ALEKSEI KOZHEVNIKOV*

Piotr Kapitza and Stalin's government: A study in moral choice

ALTHOUGH THE LIFE of Piotr Leonidovich Kapitza was unique, we find in it some very characteristic features of the relationship between science and state in the Soviet Union. Kapitza gained recognition not only for his scientific achievements, which won him the Nobel prize in 1978, but for his public activities as well. These activities, however, have received very different interpretations. In the 1970s, official Soviet historians and the media portrayed Kapitza as a true Soviet scientist, honored by the government because his work had served the nation.[1] Yet, at the same time, the anniversary article of *Physics today* carried the title "Pyotr Kapitza, octogenarian dissident."[2] Today, Soviet publicists often characterize Kapitza as a non-conformist opposed to Stalinism, a man who battled with the ruthless chief of secret police, L.P. Beria, and was persecuted for his defiance.[3] Though these portraits of Kapitza diverge from the complicated reality, each one has some factual basis. Kapitza was a very influential and elite academician—he won the Orders of Lenin five times, the Title of Hero of Socialist Labor twice, and the Stalin Prize twice. During the purges, he bravely defended persecuted scientists and saved several lives, including L.D. Landau's. And, in 1946, he was dismissed from all his official positions and disappeared from public view for several years.

*Institute for History of Science and Technology. Staropansky per. 1/5, Moscow 103012. This is a revision of a paper published originally in Russian in *Nauka i vlast* in 1990. I am grateful to Pavel Rubinin, J.L. Heilbron, and John Park for comments and support.

The following abbreviations are used: AAN, Archives of the Academy of Sciences of the Union of Soviet Socialist Republics, Moscow; AHQP, Archive for History of Quantum Physics; BA, Niels Bohr Archives, Copenhagen; KA, Kapitza's personal collection, Institute of Physical Problems, Moscow; *PN*, P.L. Kapitza, *Pis'ma o Nauke, 1930–1980* (Moscow, 1989).

1. F. Kedrov, *Kapitza: Life and discoveries* (Moscow, 1979).
2. G.M. Spruch, "Pyotr Kapitza, octogenarian dissident," *Physics today* (Sep 1979), 34–45.
3. P.E. Rubinin in *Ogonyek, 25* (1989), 18–22, and in *Priroda, 3* (1989), 98.

His Western colleagues thought him responsible for the construction of a Soviet atomic bomb, but others reported later that he was disgraced after his refusal to take part in the bomb project.[4]

Many important archival collections related to military research, politics, and the atomic bomb project are still classified, but the large manuscript collections of Kapitza's writings are now available at the Institute of Physical Problems in Moscow. Some of the documents, along with important pieces of correspondence, have been published recently by Kapitza's former assistant, Pavel Rubinin, who has charge of the archive.[5] With these sources, we can review some of the major decisions Kapitza made during his life, and we can also dispel some of the folklore surrounding him.

Expatriot

Piotr Leonidovich Kapitza was born in 1894 in Kronstadt, an island off the coast of St. Petersburg. He graduated from the Petrograd Polytechnical Institute early in 1919. He was one of the first to study under A.F. Ioffe, the famous professor of physics who would father the largest physical school and many research institutes throughout the Soviet Union. Kapitza began work on physics through Ioffe's seminars; the student proceeded quickly to conduct his own research under Ioffe's direction; Kapitza published his first scientific paper in 1916, three years before his graduation.

World War I and the Russian Civil War between 1918 and 1920 interrupted scientific contacts between Russia and the rest of Europe. After working in almost complete isolation for several years, a number of highly-ranked Soviet scientists travelled to Europe in 1921 in order to restore scientific contacts, and to purchase literature and equipment. Kapitza accompanied Ioffe to England and remained to work with Ernest Rutherford at the Cavendish Laboratory. Rutherford strongly supported his new pupil: after receiving his PhD in 1924, Kapitza was appointed Assistant Director of magnetic research at the Cavendish. He not only became a fellow of Trinity College, but at a time when the Royal Society was relatively closed to foreigners,

4. For the two most divergent accounts of Kapitza's life, see A.M. Biew, *Kapitza: Der Atom-Zar* (Munich, 1954), and Jeanne Vronskaya, *Biographical dictionary of the Soviet Union, 1917–1988* (London, 1989), s.v. "Kapitza." One very unreliable report concerning Kapitza is in the B.I. Nicolaevsky collection, Hoover Institute, Archives, 412/9.

