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Bomb physicists Igor Kurchatov and Yuli Khariton after the 1953 thermonuclear test in Central Asia.

How the Bomb Saved Soviet Physics

By DAVID HOLLOWAY

Stalin didn't mind if people starved in the name of Marxist science; but he had to have the bomb.

At the end of World War II, Josef Stalin believed that postwar international relations would resemble those of the interwar period. Germany and Japan would rise from defeat. World capitalism would run into crisis, and sharp contradictions would emerge between the capitalist states. These contradictions would lead inevitably to a new world war.

Despite Stalin's grim long-range assessment, he saw no immediate danger. Atomic diplomacy by the United States seemed to him to be the greater threat. Atomic bombs were "meant to frighten those with weak nerves," he told Alexander Werth, the London *Sunday Times* correspondent in Moscow, in September 1946. If the Soviet Union were to compete in the tit-for-tat world of atomic diplomacy, it would have to have its own atomic bombs.

Although an atomic bomb program was launched during the war, its urgency and scope were greatly increased after Hiroshima. Lavrenti Beria, the most feared man in the Soviet Union after Stalin, would direct it. Massive secret facilities eventually would be built in many locations. But the heart of the program was to be Igor Kurchatov's Laboratory No. 2, located on the outskirts of Moscow, and its offspring, Arzamas-16.

Klaus Fuchs, the Soviet spy at Los Alamos, had provided a detailed description of the plutonium implosion bomb in June 1945. But nei-

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ther Kurchatov nor Yuli Khariton, Kurchatov's closest associate, could be sure that Fuchs's information was completely reliable. Khariton and his team were assigned the task of verifying everything.

Investigating the implosion method called for repeated experiments with high explosives, which could not be done at Laboratory No. 2 because of its proximity to the city. Kurchatov therefore decided to set up a branch of the laboratory in an isolated area, where work on the design and development of the bomb could take place in total secrecy. Khariton would be the scientific director of the new laboratory.

By the spring of 1946, a site near the settlement of Sarov, about 400 kilometers east of Moscow, was chosen. It was on the edge of a large forest preserve, which provided room for expansion; and it was a beautiful spot. The town—or rather the carefully guarded "zone," which included the town and the research and development establishments—became known as Arzamas-16, after the city of Arzamas, 60 kilometers to the north. But it was sometimes known as the the "Volga office"—as well as "Los Arzamas."

The physicist Lev Altshuler moved to Arzamas-16 in December 1946. There was a narrow-gauge railway line that ran from Arzamas to Sarov, but Altshuler made the last part of the journey by bus:

"We made this journey in a bus which had been thoughtfully provided with sheepskin coats. Past the windows flashed villages which recalled the settlements of pre-Petrine Russia.

"On our arrival at the place we caught sight of the monastery churches and farmsteads, the forest, the Finnish houses nestling in the woods, the small engineering plant, and the inevitable companions of that period—the 'zones' [prison camps] populated by representatives of all the regions of the country, all the nationalities. . . . The columns of prisoners passing through the settlement in the morning on their way to work and returning to the zones in the evening were a reality that hit you in the eyes. Lermontov's lines came to mind, about 'a land of slaves, a land of masters.'"

Arzamas-16 was, Altshuler notes, at the epicenter of the "white archipelago" of atomic institutes and plants scattered about the country.[1]

Unlike the inhabitants of the Gulag Archipelago, the scientists and engineers who lived in the "white archipelago" had privileged living conditions. They were protected as far as possible from the dreadful economic conditions of the war-torn country. Arzamas-16 was like paradise compared to half-starved Moscow, in Altshuler's view. Scientists and engineers "lived very well. Leading researchers were paid a very large salary for those times. Our families experienced no needs. And the supply of food and goods was quite different. So that all material questions were removed."[2] Lazar Kaganovich, a member of the Politburo, complained in 1953 that the atomic cities were like "health resorts."[3]

These conditions reflected Stalin's belief that Soviet scientists, if they were given the "proper help," would be able to overtake the achievements of foreign science. Privileged though they were, however, the nuclear scientists were surrounded by great secrecy and tight security. They could not talk to unauthorized people about their work, and nothing was published about the Soviet effort to build the atomic bomb.

