

Intense living and working in secret cities

Reminiscences of Los Alamos, 1943-1945

L. Badash, J. O. Hirschfelder, H. P. Broida,

eds.

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City Behind a Fence: Oak Ridge, Tennessee 1942-1946

C. W. Johnson, C. O. Jackson

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Reviewed by Jane S. Wilson

Witnesses proverbially are unreliable, seeing events through the prisms of their own predilections. If this is true immediately after the occurrence, how much more true when judgment is made 30 years later. *Reminiscences of Los Alamos, 1943-1945* is a lighthearted collection of wartime memories, dotted with inaccuracies. None of them detracts from the book's readability. Ten pairs of eyes—an army colonel (John Dudley), a laboratory director (Norris Bradbury), a division leader (George Kistiakowsky), assorted group leaders (John Manley, Edwin McMillan, Joseph Hirschfelder, Richard Feynman) and several housewives (Laura Fermi, Elsie McMillan, Bernice Brode) saw what they saw and, with nostalgia, recall not necessarily how things were, but, perhaps, how they would have liked them to have been. They made their report at a symposium in 1975 on the Santa Barbara campus of the University of California. With the addition of an introduction by Lawrence Badash, this book is a transcription of their talks. Editing was minimal. Sometimes, as when accounting for the selection of Los Alamos Ranch School as the site for a secret scientific city, there are no less than three entirely different accounts. It really does not matter. If one seeks the history of Los Alamos, one may look elsewhere. Personal memories offer more than the recital of facts: Los Alamos was an adventure, and some sense of its excitement shines in these lectures. "I was in Los Alamos only a year and a half or



At Los Alamos in 1944: E. Fermi, H. Bethe, H. Staub, V. Weisskopf, J. Ashkin (?); seated: E. Staub, E. Segrè, B. Rossi. Photograph by Emilio Segrè, courtesy AIP Niels Bohr Library.

even less" says Laura Fermi, "and still it seems such a big portion of my life... it was such intense living."

Living was indeed intense in a secret city inhabited by a group of inspired individuals under the impression that their labors might save civilization. Hindsight altered the exalted view that they had of themselves. The decompression began as soon as the bomb was perfected. John Manley, a "one-man liaison" between Washington and Los Alamos, says that he learned he could not even communicate the news of the successful strike on Hiroshima to Robert Oppenheimer owing to a War Department order. The military had obtained what they wanted from the scientists.

Even so, while it lasted, Los Alamos was the home of heroes—and very young heroes, at that. Richard Feynman refers to himself as "a little kid," but, at 26 years, he was around the average age for a Los Alamos physicist. His account, "Los Alamos from Below" sparkles—as Feynman usually sparkles—with his special individuality. For him and for many another

young person collaboration and friendship with older, established scientists like Fermi or Bethe was a delight. The land itself was enchanted; it had beautiful scenery and exotic inhabitants. Bernice Brode and Elsie McMillan speak fondly of their relations with the Indian women of the Santa Clara and San Ildefonso Pueblos. The work was challenging—Edwin McMillan and Kistiakowsky consider some of their unusual problems. Above all, there was a high sense of purpose.

Some of the civilian memoirs reflect the tension that existed between the army and the scientists of the Manhattan Project. Colonel John Dudley, who was responsible for the initial construction of the New Mexico site, is the only military representative in the book. He is reasonably kind to his old antagonists—time heals all wounds—but there may be just a hint of malice when he writes about having feigned ignorance about the project's purpose. "However, as soon as I started talking to scientists, say within a matter of a half hour or 45 minutes, I knew what they were doing quite thoroughly. I

tried to turn them off, but within two minutes they would again be leaking information." Other memories attest to enormous discretion on the part of the scientists. It is possible that Dudley didn't understand as "thoroughly" as he remembers three decades later.

City Behind a Fence deals almost exclusively with this conflict between civilian workers and the Army Corps of Engineers, not at Los Alamos but at Oak Ridge, Tennessee. With its gaseous diffusion and electromagnetic separation plants, Oak Ridge was built to make the material that destroyed Hiroshima. Like Los Alamos, Oak Ridge was built in haste. Like Los Alamos, it had a population that swelled far beyond expectation. Like those at Los Alamos, the scientists had real problems. The authors of *City Behind a Fence* do not concern themselves with the scientific situation. (Indeed, they probably would not have been able to: The first page of their introduction states, incorrectly, that "nuclear physicists had long understood the structure of the atom and had believed that atomic fission was theoretically possible.") Johnson and Jackson have written a purely sociological study. They have sifted through the records and document pretty thoroughly the dilemmas facing the military in building from scratch a new city, one that within three years would be the fifth largest in the state. There never was sufficient or adequate housing. There was an alarming turnover of workers. The hope was to create a normal town, but it was, instead, "a reservation." It was a community of "civilians subject to military rule."