5. *PN*; see also Kapitza, "Pis'ma k materi (1921–1926)," *Novyi Mir* (1986), *5*, 192–216, *6*, 194–218; "Trebuetsya smelost, razmakh i derzanie. Pyat pisem academika P.L. Kapitzy N.S. Khruschevu," *Znamya, 5* (1989), 200–208, "Za nenabnost'yu vernut grazhdaninu Kapitze," *Sovetskaya Kul'tura* (21 May 1988), and *Pis'ma o nauke i vlasti* (Moscow, 1990).

Kapitza was elected a member in 1929.[6] In the following year, Rutherford managed to acquire special funding for the construction of a new laboratory where Kapitza would serve as director.

According to Rutherford, Kapitza, "if not a genius, had the brain of a physicist and the ability of a mechanician, a combination so rarely wedded in one brain, that it made him something of a phenomenon."[7] His major accomplishments during the Cambridge period came with the construction and operation of new powerful experimental devices. Most notably, Kapitza earned credit for the invention of a pulse generator for super strong magnetic fields. Near the end of the 1920s, he also started to work in low temperature physics and improved the existing helium liquefier. The new Mond Laboratory in Cambridge was specifically designed to install and operate these large devices. The laboratory opened in 1933. A year later, Kapitza was preparing a wide range of experiments using the liquid helium he had begun to obtain in April 1934. But Kapitza did not perform these experiments in Cambridge. In August 1934, he returned for a visit to the Soviet Union, and Soviet officials did not allow him to make the voyage back to England.

Russia had no political stability when Kapitza left in 1921. The Civil War had completely destroyed the economy. Peasant uprisings and the Kronstaldt revolt forced the communists to initiate new economic policies during the summer of 1921 that allowed for some private ownership of capital. But at the same time, between 1920 and 1922, the communists campaigned to seize control of the universities that resulted in the dismissal, arrest, and exile of a number of professors. Being of noble lineage, Kapitza may have found his position in Petrograd dangerous. In addition, Kapitza had lost his wife and child in the influenza epidemic of 1920. And furthermore, the conditions and supplies for scientific work in Russia were totally inadequate. We do not know how these factors contributed to Kapitza's decision to remain in Britain. In his letters to his mother from England, he generally discussed his scientific work. But in those same letters, he promised to return to Russia after becoming "a mature man capable of doing true science, not a [sort of] margarine."[8] By "margarine," then

6. D. Schoenberg, "Piotr Leonidovich Kapitza, 9 July 1894–1898," Royal Society of London, *Biographical memoirs, 31* (1985), 325–374.

7. From David Joravsky, "Return of the native," in *New York Times Review of Books* (1985), 35; see also D.J. Lockwood, ed., *P.L. Kapitsa: Letters to mother* (Ottawa, 1989).

8. Kapitza, "Pis'ma k materi" (ref. 5), 204, 206; the quotation is from ibid., "Pis'ma k materi," *Puti v neznaemoe* (1986), 455.

regarded as a low-quality substitute for butter, Kapitza referred to the mediocre research conducted in the Soviet Union.

Unlike the Soviet intellectuals of the 1970s, who adamantly refused to return to their country and lost their Soviet citizenship, Kapitza did not emigrate for political reasons. At least formally, the Russian government authorized his work at the Cavendish. In 1921, he received official permission from the Narkompros to stay in England, a decision that Soviet authorities never questioned later.[9] From the late 1920s, Soviet officials who headed the NTO VSNKh offered him tempting conditions to return to work in his native land.[10] Kapitza agreed to do so at some undetermined time. Meanwhile, in 1929, he accepted an appointment as the official consultant for the newly organized Ukranian Physico-Technical Institute (UFTI) in Kharkov, the first low-temperature laboratory established in the Soviet Union.