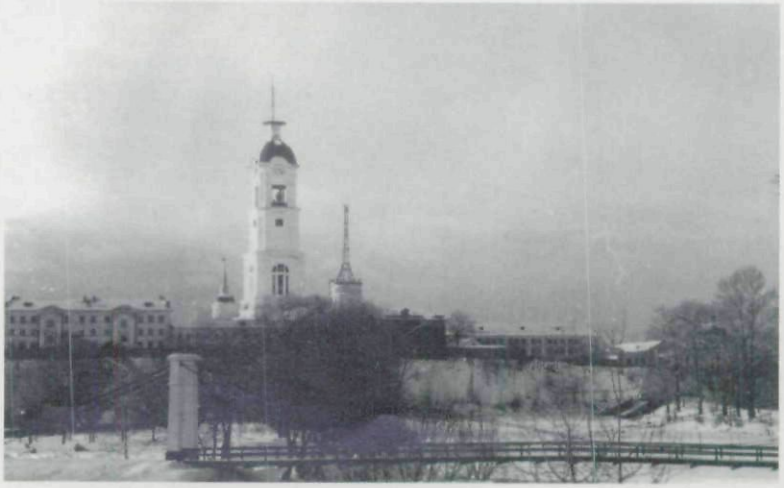
Scientists in the "white archipelago" worked in secrecy but lived relatively well.

"Beria's people were everywhere"

Within the project, secrecy was very strictly maintained. Reports were written by hand because typists were not trusted. If documents were typed—as, for example, the technical requirements for the first atomic bomb—the key words were written in by hand. Code words were used instead of scientific terms in secret reports and laboratory notes; neutrons, for example, were called "zero points." Information was strictly compartmentalized.

During Andrei Sakharov's first visit to Arzamas-16 in 1949, Iakov Zeldovich told him, "There are secrets everywhere, and the less you know that doesn't concern you, the better off you'll be. Khariton has taken on the burden of knowing it all."[4] The need for secrecy was so deeply instilled that some people had recurrent nightmares about breaching security regulations, and at least one suicide was attributed to anxiety about misfiled documents.[5]

Secrecy was reinforced by rigid security. Arzamas-16 was cut off from the outside world. A zone of about 250 square kilometers



Arzamas-16, also known as the "Volga office" and "Los Arzamas."

Stalin and Beria were suspicious of the scientists' attachment to "Western science."

In the 1920s and 1930s, Abraham Ioffe's Physicotechnical Institute became, according to Soviet physicists, the "maternal nest," the "cradle," the "forge," the "alma mater" of Soviet physics. Here Ioffe (far right) conducts a seminar. Attendees included, at extreme left, Peter Kapitsa, Iakov Frenkel, and Nikolai Semenov.

was surrounded by barbed wire and guards, and it was difficult in the early years to obtain permission to leave.[6] Khariton was accompanied wherever he went by a bodyguard. (Kurchatov and Zeldovich—and later, Sakharov—also had bodyguards.)

The security services had informers in the project, and encouraged denunciations. "Beria's people were everywhere," Khariton later remarked.[7] Once, when Khariton visited Chelyabinsk-40 to see how work on the plutonium production reactor was progressing, he attended a dinner to mark Igor Kurchatov's birthday. After the dinner—and a few drinks—Beria's representative said to Khariton: "Yuli Borisovich, if only you knew how much they write against you." Although he added, "But I don't believe them," the point had been made: there were plenty of accusations for Beria to use if he wanted to.[8]

As the date of the first atomic bomb test grew near, the political climate in the country became increasingly oppressive. In August 1948 Trofim Lysenko achieved his final victory over the geneticists, and in January 1949 a campaign was launched against "cosmopolitans"—a euphemism for Jews.

The number of denunciations increased. In Anatoli Aleksandrov's words, "A great number of 'inventors,' including scientists, were constantly trying to find mistakes, writing their 'observations' on this score, and their number increased, the closer we came to completing the task."[9] Such "observations" would not have been confined to technical matters. Mistaken technical choices were frequently explained in those days as the consequence of political error or disloyalty.

