Notes

1. Some thought that it might even become necessary to give up the conservation laws in their current form in connection with the problem of beta decay.
2. That is, the fact that the lifetime of an α-emitter changes by 25 powers of ten when the alpha-particle energy increases by a factor of two.
3. However, Heisenberg's interest extended far beyond this to the following question: What properties must the forces possess in order to give rise to the nuclear saturation phenomenon? In order to explain this phenomenon he introduced the concept of "exchange forces" which he formulated in terms of the "isospin" formalism first invented for this purpose. This created the conceptual apparatus which is still used in discussing the most direct studies of nucleon-nucleon interaction, namely, the scattering experiments. The quantitative results concerning exchange mixtures which would guarantee saturation are by now outdated. It is unfortunate that at that time one did not systematically pursue one other possible explanation of saturation: a property of the forces which is today usually called the hard core or "almost the hard core." Heisenberg also discussed this possibility in one of his papers.
4. In this letter, written long before Chadwick's discovery, the word "neutron" appears instead of "neutrino"; the latter was adopted by Pauli later, following a suggestion by Fermi.
5. However, the retardation effects could be significant: for instance, in precise calculations of "forbidden" beta and gamma transitions.
6. In particular, through the work of Brueckner and recent literature inspired by it.
7. V. M. Goldschmidt also came to the same conclusion; Suess and I had the privilege of discussing it with him in Oslo in 1942–43.
8. I learned only yesterday that the name was coined by Wigner.
9. It was just as well that I was not too well versed in "Bethe's bible"; and the old arguments against a strong spin-orbit coupling were not quite present in my memory.
10. The first group started from the shell-model point of view with a spherically symmetric potential, and handled the problem of correlations by calculating the configuration-mixing which is caused by the forces acting individually for each pair of nucleons. Thus it was shown that, even with only a few nucleons outside a closed shell, one obtains spectra very similar to the rotational spectra. In this way, although it is difficult to perform a quantitative calculation, one can understand how in nuclei with many nucleons outside closed shells (for example, the rare-earth region and the nuclei beyond radium) there are many close-lying and very different particle states contributing to configuration mixing, creating correlations of the type that can give rise to a strongly deformed nucleus. The Copenhagen group started by treating mainly the latter group of nuclei; they included correlations *ab initio* by assuming in their calculation a nonspherically symmetric, collective potential in which particle states are calculated. Then the coupling of the particle motion to the motion of the remaining deformed nucleus determines the spectra. (The ingenuity of the Copenhagen concept lies in the clever and successful treatment of the interplay of "collective" and "individual" features of nucleon motion; this provides the model with adequate flexibility to account for all the new empirical facts.) It was shown that this easily calculable "unified model" could as well explain the spectra of nuclei with only a few nucleons outside a closed shell. In this context one should also mention the new work of de-Shalit, in which the first excited states of nuclei with odd A are explained as a combination of "core excitations of the nucleus A-1" and the particle motion of the odd nucleon.

News and Comment

High-Energy Politics: Forces Now Jockeying for Position as Plans Proceed for Giant New Accelerator

In about 2 or 3 years, it now seems likely, construction will begin in this country on the most expensive basic research facility ever built—a nuclear accelerator of approximately 200 billion electron volts (bev) that is expected to cost somewhere around $300 million.

The machine, now under design at the Lawrence Radiation Laboratory, in Berkeley, California, would be wholly paid for by the federal government. It has not yet been formally approved by the executive or authorized by the Congress, but the preliminary planning is well advanced, and the ingredients for an affirmative decision are falling into place. When the accelerator, according to a widely accepted schedule, goes into full operation, around the mid-1970's, its annual running costs will be at least $50 million. Particles from the machine will possess at least six times more energy than those from any accelerator now in operation; and though there are serious discussions of eventually building even larger accelerators—the Brookhaven National Laboratory, on Long Island, is studying a 600- to 800-bev machine that might cost $1 billion—it is likely that, at least until the 1980's, the 200-bev accelerator will be the costliest, the biggest, and, as such things are often measured, the most prestigious piece of scientific equipment in the world. Need any more be added to explain why scientists and politicians, sometimes in curious combination, are now maneuvering over the unresolved issues of where the machine will be built and how it will be managed?