While continuing to serve as consultant from his laboratory in Cambridge, Kapitza offered to teach younger Soviet physicists who came to visit England. Taking advantage of new scientific contacts between the Soviet Union and the rest of Europe, a number of these students travelled to Cambridge under Kapitza's sponsorship. Among them were Yu.B. Khariton, who would later head the Soviet version of the Los Alamos Laboratory; Landau, who would be awarded the Nobel prize for developing the quantum theory of superfluidity; A.I. Leipunski, who would direct the UFTI in the mid-1930s, and later, in the 1950s, work on the construction of Soviet nuclear power plants; and K.D. Sinelikov, who would eventually succeed Leipunski as UFTI director from the 1940s through the 1960s, working on nuclear physics and the Soviet atomic bomb. Kapitza retained his Soviet citizenship during the thirteen years of his work in England. He first vacationed in the Soviet Union during the summer of 1926, and then returned home almost every year until 1934.

In his last trip in August 1934, Kapitza visited his mother in Leningrad and his colleagues in Kharkov. As he prepared to return to Cambridge at the end of September, authorities informed him that he would not be leaving. Kapitza remained in Leningrad while his second wife, Anna Alekseevna Kapitza went back to their children in Cam-

9. "Narkompros" is short for Narodnyi Komissariat Prosvescheniya, or People's Commissariat of Enlightenment.

10. "NTO VSNKh" is short for Nauchno-Tekhnicheskii Otdel Vysshego Soveta Narodnogo Khozyaistva, or the Scientific-technical Department of the Supreme Soviet National Economy. Previous heads of the NTO dismissed by Stalin include L. Trotsky (1925), L. Kamenev (1929), and N. Bukharin (1930–1932). Kamenev and Bukharin contacted Kapitza directly during his tenure in England.

bridge. She spent a year appealing for her husband's release, and when her attempts failed, she returned with her children to the Soviet Union. During their separation they corresponded frequently; Kapitza alone wrote more than a hundred letters recording at length the various events in his life. From this correspondence, we can reconstruct his initial experiences in the USSR.[11]

1. PRISONER

Kapitza felt himself surrounded by hostility and suspicion. State officials approached him as a stranger and potential enemy: for several months, NVKD agents followed him without hiding their surveillance.[12] The entire society was preparing itself psychologically for another major war; the fear of foreigners and spies permeated the nation, and great purges loomed on the horizon. In one of his first letters to his wife, Kapitza expressed regret over the assassination of S.M. Kirov.[13] In addition to the hostile political environment, Kapitza discovered that he did not have the sympathy of his closest colleagues, A.F. Ioffe and N.N. Semenov among others. They were probably afraid to befriend someone under direct public scrutiny. Kapitza wrote that even in private conversations, his colleagues openly approved of his detention.[14]

Greatly disappointed, Kapitza turned to older scientists, including I.P. Pavlov, A.N. Krylov, and A.N. Bakh, each with his own peculiar political orientation. They eased his loneliness, but unfortunately they could not help him fulfill his deeper intellectual desires. Kapitza suffered most from the inability to work on scientific research: "I can't read papers about my work because I might become half-mad....I could once understand how someone could go completely mad, but I never thought I would ever be brought to such a condition when deprived of my scientific work."[15]

Although Soviet officials regularly assured Kapitza that his scientific contributions would be important for the development of Soviet industry, they did not provide the facilities or the equipment

11. During his first year of detention, Kapitza was allowed only to write to his wife. The translations she made for Rutherford formed the basis of Lawrence Badash, *Kapitza, Rutherford, and the Kremlin* (New Haven, 1985). The original letters are in KA.

12. Kapitza to Molotov, 7 May 1935 (*PN*).

13. Kirov headed the Leningrad Communist Party. His murder was supposedly ordered by Stalin, who publicly used the incident to initiate major purges against his opposition.

14. Kapitza to A. Kapitza, 5 Apr 1935, in Badash (ref. 11), 67. He wrote: "[Leipunskii] came to me not like a friend but an emissary."

