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EDITORIAL

Los Alamos and "Los Arzamas"

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Abstract Marking the seventieth anniversary of the Los Alamos Laboratory provides an opportunity for comparison with its Soviet counterpart, Arzamas-16 (nicknamed "Los Arzamas"). There were similarities and differences, but in their principal motivations and treatments of their scientists, they diverged irrevocably. This Editorial is based on an invited presentation on June 12, 2013, at the Norris E. Bradbury Science Museum, Los Alamos National Laboratory, in Los Alamos, New Mexico.

Keywords Atomic bomb · Hydrogen bomb · Los Alamos · Arzamas-16 · J. Robert Oppenheimer · Yulii B. Khariton

This year, the Los Alamos Laboratory celebrates its seventieth anniversary. It came to life in 1943 as the concluding segment of the Manhattan Project to produce the atomic bombs for the US Army. In August 1945, these bombs were dropped over Hiroshima and Nagasaki. Apart from the devastation and human tragedies they caused, their immediate consequences included the surrender of Japan and the conclusion of World War II (Fig. 1). The Los Alamos Laboratory had importance well beyond World War II and the scientists working for the Soviet nuclear program at the secret Soviet installation, Arzamas-16, nicknamed their laboratory "Los Arzamas." This note focuses on some similarities and differences between Los Alamos and Arzamas-16.

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The two laboratories had a one-way direct connection through espionage due to which the first Soviet atomic bomb was a copy of the American plutonium bomb. Only the leadership of the Soviet project was aware of the source of information, the scientists were merely given the tasks of what solutions to work out. It proved to be a good exercise for them, but a frustrating experience since they could not bring in their own ideas. For the hydrogen bomb, with less intelligence, the Soviet physicists could utilize their innovative talents. Even later, the shadow of Los Alamos over Arzamas-16 did not disappear entirely. In 1983, the long time scientific director Yulii Khariton wondered loud in a critical moment whether they could guess what the Americans might do in a similar situation. His colleagues sometimes called Khariton the Soviet Oppenheimer [1].

J. [Julius] Robert Oppenheimer (1904–1967), the first scientific director of Los Alamos, filled the post for only two years yet his name has become synonymous with Los Alamos (Fig. 2a). Oppenheimer trained for physicist, but his early achievements included seminal discoveries in chemical physics; suffice it to mention the Born–Oppenheimer approximation worked out jointly with his Göttingen mentor, Max Born. Oppenheimer was an unlikely choice for the post of Los Alamos scientific director, but the military commander of the Manhattan Project, General Leslie Groves, had the right instinct in making it. Oppenheimer had the intellectual capacity to oversee a complex project; possessed the talent in theoretical physics to wield authority over his colleagues, and was eager to prove himself. His past involvement in leftist politics made him feel insecure, and Groves probably sensed that this made Oppenheimer pliable. The physicist came from an upper-middle-class nonreligious Jewish family. His youth was at the time when anti-Jewish discrimination was still

Fig. 1 "Whose son will die in the last minute? Minutes Count!" The poster refers to the deployment of the atomic bombs in anticipation of the expected huge sacrifices of the invasion of Japan in 1945. Photograph of the legendary Ed Westcott; courtesy of Oak Ridge National Laboratory

widespread in American academia. According to the renowned physicist Isidor I. Rabi, "Oppenheimer was Jewish, but he wished he weren't and tried to pretend that he wasn't" [2]. This must have contributed to Oppenheimer's feeling vulnerable. Oppenheimer performed impeccably against all odds and in spite of the harassments he suffered from the security services that did not trust him.

There was a conspicuous concentration of Jewish refugee scientists from Europe at Los Alamos. By the time the laboratory came to life, most other scientists had already been engaged in war-related projects. The refugees were latecomers in becoming US citizens to allow them participation in other classified projects. The atomic bomb project was a latecomer among war-related research projects. The refugees had been kicked out of their home countries, and in the US, they were welcome and were found needed. The physics of nuclear weapons was challenging, and the refugee scientists were dedicated to the fight against Germany. The anti-Nazi Jewish resistance expressed itself not only in the uprisings of the Warsaw Ghetto and the Vilna Ghetto, but in the Manhattan Project as well [3]. The Hungarian refugee Eugene P. Wigner, later, Nobel laureate, reasoned that if he could come to the US, surely, so could Hitler. The scientists in the US were not unique in recognizing the potentials of the new nuclear physics for defense. Their German, Japanese, and Soviet colleagues came to similar conclusions, but their circumstances were different.