Kurchatov was open to the accusation that he had surrounded himself with colleagues who were Jewish, or who admired Western science too much, or had strong links with the West. Khariton was particularly vulnerable: he was Jewish, and he had spent two years in Cambridge where he had worked closely with James Chadwick, a key figure in the British nuclear project. Besides, both of his parents had left Soviet Russia. His father had been expelled by the Soviet authorities and had worked in Riga as a journalist until 1940, when the Red Army occupied Latvia. He was arrested by the NKVD and was sent to the camps or shot. Khariton's mother lived with her second husband in Germany in the 1920s; later she moved to Palestine.

Stalin and Beria wanted the atomic bomb as soon as possible, and they had to rely on Kurchatov and his colleagues to make it for them. They gave the scientists massive resources and privileged living conditions. Yet they harbored a nagging suspicion of the nuclear scientists. After all, if Soviet geneticists and plant breeders had tried to undermine Soviet agricultural policy as Lysenko said, might not the physicists sabotage nuclear policy?

Aleksandrov, who was the scientific director of the chemical separation plant at Chelyabinsk-40 in 1949, was coating the plutonium hemispheres with nickel when a group that included party official Mikhail G. Pervukhin,

several generals, and the plant director, arrived. "They asked what I was doing," writes Aleksandrov:

"I explained, and then they asked a strange question: 'Why do you think it is plutonium?' I said that I knew the whole technical process for obtaining it and was therefore sure that it was plutonium and could not be anything else. 'But why are you sure that some piece of iron hasn't been substituted for it?' I held up a piece to the alpha-counter, and it began to crackle at once. 'Look,' I said, 'it's alpha-active.' 'But perhaps it has just been rubbed with plutonium on the outside and that is why it crackles,' said someone. I grew angry, took that piece and held it out to them: 'Feel it, it's hot!' One of them said that it did not take long to heat a piece of iron. Then I responded that he could sit and look till morning and check whether the plutonium remained hot. But I would go to bed. This apparently convinced them, and they went away."[10]

Such episodes, according to Aleksandrov, were not unusual. Vasili Emelyanov recounts a similar incident. He once showed People's Commissar Avraami Zavenyagin a regulus of plutonium before the atomic test. "Are you sure that's plutonium?" Zavenyagin asked, looking at Emelyanov with fear. "Perhaps," he added anxiously, "it's something else, not plutonium."[11]

"An important patriotic duty"

The scientists were aware that failure would cost them dear, and they knew that Beria had selected understudies to take over the leading positions in case of failure.[12] Terror was a key element in Beria's style of management as well as a pervasive factor in the Stalinist regime. But the scientists were not motivated by fear. Those who took part in the project believed that the Soviet Union needed its own bomb in order to defend itself, and they welcomed the challenge of proving the worth of Soviet science by building a Soviet bomb as quickly as possible.

According to Altshuler, "Our consent [to work on the bomb] was determined, first, by the fact that we were promised much better conditions for research and second, by an inner feeling that our confrontation with a very powerful opponent had not ended with the defeat of Fascist Germany. The feeling of defenselessness increased particularly after Hiroshima and Nagasaki. For all who realized the realities of the new atomic era, the creation of our own atomic weapons, the restoration of equilibrium became a categorical imperative."[13]

Victor Adamsky, who worked in the theoretical department at Arzamas-16 in the late 1940s, has written that "all scientists held the conviction—and it now seems right for that time—that the state needed to possess atomic weapons, that one could not allow one country, especially the United States, to hold a monopoly on this weapon. To the consciousness of performing a most important patriotic duty was added the purely professional satisfaction and pride from work on a splendid task in physics—and not only in physics. Therefore we worked with enthusiasm, without taking account of time, selflessly."[14]

Kurchatov in 1924.

Andrei Sakharov, who began work on thermonuclear weapons in 1948 and moved to Arzamas-16 in 1950, has said that "we (and here I speak not only in my own behalf, for in such cases moral principles are formulated in a collective psychological way) believed that our work was absolutely necessary as a means of achieving a balance in the world."[15]

In spite of the presence of informers and the threat of repression, a spirit of cooperation and friendship existed at Arzamas-16. "It was necessary to secure the defense of the country," Khariton later said. "In the collective of scientists there was quiet and intense work. Close cohesion and friendship.... Although, of course, we had our sons of bitches."[16] V. A. Tsukerman and Z. M. Azarkh write that "in the first, most romantic years of our work in the institute a wonderful atmosphere of good will and support was created around the research. We worked selflessly, with great enthusiasm and the mobilization of all our spiritual and physical forces."[17]

"If you want peace, prepare for war"

It is striking how the apparatus of the police state fused with the physics community to build the bomb. In the 1930s the physics community had enjoyed an unusual measure of intellectual autonomy, which was sustained by a set of social relationships. That autonomy was not destroyed by the creation of the nuclear project. It continued to exist within the administrative system that was set up to manage the project.