15. P. Kapitza to A. Kapitza, 21 May 1935 (*PN*).

essential for his work in physics. At first he thought of leaving physics for physiology, so that he could collaborate with I.P. Pavlov. The authorities strongly objected, perhaps because they suspected that Kapitza wanted to avoid doing any work that might help Soviet industry. Finally, on January 3, 1935, the two official Soviet newspapers, *Pravda* and *Izvestiya*, announced that the government had decided to set up a new Institute of Physical Problems within the Academy of Sciences, and that Kapitza would be its director. Still, this decision did not provide an immediate opportunity for Kapitza to resume scientific work. He had to busy himself with design and construction of the Institute itself, and then had to wait for the arrival of equipment purchased for it. His forced exile from science lasted for two very long years, until the fall of 1936.

In a report to Rutherford after his visit to the Soviet Union in 1935, E.D. Adrian offered Kapitza's speculations regarding the real reasons behind his detention. He wrote:[16]

> Three reasons for detention:
> • unfounded report from England that he was doing war work: these reports must have come from Cambridge and from a well-informed source.
> • Gamow: when Gamow was out of Russia he wrote to Molotov asking for the same standing as Kapitza used to have, and he made this the condition of his return to Russia.
> • the reason that his abilities would be valuable during a war.

As far as we know, Kapitza did no military research when at Cambridge, though he did consult with industrials.[17] Georgii Antonovich Gamow, the famous Soviet theorist who proposed the quantum theory of nuclear decay, and who decided not to return to the Soviet Union after the Solvay Conference in October 1933, had applied to the Academy of Sciences and perhaps to the central government for permission to stay abroad longer. From the documents available, we have no evidence that he explicitly referred to Kapitza, although he may have done so. When Gamow visited Cambridge in 1934, Kapitza advised him to ask Soviet authorities for no more than a temporary extension. By doing so, Gamow could slowly "inure" them to the idea that he would remain abroad, just as they might become inured to a

16. See Boag, J.W., P.E. Rubinin, and David Schoenberg, eds., *Kapitza in Cambridge and Moscow: Life and letters of a Russian physicist* (Amsterdam, 1990), 267. P.A.M. Dirac rewrote the text of this memorandum. Because he was afraid that authorities might confiscate the letter, he memorized its contents in September 1935 before returning to Cambridge.

17. Kapitza, "Khleb, maslo, no ne dzhem," in ibid., *Kratkii mig torzhestva* (Moscow, 1989), 297–307.

"chronic disease."[18] Gamow followed this advice, and he received permission from the Academy to stay abroad for one more year.

As political circumstances darkened in the 1930s, however, scientists like Kapitza and Gamow had fewer and fewer ways of negotiating their status as Soviets outside the Union. Gamow was expelled from the Academy of Sciences in 1938.[19] With his Soviet citizenship also revoked, he settled in the United States and became George Gamow, the author of many books popularizing science and one of the first to advocate the big bang theory.

Gamow advised Kapitza not to return to the Soviet Union in 1934. He wrote Bohr soon after he learned of Kapitza's detention:[20]

> You may have heard also that Kapitza is captured [in the] USSR just as a proton by the carbon nucleas. Dirac got recently a letter from Cambridge saying that [the] Soviet government will not let him go under any conditions, and I have seen in [a] Moscow newspaper that he is appointed as director of the new [Institute] of Physical Research of the Academy of Sciences. I hope he will not feel too bad; he was playing himself this dangerous game and just missed it.

Soviet officials responsible for Kapitza's fate may have been influenced by their experience with Gamow. They may reasonably have suspected that Kapitza, too, would remain outside his homeland permanently.

We should interpret Kapitza's detention not as an isolated incident, but as another manifestation of the tremendous changes the Soviet Union underwent in the mid-1930s. Soviet policy makers withdrew from their internationalism associated with world revolution, and became nationalist and isolationist in preparation for the new war. In science, Soviet scholars enjoyed relatively good international contacts for a few years beginning in 1927; but by 1938, they had broken off completely. Even if Kapitza had not returned to the Soviet Union in 1934, he would have had to choose one or two years later whether he would return at all, or remain in exile forever. Intermediate positions would not have been possible. In September 1936, a new official in charge of science—the permanent secretary of the Academy of Sciences, N.P. Gorbunov—wrote to V.N. Ipatiev, a chemist who had been working abroad since 1930, in terms that made the situation clear:[21]

18. Kapitza to Bohr, 15 Nov 1933 (BA).

19. The Academy of Science, General Assembly of the Academy of Sciences, *Proceedings*, 29 Apr 1938 (AAN).

20. Gamow to Bohr, 20 Jan 1935 (AHQP); see also his letters to Bohr of 24 Nov 1933, 13 June 1934, and 1 June 1935, all in AHQP.

