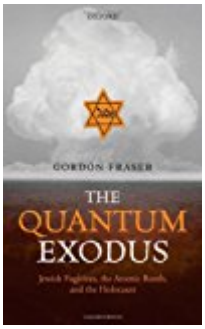
H-Net Reviews
in the Humanities & Social Sciences

Gordon Fraser. *The Quantum Exodus: Jewish Fugitives, the Atomic Bomb, and the Holocaust.* Oxford: Oxford University Press, 2012. viii + 267 pp. $45.00 (cloth), ISBN 978-0-19-959215-9.



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Published on H-War (August, 2013)
Commissioned by Margaret Sankey

Hitler's Brain Drain

Gordon Fraser's *The Quantum Exodus* is an interesting, as well as problematic, book to read. The cover is potentially offensive as it is comprised of a yellow Star of David on top of the Alamogordo mushroom cloud. The title of the work suggests the focus is on the Jewish physicists who fled the Nazi regime and later played a major role in the Manhattan Project, but the sprawling narrative is much broader, including tangents on academics of all kinds, doctors, writers, and intellectuals. The first appendix, for instance, offers a list of one hundred and eleven "emigrant scientists" (p. 241), yet starts with Hannah Arendt (a political scientist) and ends with Ludwig Wittgenstein (a philosopher). In eleven chapters, plus an epilogue, Fraser provides an overview of the Jewish brain drain from Germany, Nazi-occupied territories, and Italy as well. Unfortunately, the reader must not just read what Fraser wrote but also study and analyze the text in order to sort things out and to reconstruct chronology that was sloppily presented.

According to the author, Hitler's obsession with the Final Solution kept Nazi Germany from developing the atomic bomb. First, the Jewish brain drain deprived him of the talent that was needed. Two, resources that would have been needed for atomic research were used for carrying out the Holocaust. The material presented in *The Quantum Exodus* seems to prove the first argument, but some readers might not be convinced of the second point. The author perhaps overreaches by emphasizing his thesis of fatalism that "it was no accident that the Atomic Bomb and the Holocaust emerged simultaneously" (p. 1).

When Hitler came to power in 1933, Germany was ideally positioned with respect to atomic research. At the time Germany was where one worked or studied to learn about the interior of atoms. For example, the American-born J. Robert Oppenheimer, who would later become the director of the Manhattan Project, studied in Germany during the late 1920s, earning his doctorate in theoretical physics at Göttingen University. (In Göttingen Jews made up 1 percent of the town's population yet occupied nearly 20 percent of the academic posts, including 43 percent and 59 percent of the physics and mathematics departments, respectively.) The other important centers of research were the countries that the Nazis would eventually occupy. In other words, the Nazis gained control of an academic system poised for unlocking the secrets of the atom, poised for developing the atomic bomb. But hatred of Jews prevented Hitler from allowing this situation to follow its natural trajectory. Jews, who were not to be tolerated in this new fascist world, happened to be the leaders in the field of understanding the "arcane code" of atoms, "the quantum hieroglyphics" (p. 4).

Another factor was that anti-Semitism went hand in hand with anti-intellectualism. At one point Hitler declared that Germans were no longer to receive Nobel Prizes, a decree that Swedish officials flatly ignored. For conservative-minded Nazis, figures like Albert Einstein, with his physics that seemed esoteric and overly abstract, represented nonconformity. According to Fraser, the ignorant-minded believed Einstein and others could not possibly be explaining reality when "their underlying ideas were incomprehensible" (p. 76). Some decided that there were too many Jews in physics. Thus, an "Aryan physics campaign" (p. 77) rose up against "Judenphysik" (p. 75) and the "Relativity Jews" (p. 77). The science that was important to Nazis was rooted in "common sense" and they did not want Jewish science to be the basis for subsequent research. The purge of Jews in higher learning began almost immediately after the Nazi takeover, crippling atomic research on the Continent and unwittingly providing a scientific boon for the Third Reich's destined enemies, Great Britain and the United States.

Fraser points out that the Russian pogrom of the 1880s led to an influx of Jews to Germany and as many as two million to the United States, the farthest extreme of the diaspora. During the 1930s the Nazis reflected on the consequence of such Russian history and began their persecution for the purpose of uprooting the roughly half-million Jews in their midst. In other words, they wanted to coerce Jews toward self-deportation. In April 1933 the regime imposed a purification of the civil service, ridding its ranks by fits and starts of non-Aryans. In the first wave of persecution some 1,600 Jewish educators, scholars, and librarians were sidelined. Practically overnight, one-fourth of Germany's physicists left the country. Droves more would follow. One Nazi official explained that Jews were being targeted for being "not nationals" and for having "failed to protect the people from Marxist infection and from atheism" (p. 45). In fact, most Jews were not communists and many were fully assimilated Germans, some baptized into churches. By 1939, after "prejudice had escalated into outright persecution, and would soon become annihilation" (pp. 5-6), about thirty Jewish Nobel laureates had left the country.

For the Nazis, their war drive outpaced their plan for Jewish self-deportation. According to Fraser, "As German armies pushed eastwards across Poland and the Soviet Union, they overran the heartland of world Jewry. Populations numbered in millions were far too large for mass emigration" (p. 6). Consequently, the Nazis turned to genocide. Fraser argues that the logistics of the death camps made it impossible for Hitler to have enough administration left over for developing the atomic bomb. Near the end of his work, however, the author suggests "a stripped-down wartime German nuclear project might have been feasible, had it been prioritized" (p. 192). The argument is further weakened when the author explains that the Manhattan Project's estimated $1.9 billion cost was relatively "small," something "comparable with the wartime expenditures in the United States on conventional bombs, or on small arms, and a fraction of that spent on armoured vehicles or on aircraft" (p. 192).