Before the war the nuclear scientists had paid close attention to research being done abroad and had striven to show themselves as good as their foreign colleagues. The

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Lev Landau in 1958.

Individual scientists could refuse personally to work on the bomb, as Sakharov did until 1948, but open opposition to the project would have been fatal.

American atomic bomb presented a formidable challenge to Soviet scientists and engineers, who now sought to prove their worth in this new competition. The fact that the Americans had already used the bomb may have lessened the sense of responsibility that Soviet scientists felt in making this destructive weapon. They were responding to the American challenge, not initiating the atomic competition. They believed the Soviet Union needed its own atomic bomb in response.

Discussion of moral qualms would of course have been dangerous; open opposition to the project, fatal. Terror encouraged people to put such questions aside and immerse themselves in their work. But the scientists did not have to work on the bomb; they could refuse to join the project, and some did, including Sakharov before 1948.

In his memoirs, Nikolai Dollezhal, the chief designer of the first reactor, discusses his own thoughts in 1946 when Kurchatov first drew him into the project. Dollezhal had regarded the bombing of Hiroshima as a "repulsive act of cynical antihumanism."[18] If that was so, did the Soviet Union have the right to make and use the same weapon? His answer was yes, on two grounds:

First, making the weapon was not the same as using it against peaceful cities. The military and political leadership would choose the targets. And although Dollezhal knew something of the terrible purge of 1947, "Those affairs were internal—domestic, so to speak."[19] The Soviet Union as far as he knew, did not contravene the laws of war: unlike the Germans, they had not destroyed the noncombatant population; unlike the Allies, they had not carpet-bombed German cities.

Dollezhal's second argument was that possession of the bomb did not mean it would be used. All the main combatants in the war had had chemical weapons, but no one had employed them. That was because they feared retaliation. The Soviet Union needed all the means of attack possessed by the aggressor if it wanted to prevent such weapons from being used.

After the war, writes Dollezhal, cracks appeared in the foundation of the wartime alliance with the United States. Things that had not been spoken of in the critical moments of the war were now brought to light with merciless clarity: "The two systems were completely alien to each other ideologically—more than that, they were antagonistic, and the political trust generated by the wartime alliance was not long-lived or solid." The United States might declare the Soviet Union an enemy at any time in the future:

"The security of the country and patriotic duty demanded that we create the atomic bomb. And these were not mere words. This was objective reality. Who would forgive the leadership of the country if it began to create the weapons only after the enemy had decided to attack? The ancients had a point when they coined the phrase 'If you want peace, prepare for war.'"

From this reasoning Dollezhal drew the conclusion that work on the bomb was morally justified. In his memoirs he writes that in a conversation early in 1946 he found that this was Kurchatov's position too.

Whether or not Dollezhal's memory is accurate—he may be reflecting conclusions he reached later on—his account is consistent with what other scientists have written about their general attitude to the project. Moreover, on two specific points Dollezhal's view was shared by other scientists at the time. It is apparent that others—Lev Artsimovich and Vitali G. Khlopin for example—were appalled by Hiroshima and Nagasaki.[20] Although they knew of the terror and the slave labor camps, they were not aware of the full extent of Stalin and Beria's crimes. Altshuler later observed that "we knew nothing of those horrors of Stalinism which are today generally known. You can't jump out of your own time."[21]

The attitude of Soviet scientists was shaped, finally, by the war against Nazi Germany. The participants in the atomic project had either fought in the war or contributed to the war effort by designing or producing weapons. They had taken part in a bitter and destructive war to defend the Soviet Union and, whatever they may have thought of Stalin's regime or his policies, they believed that their cause was just.