21. AAN, 459/3/10.

It has been six years since you have been absent from the Soviet Union and have failed to participate in the enormous tasks for the construction of socialism.

You are a Soviet citizen, a prominent scientist, and a full member of the Academy of Sciences. Our country needs you. Therefore, on behalf of the Presidium of the Academy of Sciences, I ask for your clear and sincere answer to the following question: do you think that you have an obligation to work totally for the sake of your country, the Soviet Union, for its strength and properity, and if you do, are you ready to draw from this the necessary steps you must take? This is a legitimate question, since your voluntary separation from our country has been so protracted. If you answer the above question positively, you must return to the Soviet Union as soon as possible to continue your scientific work. The Academy of Sciences will take all necessary steps to create favorable conditions for your scientific work and for your living conditions.

In the event that you decide negatively, the Academy of Sciences and the whole nation will have to draw the proper conclusions about your attitude toward the Soviet Union.

We wait for your prompt response, and we hope that you will return soon.

In the same year, the government solidified the recent dramatic changes in Soviet science policy. Editors from *Pravda* accused N.N. Luzin, a mathematician and member of the Academy of Sciences, of "bending his head before the West."[22] Luzin had published works in foreign languages. After a scandalous series of public meetings in which these and other charges were brought forth, he lost his considerable influence among Soviet mathematicians. Meanwhile, Soviet officials made it almost impossible for scientists to travel abroad for any length of time. They suspended international conferences scheduled in the Soviet Union. No one was to publish in a foreign journal; private correspondence with foreigners became exceedingly dangerous. Kapitza was but one scientist affected by this new isolationist trend in the Soviet Union.

Khruschev states in his autobiography that Stalin himself made the decision concerning Kapitza.[23] We have no documentary evidence to

22. *Pravda*, 9 Jul 1936.

23. Khrushchev recalled, "I remember we had a conference that Kapitza came from England to attend. Stalin decided to keep him from going back. Mezhlauk was to take care of the matter. Occassionally, I heard Stalin when he explained the ways of convincing Kapitza to remain in the Soviet Union: plead with him and take away his foreign passport as a last resort. Mezhlauk spoke to Kapitza and then reported to Stalin. It was agreed that Kapitza would stay, certainly not voluntarily, but provided that he would be granted conditions for scientific work....Stalin spoke ill of Kapitza, said that he was not a patriot and so on." This short excerpt appears in N.S. Khruschev, "Reminiscences," *Znamya, 9* (1989), 3–39, on 31. This passage does not appear in N. Khrushchev, *Khruschev remembers*, trans. Jerrold L. Scheter (Boston, 1970).

back this claim; however, circumstantial evidence suggests that it may have been true. From the very beginning, Kapitza had contacts with high-level officials in the Soviet hierarchy. He corresponded with V.I. Mezhlauk and later with V.M. Molotov, both of whom dealt with his case personally.[24] Their behavior, according to Kapitza, indicated that they could not discuss the merits of his detention, as though someone above them had made that decision.

2. MISSIONARY

Trapped in the Soviet Union, Kapitza argued that he could not continue his research without more advanced laboratory equipment. In response, the SNK decided in December 1934 to build the special institute in Moscow under the Academy of Sciences. Kapitza would serve as Director, and would also have the authority to purchase the equipment of the Mond Laboratory in Cambridge with the free currency set aside for the institute. At first, the negotiations with Cambridge went badly, perhaps because Kapitza was not permitted to take part in them. Rutherford may have hoped that Soviet officials would release the prisoner, and he continued his pleas on Kapitza's behalf.[25] P.A.M. Dirac, along with the Cambridge physiologists A.D. Hill and E.D. Adrian, visited Moscow in August 1935 for a Congress on Physiology; they, too, pleaded for Kapitza. But they only returned to England with a long memorandum in which Kapitza told Rutherford what he would need to continue his work in the Soviet Union. In October, Kapitza was allowed to write an official letter to Rutherford, after which a new Soviet representative whom Rutherford trusted took over the negotiations. In the fall of 1935, the Senate of Cambridge University agreed to send the first shipments of material and equipment to Moscow. These included copies of the principal equipment of the Mond Laboratory. Kapitza began to work with them in Moscow in the fall of 1936.