The truth is the author is engaging in counterfactual history when he suggests that the Nazis failed to acquire the atomic bomb on account of being distracted by the death camps. The discovery of nuclear fission in December 1938 by the German chemists Otto Hahn and Fritz Strassmann, which was confirmed by others by the end of January 1939, did indeed coincide with the downward spiral of the Holocaust. But the firm ground is the story Fraser provides about the emigrant Jewish scientists who, after leaving fascist-controlled Europe, end up contributing to the Manhattan Project. Both Hahn and Strassmann, neither being Jewish, stayed in Germany during the duration of the war. But their fission breakthrough was only first comprehended and then explained by the physicists Lise Meitner (an Austrian Jew who had immigrated to Sweden) and her nephew Otto Robert Frisch (an Austrian Jew who had found research posts in Denmark and then Britain, and who would later move to America and work at Los Alamos). Any reader not familiar with the story of how Meitner and Frish deciphered the fission breakthrough will be confused by Fraser's convoluted account (found in chapter 8), but what is important is that Frisch and other Jewish scientists (Rudolf Peierls, Leo Szilard, John von Neumann, Victor Weisskopf, Edward Teller, Eugene Wigner, Georg Placzek, Niels Bohrs, Enrico Fermi, and so on) would be the ones that make it possible for the United States to develop the atomic bomb.

When Meitner and Frisch (predominately Meitner) figured out the implications of Hahn and Strassman's discovery, Einstein's e=mc2 equation is what made what happened decipherable. Einstein, who had sensed something politically wrong early on, left Germany in 1932, before the quantum exodus really took off. According to Fraser, Einstein's move to the United States the following year "can be seen as symbolically marking a watershed in international science supremacy: the centre of gravity of science moved away from Europe [to America]" (p. 67). Szilard, a Hungarian Jew, was Einstein's "scientific stalker" (p. 64) and used him like "a political chess

piece" (p. 72), persuading the famous scientist in August 1939 to write Franklin D. Roosevelt in order to alert the president about the potential of atomic weaponry. Other than twice writing FDR, Einstein played no role in the development of the atomic bomb. According to Fraser, he had "misgivings about quantum mechanics" and his subsequent lack of participation in the Manhattan Project relegated him to "a scientific anachronism" (p. 211).

After Hiroshima and Nagasaki, Einstein becomes a critic of the nuclear age, suggesting that world government (in terms of the United Nations) was necessary to offset this new danger. That led him to fall from grace in certain circles. One harsh critic declared, "One of the greatest fakers the world ever knew is Albert Einstein, who should have been deported for his communist activities years ago" (p. 212). A *Washington Post* editorial suggested that Einstein's opinions placed him in "the extremist category" (p. 213). The FBI tracked Einstein, compiling a file of over 2,000 pages. Other physicists who came to the United States from Europe also found themselves being monitored while government rules about secrecy hampered the freewheeling research approach members of this scientific community were accustomed to.

Einstein was not the only quantum exile who had misgivings about the Manhattan Project. The Jewish scientists who had fled the Nazis threw themselves into developing the atomic bomb out of a fear of what could happen if Hitler beat the United States and Great Britain in this quest. This was why Szilard had Einstein write FDR. No one could know that German progress in atomic research would largely flounder. There was also no way of knowing that the weapon that was being invented at Los Alamos would end up being used against Japan instead. Chapter 11 ("Science and Anxiety") tells the story of the "perturbed scientists" (p. 196), but also shows that Edward Teller, the Hungarian Jew, was very eager to press on ahead with the Cold War by developing the hydrogen bomb. Controversially, Klaus Fuchs, who passed on secrets of the Manhattan Project to the Soviet Union, saw himself as acting altruistically, as he said all sides should possess such knowledge.

Fraser should have ended his book sooner, but he wanted to include an epilogue that tells the story of the European Council for Nuclear Research, commonly referred to as CERN. Founded in 1954 by quantum exiles who had returned to Europe, CERN would over time become an important counterpart to American physics research. According to the author, the tide in subnuclear research turned in 1993 when President Bill Clinton cancelled, for budget reasons, the Superconducting Super Collider (SSC), which was to have been completed at a suburb of Dallas-Fort Worth, Texas. Arguably, this made Europe once again the center of nuclear research, with the important experiments being conducted at CERN's Large Hadron Collider (LHC) in Geneva.

Despite its unwieldiness and other flaws, *The Quantum Exodus* is a notable work. Anyone seeking a who's who of physicists who made the atomic bomb possible will enjoy the story Fraser provides. There are many fascinating anecdotes that this reviewer did not have time to recount or discuss. The narrative is fair in showing that numerous German scientists disapproved of the Nazis and looked out for their Jewish colleagues when they could do so without getting caught. Also, Fraser shows that England and the United States were not perfect sanctuaries, as anti-Semitism existed in those cultures as well. By and large, the physics community is shown to have been a true fellowship in which friendship and respect transcended nationality.

Citation: Roger Chapman. Review of Fraser, Gordon, *The Quantum Exodus: Jewish Fugitives, the Atomic Bomb, and the Holocaust.* H-War, H-Net Reviews. August, 2013.

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