The war was hardly over before the atomic bomb posed a potential new threat. They had taken up arms against the German invader, and now they worked to provide their country with its own atomic bomb. The atomic project was in some psychological sense a continuation of the war with Germany. In his memoirs Sakharov writes that he understood the terrible and inhuman nature of the weapons he was helping to build. But World War II had also been an inhuman affair. He had not been a soldier in that war, but "I regarded myself as a soldier in this new scientific war." Kurchatov, he notes, used to say they were soldiers, and he sometimes signed his letters and memoranda "Soldier Kurchatov."[22]

"Ideologically harmful" works

During the war Vladimir Vernadski and Peter Kapitsa called for collaboration with Western scientists. It seemed as though their wish might be granted when Vyacheslav Molotov,

The United States tested its plutonium bomb on July 16, 1945. On July 24, President Truman informed Stalin at the Potsdam Conference (shown here) that the United States "had a new weapon of unusual destructive force." He did not, however, say it was an atomic bomb. Although Stalin already knew of the bomb program through his spy network, he gave no indication that he knew what Truman meant.

during the Academy celebration in June 1945, promised the "most favorable conditions" for closer ties between Soviet and world science. The scientists' hopes were part of a broad desire among Soviet intellectuals for greater contact with the rest of the world.[23] They also reflected the widespread longing in the country for an easing of repression and a return to normal life. The war had restored the people's "pride and dignity," Sakharov wrote later. "We all believed—or at least hoped—that the postwar world would be decent and humane. How could it be otherwise?"[24]

Stalin, however, dealt a blow to hopes of a normal life in a speech of February 6, 1946, which signaled a return to prewar economic policies and pointed to a dangerous period of international relations ahead. Stalin soon made it clear that the relative intellectual tolerance of the war would be brought to an end. In August 1946 the Central Committee criticized the Leningrad journals *Zvezda* and *Leningrad* for publishing "ideologically harmful" works. The campaign for ideological orthodoxy gathered momentum and in the course of 1947 "discussions" were organized in philosophy, economics, and biology. Militant critics attacked more moderate scholars and officials for subservience to Western ideas and a lack of ideological vigilance.[25]

The ideological campaign is associated with the name of Andrei Zhdanov, the party secretary responsible for ideology, but it was Stalin who orchestrated it. The attack on Western ideas was part of Stalin's effort to tighten party control over the intelligentsia. In May 1947 Stalin told Konstantin Simonov and two other writers:

"If you take our middle intelligentsia, the scientific intelligentsia, professors, physicians, they have an insufficiently educated feeling of Soviet patriotism. They have an unjustified admiration for foreign culture. They all feel themselves to be still under age, not a hundred percent, they have got used to thinking of themselves as eternal students. This is an obsolete tradition, it comes from Peter. Peter had good ideas, but soon there were too many Germans, that was the period of admiration for Germans. . . . First the Germans, then the French, there was admiration for foreigners.... A simple peasant will not bow for nothing, take his cap off, but these people do not have enough dignity or patriotism, do not understand the role that Russia plays."[26]

Stalin showed the writers a soon-to-be published letter condemning two Soviet scientists for sending a manuscript on the treatment of cancer to an American publisher. The publication of this letter marked the beginning of a campaign against admiration for foreign culture.

The changing political climate had a profound effect on Soviet science. It offered Lysenko the opportunity to revive his fortunes. In the brief period of hope at the end of the war Lysenko's position had been weak—in 1946 one of his main opponents, the geneticist N. P. Dubinin, had been elected a corresponding member of the Soviet Academy of Science.

Party overseers: Top, Mikhail Pervukhin; middle, Vyacheslav Malyshev; bottom, Avraami Zavenyagin.

But Lysenko managed to link his crusade against genetics to the campaign for ideological purity. By clever political maneuvering, in which he portrayed his opponents as politically disloyal and in thrall to foreign ideas, he managed to win Stalin's support.[27]

In July 1948 Lysenko was summoned to a conversation with Stalin. He promised great improvements in agricultural output if he was allowed to defeat his scientific opponents and prevent their interference with his work. Stalin accepted Lysenko's argument. A special session of the Lenin All-Union Academy of Agricultural Sciences was hurriedly convened to review the situation in biology.[28]

Lysenko's report to the meeting, which had been read and edited by Stalin himself, asserted that the science of genetics was incompatible with Marxism-Leninism, and that genetics was a bourgeois fabrication designed to undermine the true materialist theory of biological development.[29] Several speakers rejected Lysenko's claims, but Lysenko effectively silenced them by declaring, at the end of the conference, that "the Party Central Committee had examined my report and approved it."[30]