Within a year, Kapitza offered the world perhaps his greatest scientific discovery—the superfluidity of liquid helium. The discovery came as his circumstances began to improve. In a letter to Niels Bohr dated October 20, 1936, Kapitza described the situation:[26]

24. V.I. Mezhlauk was at the time deputy chairman of the Soviet Narodnykh Komissarov, or the SNK, translated as the Soviet of People's Commissars, or the Council of Ministers. V.M. Molotov was the second person in command in the Soviet Union as chairman of the SNK.

25. Rutherford's efforts to release Kapitza are detailed in Badash (ref. 11), 20–36.

26. Kapitza to Bohr, 20 Oct 1936 (BA).

My institute is in a state of being finished. We got the apparatus from Cambridge and hope that we shall be able to resume work in a few week's time. After two years of interruption it is a great relief to start again on research. It is really quite unexpected for me to find out that scientific work is such an essential part [of] my life and it was so painful to be deprived of it, and it was all so silly, as there was no apparent reason for doing it in such a rude manner.

In general the position of science and [researchers]...is somewhat peculiar here. It reminds me of a child with a pet animal which is tormented and tortured by him with the best intentions. But indeed the child grows up and learns how to look properly after his pets, and make of them useful domestic animals. I hope it will not take long to happen here.

I am very critical here, and make my criticisms quite openly, and I think this is the only right way of acting. I even find now that the responsible comrades listen and on a number of occasions are quite willing to discuss and change things. Much less sympathy I find among my own colleagues, scientists who are mostly interested in the comforts of their personal work and hate to put questions on a broad base.

In spite of all this I have a strong conviction that after a number of mistakes and blunders, science will progress here; the general line on which the social life of the country is organized is much more superior and more correct than that of any of the countries of the old capitalist world. And the leaders are people most sincerely devoted to their work and personal, selfish motives exist at a minimum, which is inevitable and keeps people human.

It is for the scientists themselves to take opportunity of these circumstances and to find their own proper and useful place for the work in this new system. If this has not yet happened it is mostly due to the attitude of Russian scientists, as I just said, who cannot grasp the opportunity of the future and only grumble on small things.

Indeed at the moment the conditions for work here are not nearly as good as in Cambridge, but they are rapidly improving.

I am trying my best to help the people here...organize science, and it is my conviction that the injustice done to me must not blind me...to this world. During great historical moments there are always victims, such is life, and the worse in my case is over.

I feel the responsibility of my position, especially having the experience which I gained in Cambridge. Besides just resuming my work here, I think I must try to organize my Institute in such a way as to show people here all the healthy and powerful methods of the work in the Cavendish. I will try to follow Rutherford's methods as far as I am capable.

One may question the sincerity of letters like this, mainly because Kapitza probably suspected that they were being perused by people for whom he did not intend them. Nonetheless, they show a rare honesty. He may have left some things unsaid, but he does not play the hypo-

crite or liar. Socialist illusions of the type found in Kapitza's letters were widespread at the time, among both Soviet and British scientists, despite the evident contradictions between the doctrine and the reality. Many Soviets, especially those who received their education after the revolution, sincerely shared the enthusiasm of those years of collectivization and industrialization, only recognizing the sad deterioration of Soviet politics at the height of the purges in 1937 and 1938. Kapitza was sympathetic toward the principles of internationalism, the ideas of social justice, and the new social and economic policies proposed by the Soviet leaders.