The maneuvers have generally occurred out of public view, but in the course of hearings, 2–5 March, before the Joint Committee on Atomic Energy (JCAE) a good deal of light was cast on the current deployment of forces; and subsequent inquiry turned up a bit more. On the basis of what is now visible, it appears that, although peacemaking forces are at work, a scientific-political storm of prodigious proportions may be in the making.

A review of the organizational cast of characters in the brewing storm must start with the Lawrence Radiation Laboratory, which the University of California operates under a contract with the Atomic Energy Commission (AEC), source of virtually all the government money in high-energy physics. Lawrence, which has been designing the 200-bev machine for the past 2 or 3 years, would understandably like to see its creation built in its own backyard, though with some reluctance it now seems willing to concede that the size, cost, and scientific potential of the new machine justify a broad-based management, rather than the management of a single university. However, among many non-Lawrence physicists, there is, justifiably or not, something of a store of ill will toward Lawrence's management of its present facilities, based on the contention that Lawrence has been laggard in admitting outside researchers to the use of what is supposed to be a national laboratory. (In the course of the JCAE hearings, Glenn Seaborg, chairman of the AEC, said that the Lawrence laboratory "is almost completely integrated in the Berkeley campus . . . and is therefore less of a national laboratory than the other laboratories . . . I don't mean by this that . . . visiting scientists aren't welcome. I just think that in any description of that particular laboratory, it is clear that it is a laboratory integrated in a single university.") Lawrence administrators contend that the laboratory is as wide open to outsiders as are the major high-energy

Soviet-American Exchange

At hearings earlier this month on high-energy physics, held before the Joint Committee on Atomic Energy, Norman F. Ramsey, professor of physics at Harvard, was testifying when Representative Melvin Price (D-Ill.) told of a 1959 congressional tour of the Soviet high-energy laboratory at Dubna, and asked Ramsey for comment. The exchange went as follows:

PRICE: . . . Senator [Albert] Gore [D–Tenn.] was sitting alongside the director of the Dubna Laboratory and during the course of the evening, the director asked Senator Gore, "How do you people get your money to build accelerators?" Senator Gore traced for him the legislative process, the request at the lowest level in the [Atomic Energy] Commission . . . then the Commission approval . . . then the budget approval, and then Congressional approval . . . The director looked at him and said, "Well, Senator, I understand it is different than that." The Senator said, "No, that is it." The director insisted, "I understand, in fact I have been told, that you get your money by saying that the Russians have a 10 bev accelerator and we need a larger one, and then you get your money." I broke into the conversation and asked the director, "How do you get your money?" And he replied quickly, "The same way" . . .

RAMSEY: . . . I think I would agree . . . with Senator Gore's response, rather than probably the director's, because we don't get it that way now.

—D.S.G.

facilities that are operated or managed by combines of universities, such as Brookhaven and, under a plan now being put into effect, the Argonne National Laboratory near Chicago. But whatever the case may be, Lawrence's desire for the new machine automatically arouses opposition among many influential high-energy physicists.

Last year, with the knowledge of the AEC, Lawrence appointed a national advisory committee under the chairmanship of W. F. Fry, of the University of Wisconsin, to provide counsel on problems related to the new machine. The committee, consisting of four physicists from the East, four from the West, and two from the Midwest, presented a report which recommended the establishment of a national corporation to manage the machine; the report also strongly hinted that the machine should be built in California. And it also stirred suspicions that Lawrence was, very early in the game, using the well-established ploy of an influential outside advisory committee to buttress its own position.

The next arrival in the organizational cast was the National Academy of Sciences, whose president, Frederick Seitz, has long displayed an aversion to scientific fights erupting into public view. Apparently feeling that the accelerator held the potential for a nasty fight, Seitz, following consultations with the AEC, quietly organized a committee of 25 university presidents with the intention that the group would eventually evolve into a national corporation that would offer itself to the AEC as manager of the new accelerator. Although Clark Kerr, president of the University of California, was a member of the committee, it appears that communication between the academy and California's Lawrence Laboratory was minimal or nonexistent, which was a source of deep anguish to the Lawrence group. For other reasons, the JCAE wasn't happy about it, either.