In other words, to challenge Lysenko was to challenge the party leadership. The party—and more particularly Stalin—claimed ultimate authority in science, the right to say what constituted scientific truth. Thousands of geneticists and plant biologists were removed from their teaching and research positions. Sergei Kaftanov, who had advised Stalin to start an atomic project in 1942 and was now Minister of Higher Education, took an active role in this purge.[31]

Lysenko's victory gave heart to those who wanted to do for other disciplines what he had done for biology. In the next two years conferences were organized in physiology, astronomy, chemistry, and ethnography to root out foreign ideological influences: "cosmopolitanism" was attacked, and often ludicrous claims made for the priority of Russian and Soviet scientists and engineers in discovery and invention.[32]

"The struggle against kowtowing"

Physics too came under threat. Quantum mechanics and relativity theory had been attacked by philosophers in the 1930s. A new controversy broke out in 1947, following the publication of an article by Moisei A. Markov of the Physics Institute of the Academy of Sciences (FIAN) on epistemological problems in quantum mechanics.[33] Markov was attacked by the militant philosopher A. A. Maksimov for his stand on these issues, and especially for his espousal of Niels Bohr's concept of complementarity.[34] The editor of the journal in which Markov's article had appeared was removed from his post in 1948, and the Copenhagen school's interpretation of quantum mechanics was banished from the Soviet press for over a decade.[35]

Lysenko's triumph in August 1948 presented a far graver threat to physics than the ban on a particular interpretation of quantum mechanics. Within four months preparations were under way for an All-Union Conference of Physicists to discuss shortcomings in Soviet physics. The conference was to be organized by the Ministry of Higher Education, headed by Kaftanov, and by the Academy of Sciences, of which Sergei Vavilov was now president. On December 17 an organizing committee was set up with A. V. Topchiev, Deputy Minister of Higher Education, as chairman and Abram Ioffe as his deputy.[36]

In a letter to Deputy Premier Klimenti Voroshilov, Kaftanov outlined the shortcomings the conference was expected to remedy:

"Physics is taught in many educational establishments without any regard to dialectical materialism. . . . Instead of decisively unmasking trends which are inimical to Marxism-Leninism, some of our scientists frequently adopt idealist positions, which are making their way into higher educational establishments through physics. . . . The modern achievements of physics do not receive consistent exposition on the basis of dialectical materialism in Soviet physics textbooks. . . . The role of Russian and Soviet scientists in the development of physics is treated in a completely inadequate way in textbooks; the books abound in the names of foreign scientists."[37]

Six hundred physicists were to be invited to the Moscow "House of Scholars" for this conference—a kind of sequel to the 1936 conference on physics, which was now criticized for having paid too little attention to ideology.[38]

The organizing committee met 42 times between December 30, 1948 and March 16, 1949. The meetings were attended not only by members of the committee but also by invited guests. The discussions were often bitter.

Battle lines were not only drawn between physicists and philosophers: In the late 1940s the Soviet physics community was split into two groups—those from the Academy (FIAN) and those from Moscow University.[39] This split dated back to the mid-1930s when Vavilov began to build up FIAN as a powerful institute. As FIAN grew stronger, the situation at the university worsened. After B. M. Gessen, dean of the physics faculty, was arrested in 1936, the faculty was increasingly dominated by physicists who were willing to resort to appeals to political authority in their academic

and administrative disputes. A number of physicists, including Peter Kapitsa and Abram Ioffe, wrote to Molotov in 1944 to express their concern about the quality of teaching at the university and to ask him to appoint one of the leading physicists (Ivan Obreimov, Mikhail Leontovich, or Vladimir Fok) as dean. Molotov did not take their advice, and the situation grew worse after Leonid Mandelshtam died in 1944.[40]

One by one members of Mandelshtam's school—Grigorii S. Landsberg, Igor Tamm, S. E. Khaikin, and Leontovich—left the university, which was taken over by a varied group of mediocre physicists. The group included some serious physicists such as Dmitri Ivanenko and Aleksandr S. Predvoditelev, but also men like V. M. Kessenikh and V. F. Nozdrev, who made up for their lack of ability in physics with ideological vigilance.[41]