He did not, however, overlook the seamy sides of socialism. In his letters, he mentioned the troubled bureaucracies, incompetence, lack of respect for individual rights, and other nagging problems. Nevertheless, in a letter to his wife, he hoped that these flaws would soon disappear:[27]

> What is done by a telephone call in England requires hundreds of papers here. You are trusted in nothing....People do not trust each other at all. They only trust paper—that is why paper is so scarce! Bureaucracy is strangling everyone....[But] to destroy this bureaucracy will not be an [easy] task....As far as I can see, this is more a question of education than of organisation, and to educate takes years. [Yet] even in spite of my cursing, I do believe that the country will come out of all these difficulties victorious. I believe it will prove that the socialist economy is not only the most rational one, but will create a State answering to the world's spiritual and ethical demands. But, for me as a scientist, it is difficult to find a place during the birth pangs, and as I wrote in my last letter, the time is not yet ripe and that is the tragedy of my position. The only way out is to be like a hot-house plant under the special care of the government. But is this right?....Lots of things are not clear to me....But life will show.

Eventually, he solved this moral problem by becoming a persistently critical "hot-house plant." His criticism was not simply a manifestation of his independent character, but a conscious position taken as a social duty. In one of his first letters to his wife written from the Soviet Union, he described a conversation he had shared with I.P. Pavlov:[28]

> [Pavlov] told me, "Piotr Leonidovich, look—I am the only person here who says what he thinks. I will die soon, and you must take my place. It is so important for our country, which I love much more now that she is in a difficult situation." I will not be afraid to say what I think, but I do

27. Kapitza to A. Kapitza, 23 Feb 1935 (*PN*), as translated in Boag et al. (ref. 16), 225–227.

28. Kapitza to A. Kapitza, 4 Dec 1934 (*PN*); cf. Boag et al. (ref. 16), 213–214.

> not have the same opportunities as he [Pavlov]. He is a recognized leader of a scientific school, and I am here alone, without support or respect.

Any published or public criticism was unthinkable in the mid-1930s. Kapitza had to find other, more creative ways of expressing dissent. He chose one that was almost a cultural tradition. Soviet citizens had been encouraged to write letters, either to the newspapers or directly to public authorities. Letters were expected to contain practical suggestions for improving government services without condemning the leaders of the political system or the system itself. Some grassroot responses were published—if they coincided with the decisions of the authorities—and some were planted from above to provide the illusion that the changes in policy came from below. Kapitza conveyed his criticisms through this channel, even though an "above average" person of his rank usually did not engage in such activities. Many of his letters to various politicians remain, including forty-five letters to Stalin and roughly fifty each to Molotov, Malenkov, Mezhlauk, and others.

In his first letters, Kapitza devoted his energies to defending his dignity and independence. He insisted that he ought to be treated with respect, that his letters ought to be answered, that he ought to be free from ungrounded accusations and suspicions, and that he ought to be seen promptly when he had made an appointment. His letters were far from servile and formal, and he occassionally offended the authorities he adressed. In one letter to Molotov, Kapitza wrote:[29]

> You better accept me as I am: a bit impudent, a lover of freedom, independent in my scientific work, unable to wag my tail even if I had one, but certainly committed to the Union and to the work for socialist construction, to which you are also committed. I am sincerely willing...to help establish science in our country. But you better abandon forever the notion of training me like a dog: "being a good child you will receive thus and such, and if you behave badly, you stinker, we will not allow you to go to the theater and we will charge you such a fee for a parcel that you will whine." I tell you once and forever, that I will not behave like a "good boy" at his school desk. For instance, you told me when we spoke, "We have lots of Kapitzas." But this again resembles the training of an animal. I know that you think you should take me down a peg. You will see later that I am not overly supercilious. I have a lot of other bad qualities, but not this....
>
> If, instead of all this training, you would have tried to involve me in our country's life, which in fact is much more remarkable than you even think, then we could have been friends a long time ago.

29. Kapitza to Molotov, 5 Jul 1935 (KA).

Soon, Kapitza himself became a trainer. In a letter to Mezhlauk, he used the same analogy:[30]

> I am sorry for bothering you once more with the problems of "Tekhnoimport," but I feel that if it isn't put into confusion and beaten for every stupid and untidy deed, we will not teach it how to work well. You know that when a dog is being tamed, the most important thing is not to relent in the initial stages of training....."Tekhnoimport" behaves like a bad, untrained dog. After the first reprimand you gave it, it improved for a while, but now it has reverted to its old ways.