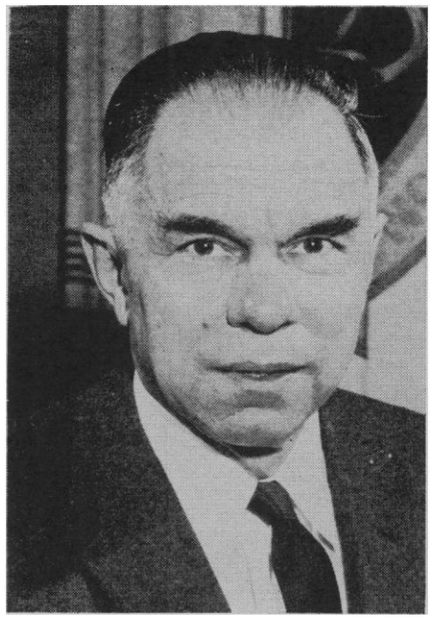
Just how the JCAE was tipped off to the existence of the academy-sponsored university committee isn't clear. But the JCAE, which, by statute, exercises a uniquely tight surveillance over its jurisdiction, appeared to suspect that the AEC might be attempting to use the academy to insulate itself from congressional control over the accelerator. And, at the outset of the hearings this month, it was brimming with often-hostile questions about Seitz's creation.

It demanded to know of AEC Chairman Seaborg just what role the university committee would play in the AEC's decisions on the accelerator. JCAE Chairman Chet Holifield (D–Calif.) asked, "Assuming that they [the university committee] make recommendations which are contrary to the judgment of the Atomic Energy Commission, what position will you find yourself in at that time? Will it not be embarrassing to you to reject a recommendation made by these prominent university presidents?" Seaborg, who appeared to be taken off guard by the sudden barrage of unanticipated questions, replied that the AEC would make its own decisions, but then he added, "I think that as a result of our participation with this group of university presidents it is very unlikely that they will make recommendations that are contrary."

Seaborg's defense of the university committee didn't seem to sit too well with Representative Craig Hosmer (R–Calif.), who, it is known, had discussed the committee a day or two before with at least one West Coast scientist. Without identifying his source, Hosmer stated, "as one physicist said, of this situation, it is one in which the division of the pork barrel is being taken care of by the pigs themselves. He was not referring to the congress, he was referring to the people in the fraternity." (Quotations are from the original, unedited stenographic transcripts of the hearings. Deletions and additions are often made in the printed versions.)

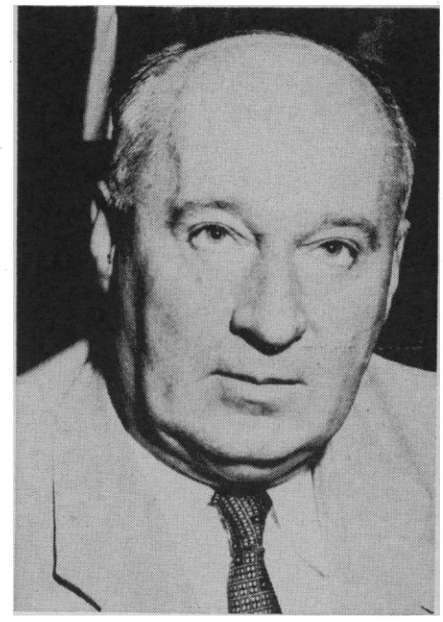
The JCAE then returned to the formal agenda of the hearings, which took testimony from 34 scientists and administrators on the scientific status of high-energy physics and its relation to other disciplines and scientific education. But the question of who gets the accelerator repeatedly entered into the proceedings. And the JCAE, which is by a wide margin the dominant voice in the affairs of the AEC, made it plain that it wasn't pleased by any of the current maneuvers. For example, when Edward J. Lofgren, a group leader from Lawrence, casually mentioned studies of a site at Camp Parks, an inactive Army base not far from the Berkeley campus, Hosmer broke in with, "Just a moment, doctor. You are not trying to sell us this site?" Lofgren replied, "No, I am using this as an example." Hosmer then went on to declare, "There have been two areas already that have tried to jump the gun here and start a big national fight about where this thing is going to go. . . . If those people continue, on my own responsibility I am going to do everything possible I can to block the possibility of their ever getting this machine. It is a promise as far as I am concerned that those people are going to be black-listed."