What united the university physicists was the belief that their work had not received the recognition they thought it deserved. They were also annoyed that, in spite of strenuous efforts, they had not been drawn into the atomic project. Some of them were willing to resort to political charges to settle scores with the Academy physicists. The campaign against cosmopolitanism provided political cover for their accusations.[42]

The organizing committee discussed the ten papers that were to be presented at the conference. Vavilov was to deliver a paper "On Contemporary Physics and the Tasks of Soviet Physicists," and Ioffe "On Measures to Improve the Teaching of Physics in Technical Schools"; others were to speak on textbooks and ways to improve physics education. But the discussion in the committee ranged far beyond these apparently innocuous topics. The university physicists and their philosopher allies went on the attack, accusing the Academy physicists of spreading cosmopolitanism and idealism, of not citing Russian scientists, of avoiding honest arguments, of refusing to develop fundamental physics, and of spying for Germany.

This last charge was leveled against Mandelshtam, who had died five years earlier. But living physicists were also criticized. Ioffe, Tamm, and Markov, all of whom took part in the committee meetings, were severely criticized. Iakov Frenkel was a particular target, and his 1931 position on the irrelevance of dialectical materialism to physics was brought up against him. The absent Kapitsa was also attacked.[43]

Vavilov was in a difficult position. As a physicist he understood the absurdity of the charges made by the university physicists and their allies. As president of the Academy, however, he had to take part in a campaign that had been approved by the political authorities. He tried to balance these competing responsibilities but failed to satisfy the university physicists.

The Academy physicists rejected the criticisms of quantum mechanics and relativity theory. They also rejected the criticisms of their attitude toward Western science. If they did not cite the works of the university physicists more often, said Tamm, it was because they did not think they were very good. Landsberg accused Ivanenko of making citation of his work and that of his students the touchstone of a Soviet physicist's patriotism. The Academy physicists were willing to make token criticisms of the idealist philosophical views of some Western physicists. Under intense criticism Frenkel admitted that he had explained the ideas of the creators of quantum mechanics without criticizing them. On the key issues, however, the Academy physicists stood their ground.

In spite of their resistance, it is clear from the draft resolution the conference was expected to adopt that the university physicists had official support. "For Soviet physics," the resolution said, "the struggle against kowtowing and groveling before the West, and the education of a feeling of national pride, of faith in the inexhaustible powers of the Soviet people, have special significance. It is necessary to root out mercilessly every hint of cosmopolitanism, which is Anglo-American imperialism's ideological weapon of diversion."

The draft resolution also criticized specific physicists. Lev Landau and Abram Ioffe were accused of "groveling before the West"; Peter Kapitsa of propagating "open cosmopolitanism"; Iakov Frenkel and Moisei Markov of "uncritically receiving Western physical theories and propagandizing them in our country." Textbooks by S. E. Khaikin, Landau and Evgenii Lifshits, Eduard Shpolski and Frenkel were condemned for popularizing foreign ideological concepts and for not citing Russian authors frequently enough.[44]

"We can always shoot them later"

It is hard to say what effect the conference might have had on Soviet physics. The draft resolution did not condemn quantum mechanics and relativity theory as such, so the conference might not have been as devastating to physics as the August 1948 meeting was to biology. But it would have strengthened the position of the Moscow university physicists who, as a group, were narrow-minded, chauvinistic, and less able than the Academy physicists. Physics would have been drawn further into the realm of ideology, and disagreements

An all-Soviet conference on physics was planned to deal with ideological problems; Frenkel, for instance, had once declared dialectical materialism irrelevant to physics.

In the end, though, Stalin chose the bomb over ideological purity.

and disputes would have been conducted more frequently in the language of Stalinist politics. The role of the philosophers as ideological policemen would have been strengthened. All this would have created a dangerous situation for Soviet physics.

The conference failed to take place, however, and its possible effects must remain a matter of speculation. The last meeting of the organizing committee took place on March 16, 1949, and the conference was due to start on March 21. It was canceled between those two dates. Only Stalin could have taken this decision, and it appears that he canceled the conference because it might retard the atomic project.

