to a reactor. In his eyes, Rabi had helped science serve one of its noblest purposes as a tool of foreign policy: to encourage peace and harmony through international cooperation.

I thank Allan A. Needell, who kindly made recently declassified documents available to me.

References

1. A fine biography is J. S. Rigden, *Rabi: Scientist and Citizen*, Harvard U. Press, Cambridge, MA (2000).
2. See, for example, D. Pestre, in A. Hermann, J. Krige, D. Pestre, U. Mersits, eds., *History of CERN,* vol. 1, North-Holland, Amsterdam (1987) chaps. 2–6; J. Krige, D. Pestre, in P. Galison, B. Hevly, eds., *Big Science: The Growth of Large-Scale Research*, Stanford U. Press, Stanford, CA (1992), p. 78; L. Kowarski, *Bull. At. Sci.* **11**, 354 (1955).
3. J. Krige, *Phys. Perspect.* (in press).
4. R. P. Crease, *Making Physics: A Biography of Brookhaven National Laboratory, 1946–1972*, U. of Chicago Press, Chicago (1999), chaps. 5 and 7.
5. See A. A. Needell, *Science, Cold War and the American State: Lloyd V. Berkner and the Balance of Professional Ideals*, Harwood Academic, Amsterdam (2000), chap. 5.
6. E. Teller, *Bull. At. Sci.* **6**, 71 (1950).
7. Fiftieth anniversary issue entitled "Lawrence and his Laboratory: Nuclear Science at Berkeley," *LBL News Magazine*, Fall 1981, p. 63. This issue is available online at http://www.lbl.gov/Science-Articles/Research-Review/Magazine/1981.
8. See W. Lexow, *Studies in Intelligence*, Spring 1966, p. 21. For ordering information see http://www.cia.gov/csi/studies/declass.
9. J. Gimbel, *Science, Technology, and Reparations: Exploitation and Plunder in Postwar Germany*, Stanford U. Press, Stanford, CA (1990).
10. D. W. Ellwood, *Rebuilding Europe: Western Europe, America, and Postwar Reconstruction*, Longman, New York (1992).
11. W. I. Hitchcock, *France Restored: Cold War Diplomacy and the Quest for Leadership in Europe, 1944–1954*, U. of North Carolina Press, Chapel Hill (1998), p. 126.
12. I. I. Rabi, "The Cultural and Scientific Meaning of CERN," Library of Congress, Rabi Papers, Box 26, Folder 6. ■