The "two areas" to which Hosmer referred are presumably the State of Washington, which is undertaking a



Glenn Seaborg

Craig Hosmer



Melvin Price

major science development program and would like to see the accelerator built at Hanford, where plutonium production is being cut back, and Colorado, which, a few days before the hearings, widely distributed a 53-page, colored-covered booklet titled "Advantages of the Boulder-Denver Area for the 200-300 bev Proton Accelerator." The booklet was produced jointly by the Colorado Division of Commerce and Development and the Proton Accelerator Committee of the University of Colorado, chaired by E. U. Condon, former director of the National Bureau of Standards. It reports favorably on everything in the Boulder-Denver area, from computers through dog racing.

It is extremely doubtful that Hosmer swings sufficient weight to block or bestow the accelerator, but his pique with the academy's university committee and the Washington and Colorado lobbying efforts reflect the JCAE's opposition to any diffusion of control over the AEC. The JCAE, in a fashion that is not remotely approached by other congressional committees, dominates its jurisdiction, principally through the statutory requirement that the AEC must keep it "fully and currently informed" on its activities. The JCAE has interpreted this to mean that the AEC may literally do nothing of significance without first informing the committee.

(In a humorous exchange that derived from the JCAE's grim insistence on its right to know, Chairman Holifield several years ago good-naturedly admonished NSF Director Leland J. Haworth, then an AEC commissioner, for failing to inform the committee of his impending wedding.)

Thus, it is easy to see why the JCAE looks with suspicion on Seitz's unannounced creation of a nationwide committee of university presidents to manage the costliest piece of scientific equipment ever built anywhere. In a curious way, both Seitz and the JCAE have the same objective—namely, to keep the peace on a project that contains the potential for a major political blowup. But the respective paths that they have chosen reflect the different approach that scientists and politicians often adopt in handling problems of science and government. The JCAE, which has done an excellent job of using the congressional hearing to illuminate problems of atomic energy and nuclear science and to educate the public in this area, reflects the politician's view—which is largely derived from the adversary concepts of the legal profession—that public debate and conflict help lead to the best solution. The Academy's assemblage of an influential committee to manage the accelerator reflects the scientists' view that the scientific community's business is best handled by knowledgeable people working behind closed doors, and away from public pressures and interference. It's a nice theory, but it isn't viable when $300 million of public funds are involved. And that helps explain why the JCAE looks with suspicion upon what Seitz obviously intended as no more than a disinterested effort to keep the peace and promote a thoughtful solution on a matter of major scientific importance.

The JCAE hearings were also noteworthy for their efforts to explain high-energy physics to the layman and to plumb the scientific community's sentiments on the advisability of continuing to invest large sums in this discipline. Representative Melvin Price (D–Ill.), who chaired the hearings, noted at the outset that the annual federal appropriations for high-energy research, construction, and equipment have risen from $87 million in 1961 to $173 million this year, and may go as high as $500 million in a decade. Price said that the committee clearly recognized the need for basic research, but he warned that "the burden . . . rests with the scientists in this field to communicate to the Congress and the public the objectives, the needs and the social benefits of high energy physics research."

To help communicate this knowledge, the committee heard testimony from 34 scientists and administrators, and it also sponsored a panel discussion on "The Relation of High Energy Physics to Other Sciences, Education, and Technology." The participants were Seitz, who chaired the discussion; Philip H. Abelson, editor of *Science* and director of the Carnegie Institution's Geophysical Laboratory; George Kistiakowsky, professor of chemistry, Harvard; William McElroy, professor of biology, Johns Hopkins; Wolfgang K.

H. Panofsky, director of the Stanford Linear Accelerator; Emanuel R. Piore, I.B.M. vice president for research and engineering; Charles Townes, provost, M.I.T.; Eugene Wigner, professor of physics, Princeton; and C. N. Yang, professor of theoretical physics, Princeton. With the exception of Wigner and Abelson, the panel agreed that high-energy physics represented a frontier of science that deserved generous support. Wigner explained, "I entertain no doubt that high energy phenomena are worth exploring. . . . If there is a question in my mind, it concerns the rate of exploration, that is, whether or not the proposed rate is so fast that it entails a less effective use of the expenditures and scientific manpower than could be attained in other areas." Abelson offered the view that in terms of its potential for socially useful developments, high-energy physics was receiving a highly disproportionate share of the support made available to science. It should be supported, he told the committee, primarily because of its importance to science and philosophical values, but he said he would place it behind materials sciences, unmanned space exploration, and molecular biology in priority for support.