According to Gen. V.A. Makhnev, head of the secretariat of the Special Committee on the Atomic Bomb, Beria asked Kurchatov whether it was true that quantum mechanics and relativity theory were idealist, in the sense of antimaterialist. Kurchatov replied that if relativity theory and quantum mechanics were rejected, the bomb would have to be rejected too. Beria was worried by this reply, and may have asked Stalin to call off the conference.[45]

A more circumstantial account, which does not contradict Makhnev's story, was given by Artsimovich, on the basis of a conversation with Beria after Stalin's death. According to Artsimovich, three leading physicists—Kurchatov may have been among them—approached Beria in mid-March 1949 and asked him to call off the conference on the grounds that it would harm Soviet physics and interfere with the atomic project. Beria replied that he could not make a decision on this himself, but that he would speak to Stalin. Stalin agreed to cancel the conference, saying of the physicists, according to Beria, "Leave them in peace. We can always shoot them later."[46]

It was the atomic bomb that saved Soviet physics in 1949. Stalin was not so concerned about the condition of agriculture—he tolerated, after all, a desperate famine in the Ukraine in 1947—and so it may not have mattered very much to him whether Lysenko was a charlatan or not. The nuclear project was more important, however, than the lives of Soviet citizens, so it was crucial to be sure that the scientists in the nuclear project were not frauds.

For Beria, who was answerable to Stalin for the success of the project, it was important that the scientists should be politically reliable. But it was even more important that they should not be charlatans. Beria wanted the project to succeed and, in spite of the atmosphere of menace he created, he did not arrest any of the senior people in the project. For the same reason it was in his interest to resist those who wanted to do for physics what Lysenko had done for genetics.

The same logic can be seen in an episode that took place in 1951. A commission came to examine the level of political education at Arzamas-16. When Altshuler told the commission that he did not think Lysenko was right in his attack on classical genetics, the commission recommended that Altshuler be dismissed. Sakharov and Zeldovich protested to Zavenyagin, who was visiting the installation, and Altshuler was allowed to remain. A year later the issue came up again. This time Khariton telephoned Beria, who asked, "Do you need him very much?" Khariton replied that he did, and that was the end of the matter.[47]

The cancellation of the March 1949 conference and the successful atomic test five months later were serious setbacks for the university physicists and the philosophers. But their criticism of cosmopolitanism and idealism did not stop, and physicists had to parry their attacks. Kurchatov was forthright in his views. Zeldovich recalled that he was sitting in Kurchatov's office in the early 1950s when a telephone call came from an editorial board in Moscow asking whether they should publish an article attacking the theory of relativity. "Well, if that article is right," replied Kurchatov, "we can close down our business."[48]

In 1952 some of the papers prepared for the aborted March 1949 conference were published. The editors, headed by Maksimov, complained that Soviet physicists lagged behind specialists in such fields as agrobiology and physiology—both of which had been thoroughly purged—in fighting against the survivals of capitalism in their own consciousness.[49]

The first example of nuclear deterrence

A disjunction now existed in Soviet policy. Stalin had given support to Lysenko's argument that there was a fundamental difference between socialist science and capitalist science; at the same time Soviet physicists were building the plutonium bomb on the basis of the American design. Stalin had launched a campaign against kowtowing to the West, and against the denigration of Russian and Soviet science and technology; but it was the party leadership that took Western technology as the model and distrusted Soviet scientists and engineers.

The Soviet Union was copying foreign technology in several areas (the atomic bomb, the V-2 missile, the B-29 bomber), but trying to hide the fact from its own people by trumpeting Soviet achievements.

The campaign against foreign influence helped to create a political situation in which

genetics was destroyed and physics put at risk. The Stalinist regime gave great importance to technology, and especially to military technology, but, unlike a technocracy, the regime did not accept the authority or autonomy of technical expertise. The regime's fundamental logic was political: it claimed the right to say what constituted scientific truth and destroyed whole disciplines in the name of ideological orthodoxy.

In the end, Stalin did not destroy physics because physics was needed to enhance the power of the state. Landau has said that the survival of Soviet physics was the first example of successful nuclear deterrence. What the bomb saved was a small island of intellectual autonomy in a society where the state claimed control of intellectual life.

Besides, the physics community saw itself in some significant sense as part of a larger international community, and it was perhaps more closely linked with the West, in cultural terms, than any other part of Soviet society. Thus the atomic bomb, the most potent symbol of the hostility between the Soviet Union and the West, saved a community that constituted an important cultural and intellectual link between the West and the Soviet Union. ■

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