The Soviet nuclear weapons project had its roots at the time right after the discovery of nuclear fission in December 1938 in Berlin. Just as in the US, a few scientists began a project before it could have been sanctioned and financed by the government. Yakov Zeldovich and Yulii Khariton were the principal protagonists and they worked at Nikolai Semenov's Institute of Chemical Physics in Leningrad. Khariton started his career in chemical physics and he and Semenov had co-discovered the branched chain reactions in chemistry in the early 1920s (for which Semenov would receive the Nobel Prize in Chemistry in 1956). In 1933, the Hungarian refugee Leo Szilard in London came to the idea of the analogous nuclear chain reaction; he patented it in 1934, and deposited his patent with the British Admiralty.

Even the small-scale Soviet attempts came to a halt between 1941 and 1943 when the scientists had to work on improving traditional weapons, among them the famous Katyushas. The German troops were still fighting on Soviet territory, however, when the nuclear program, by now as a state project, resumed. Soon after the war ended, the Soviet government established the secret nuclear installation, Arzamas-16, some two hundred and forty miles east of Moscow.

Many of the most prominent Soviet physicists happened to be Jewish and some joined Arzamas-16. The nuclear weapons project protected the physicists during the difficult period of 1948–1953 when Stalin's paranoia developed into active anti-science as well as anti-Semitic persecution. When Zeldovich got into trouble in Moscow, he found refuge at Arzamas. Another Jewish physicist, Ovsei Leipunskii, found shelter at the even more distant Semipalatinsk Proving Ground in Eastern Kazakhstan, to ride out a crisis. Under Stalin, as well as under subsequent Soviet leaders, if there was a project deemed exceptionally important, it was exempted to observe quotas or even complete ban on hiring Jewish scientists.

Fig. 2 **a** Upper part of the statue of J. Robert Oppenheimer in Los Alamos, New Mexico (photograph by I. Hargittai). **b** Yulii B. Khariton on Russian postage stamp, 2004

Yulii Khariton (1904–1996), the long-time director of Arzamas-16, himself was a conspicuous exception (Fig. 2b). His year of birth and his first name were not the only similarities with Oppenheimer (Yulii being the Russian equivalent of Julius). They both spent years in Western Europe for postgraduate studies. For both, this included Ernest Rutherford's Cavendish Laboratory in Cambridge, England. There, each had a future Nobel laureate for mentor; Patrick Blackett for Khariton and, a little later, James Chadwick for Oppenheimer. Khariton blended well into the Cavendish program and he earned his doctorate there whereas Oppenheimer did not, and left for Göttingen. Later as scientific director of Arzamas, Khariton tried to emulate what he experienced at the Cavendish—without success—but at least that was on his mind.

Like Oppenheimer, Khariton was Jewish, a life-threatening condition under Stalin and a definite disadvantage under the subsequent Soviet leaders. There was substantial difference between American anti-Semitism in academia—while it existed—and anti-Semitism in the Soviet Union. In the US, it was discrimination; in the Soviet Union it often developed into persecution. Khariton's situation was especially difficult. His mother lived in Palestine and his father had been kicked out of the Soviet Union and lived in a Baltic state. When in 1940, the Soviet Union annexed the Baltics, he was arrested and directed to the Gulag. Every time Khariton had to submit an autobiography, he painstakingly described his family background—known to the authorities in more detail than to him—lest he be accused of hiding it.

It was for Khariton's exceptional talent and abilities that in spite of his circumstances he was made, and retained for forty-six years, the scientific leader of the nuclear weapons installation. It was forty-six years of luxurious isolation, a "golden cage," with his private railway car for travel and other perks and the highest decorations.

There was a superficial similarity in the motivations of the American and Soviet programs. With few exceptions, the Soviet scientists were dedicated to their nuclear weapons program, at least initially. They were past a bloody war called with good reason the Great Patriotic War, in which their nation literally fought for survival. In the early 1950s, they were taught that a yet more dangerous foreign enemy might attempt their annihilation. This is why even the future fearless human rights fighter Andrei Sakharov could propose murderous schemes to destroy densely populated foreign ports with Soviet thermonuclear devices.

Gradually, however, the Soviet scientists came to the realization that placing nuclear weapons into the hands of a dictator could have led to unforeseeable tragedies. Clashes between Sakharov and the Soviet leader Nikita Khrushchev demonstrated the blatant recklessness of the Soviet leadership in connection with the nuclear arms race. When during the 1967 war between Israel and its neighbors, Zeldovich heard about the consideration of dropping a nuclear bomb over Israel, he deposited a suicide note in secure hands (he knew the authorities would destroy such a note if they found it) and decided to kill himself if the bombing happened. Fortunately, it did not. The nature of relationship of the scientists toward the Soviet nuclear program changed. Los Alamos and "Los Arzamas" diverged irrevocably.

Khariton, on his part, never expressed dissidence. However, when in 1990, amid the great political changes in the Soviet Union, the octogenarian Khariton greeted the first US visitors at Arzamas-16, he told them: "I was waiting for this day for forty years" [4].

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