An uninitiated visitor to the hearing room would easily have obtained the impression that the committee was weighing whether or not to continue with massive support for high-energy physics. That's because a congressional hearing, by the nature of its physical layout, resembles a judicial proceeding, with the participants roughly occupying the roles of judges and witnesses. In fact, however, a congressional hearing is more in the nature of a rehearsed dramatic presentation than a judicial proceeding. It was clear from the outset that the committee—long a friend and advocate of high-energy research—was not the least bit inclined to cut back in this field. When Piore asked the committee if it was going to permit high-energy physics to stagnate, he gave the answer himself by saying, "Fortunately, we are sufficiently affluent that we don't have to even ask that question." None of the JCAE members put it so bluntly, but in questioning Donald F. Hornig, the White House science adviser, they provided a glimpse of what was bothering them about the costs of high-energy physics. It wasn't so much that the field itself was becoming increasingly expensive, they indicated; rather, it was that, while the high-energy budget was growing, the executive branch had consistently held the AEC to an annual budget of around $2.5 billion. As a consequence, severe budgetary pressures were restricting nuclear development programs in space and power generation. Holifield said he thought it might be useful to break up the annual legislation into separate titles that would permit high-energy physics to expand without putting pressure on other AEC programs. Hornig agreed that high-energy physics should be "considered in the light of its own national needs," and, though he wasn't prepared to make a commitment, he seemed responsive to the committee's concern. Meanwhile, the issues of location and management of the new accelerator remain unresolved, and the maneuvering goes on. The JCAE, which will inevitably play a leading role in settling those issues, has decreed that it wants a final site decision for the fiscal 1967 budget, which means that a solution will have to be worked out within a year or so if work on the accelerator is to proceed.

—D. S. GREENBERG

Veterans' Medicine: Imbroglio over Closing of VA Facilities Is Partly Clash of Old and New

Of the current dispute between Congress and the administration over the planned closing of a number of Veterans Administration facilities, one might say what Chesterton is supposed to have remarked when he saw two housemaids screaming at each other from houses on opposite sides of the street: "They'll never agree, they're arguing from different premises."

On 13 January the VA announced plans to close 11 "marginal" hospitals, consolidate 17 regional offices with larger ones, and shut down four domiciliary homes. The agency release said, "The reorganization of these functions is in consonance with the President's appeal to Government departments and agencies to increase operating efficiency and reduce spending."

These are unexceptionable aims, but coming on top of closing orders for several military installations and on even shorter notice, the result was an upsurge of congressional choler.

The protests centered on the closing of hospitals and domiciliaries. The legislators lamented the effect the closing would have on VA employees and on the towns, most of them small, where the facilities were located, but most of all they deplored the effect on the well-being and convenience of the veterans.

Congress has been very kindly disposed to the VA over the years, and this amicable history seems to have made congressional critics all the more irritable today.

(The VA operates a $5.6-billion-a-year program, with nearly $4 billion going into veterans pensions and other types of compensation. The agency spends more than $1 billion a year on medical care and is the giant among federal agencies providing medical treatment and hospital care, maintaining 120,000 beds as compared to 40,000 in Defense Department hospitals. Since World War II the VA has assumed an important role in medical education, and in recent years it has developed a significant program in medical research.)

The seeds of the present dispute were sown soon after World War II when the VA adopted the standards of "big medicine" as the standard of treatment for its patients. This meant big hospitals in big cities, and the new policy guaranteed an eventual conflict with the older VA pattern of smaller hospitals widely distributed, which was established after World War I.

Before that war, veterans were cared for in federal and state old soldiers' homes, with such medical services as were available not achieving very high standards.

After World War I, federal activities in behalf of veterans were consolidated into one agency, then called the Veterans Bureau, and a system of federal veterans hospitals was established. This was done primarily by taking over military hospitals, many of them in remote places. The location of the VA hospitals was very often determined by pressure on the agency from influential legislators and veterans' organizations.

Toward the end of World War II it became clear that, with its depleted staff, inadequate plant, and outmoded policies, the VA medical system was unequal to the demands that the return of more than 15 million veterans would inevitably place on it.

The transformation of the old, veterans' "facilities"—they weren't even called hospitals—into a system of hospitals, a number of which compare favorably with the best teaching hospitals, was a remarkable accomplishment carried out in a remarkably brief time.