Johnson and Jackson are more dispassionate than the survivors who remember Los Alamos. They were not there. Soon no one who was *there*, either at Los Alamos or at Oak Ridge, will be *here*. Even those army records will disappear by trashing or shredding or chance or worms. These books are valuable records of an endeavor which affected not only the lives of the people involved in it but everyone anywhere.

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Variational Methods in Electron-Atom Scattering Theory

R. K. Nesbet

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Atomic physics has been born again—and again and still again—since it was the frontier of physics some 50 years

ago. It was the testing ground of QED for a period starting in the 1940s. More recently, the advent of lasers provided an enormous boost, making possible entirely new classes of experiment. Very recently, atomic physicists have looked for the effects of weak currents. More to the point for present purposes is the vast increase in activity in the field that started about two decades ago and has continued unabated. That increase partly reflects developments of intrinsic interest and partly reflects the fact that atomic properties such as transition rates and cross sections, of great importance in astrophysics and in many other areas, can now be calculated with reasonable accuracy for the first time. That accuracy was made possible because high-speed computers could implement theoretical tools, such as variational principles in scattering theory, that had been developed. A leading practitioner in the field is the author, Robert K. Nesbet. He combines a strong mathematical background with computer know-how and a good knowledge of the experimental data which have been obtained and which are needed in other areas.

The material covered in the book is reasonably well described by the title, but is more precisely described in the opening paragraph: The emphasis is primarily on the scattering of electrons by neutral atoms at energies below the ionization threshold. (Some of the methods can be applied readily at higher energies and in electron-molecule scattering.) That restricted domain encompasses any number of extremely interesting processes, which would well repay study even if they did not have important applications. As a dramatic example, we note that in nonrelativistic theory there are an *infinite* number of (rather sharp) "Feshbach resonances" in electron-hydrogen scattering at energies just below the $n = 2$ (and the $n = 3, n = 4, \dots$) level of hydrogen. (The electron excites the hydrogen atom to its $n = 2$ level, forming any of an infinite number of bound states in the approximation in which the $n = 2$ to $n = 1$ transition cannot occur; the degeneracy of the $n = 2$ level gives rise to an effective potential that falls off as $1/r^2$.) Furthermore, these resonances can be calculated with high precision, the calculation being very much simplified by the fact that the projection operators that are required in the Feshbach formalism can be written down explicitly—something which cannot be done in any realistic problem in nuclear physics.

After providing some material on the quantum mechanical theory of electron-atom scattering, the author discusses a variety of variational approaches. The emphasis is very definitely on the use rather than on the

development of variational principles. (Principles that differ only trivially from the conceptual viewpoint can vary greatly in their effectiveness.) There is then a discussion of resonances and of threshold effects. Long-range interactions such as the r^{-4} polarization potential often play a decisive role in low-energy electron-atom scattering and generate a rich structure for both resonance and threshold phenomena. A is only natural for an IBM employee. Nesbet discusses computational techniques in some detail. There are two strong chapters on applications, on scattering by hydrogen atoms and by other atoms; these include a good number of figures comparing theory and experiment, with detailed discussions of who calculated what and by which method, and who measured what when. There are more than 300 references.

While I have no scathing comments, I have some criticisms.

The use of acronyms is completely out of hand. A table of acronyms would have been very useful to McLuhanian nonlinear readers who like to browse and who may not immediately know what VS, NV, EPOM, and so forth, represent.

While credits are not something anyone can discuss objectively, to this reader the references are not always the ones that would have come to mind. The author sometimes follows the not uncommon prescription of ascribing a result to the *last* person to derive it (ultimoottribution, one might call it, analog of ultimogeniture), or, in a new wrinkle, to the first person to use the result.

The implication in a remark on page 35 that a variational bound is possible only if the trial wave function for a given energy is orthogonal to all wave functions of lower energy is not correct: Variational bounds would then be essentially impossible to obtain.

Insufficient effort is made to discuss the origin of variational principles. Thus, given two approximations, T_1 and T_2 , to $T = \tan \eta$, the Schwinger variational principle is stated to be that T_1^2/T_2 is an extremum; it is then verified that this particular ratio is indeed stationary. It would take less effort and be far more educational to show in some generality how to obtain a variational principle.

The author's emphasis on his own work does not leave enough room for the work of others. For example, there is no mention of the exceedingly beautiful series of experiments on electron-hydrogen resonances by a group led by Howard Bryant, using the Los Alamos high-energy H^- beam analyzed by means of a tunable (Doppler shifted) laser beam.

The book was not intended as a