The following excerpt comes from Kapitza's most impudent letter, addressed to Mezhlauk:[31]

> Tell me in general how you see that mechanism that will force the builders of the Soviet Union to fulfill their long term promises? Why is it that you in the government can do nothing? I can only think of two answers:
>
> • You do not consider my work important enough for the country. Then why did you detain me?
>
> • Even worse, you can not force the construction firm to obey you, to build for you a two storey house in a certain amount of time. What kind of a government are you then? You are but bumblers.
>
> Look at what is happening. Imagine that you've seen a violin that belongs to a neighbor and you have found a way to steal it from him. And [after you steal it], you can't even play it. For two years, you have used it to hammer nails into a stone wall....You have managed to take away the violin, but you can't even play a Chizhik [a simple song and dance] with it.

It is difficult to imagine that any of the important members of Stalin's government would have tolerated such sharp criticism from anyone other than Kapitza in the late 1930s. He had established special relations with government officials, informal, intimate, and perhaps even sincere. In addition to his international reputation, Kapitza made a virtue of what had been his main source of trouble. After spending thirteen years abroad, he was treated as a foreigner unaccustomed to Soviet ways, and so given room to behave unconventionally. Kapitza could very well have calculated his steps perfectly, taking advantage of his position and consistently acting as though he were "untrained."

Kapitza did not direct his barbs just for the improvement of his personal working conditions. He felt personally responsible for developing and improving conditions for science in the Soviet Union.

30. Kapitza to Mezhlauk, 19 Dec 1936 (*PN*).
31. Kapitza to Mezhlauk, 26 Apr 1936 (*PN*); cf. Boag et al. (ref. 16), 328.

He complained that no true scientific community existed within the Union, and that interest in scientific work among the general population—as well as among different scientists—was exceptionally low. As a result, no one offered open scientific criticism of anyone else's work. Kapitza was especially troubled with the Academy of Sciences, an "obsolete wagon" that went nowhere during a time of revolutionary changes. According to Kapitza, members of the Academy behaved like priests presiding over sacred rituals in the name of science. He considered himself fit for a position higher than corresponding member. In a letter to Rutherford dated March 2, 1936, he listed these complaints while characterizing maliciously the caliber of the members of the Presidium, the ruling body of the Academy.[32] By his standards, the official leaders of the "scientific community" either did not care enough about the development of science in the country, or were not brave enough to discuss important matters with powerful political figures. Kapitza therefore sidestepped the Presidium and made his appeals directly to high political officials.

At first, he established close contacts with second-level politicians, like Mezhlauk and K.Yu. Bauman, the director of the Science Department of the Party Central Committee. They helped him solve some relatively small problems. They managed the physical construction of the Institute and they helped him acquire equipment, managers, and tickets to the theater. Kapitza characterizd the process by an English proverb: "Like using a sledgehammer to crack nuts." But more important decisions were made at higher levels considerably harder to approach. Kapitza tried repeatedly to get an appointment with Molotov. After a number of failed attempts, he found an occasion to write to him personally.

In April 1935 British newspapers announced Kapitza's detainment. Rutherford had not disclosed the situation, while he attempted to negotiate a release. Mezhlauk officially asked Kapitza to announce through the Soviet press that he was working in the Soviet Union for his own personal reasons. Kapitza flatly refused: "I can't say what I don't think and feel to be the truth, and now it is certainly not better for me here than in Cambridge, but in fact much worse....I speak...solely...about the conditions and possibilities for my scientific work."[33]

Kapitza wrote Stalin for the first time on December 1, 1935, just after the Senate of Cambridge University had approved the sale of the Mond equipment. Kapitza outlined his plans for the future. His later

32. Kapitza to Rutherford, 2 Mar 1936 (*PN*), and in Badash (ref. 11).
33. Kapitza to Molotov, 7 May 1935 (*PN*).

letters to Stalin and other high officials were often very long and resembled minor scientific treatises. He would begin his letters with problems of his own or of his Institute, and proceed to broader discussions of science and science policy in the Soviet Union. He pointed out that the prevalent attitudes toward scientists contradicted the special place of science in society. He touched on the relationship of pure and applied research, the proper ways of organizing resources, and a rational method for overseeing scientific secrets and other confidential matters. He usually did not receive written responses, nor did he expect them. Occasionally, the authorities responded in various ways, to show perhaps that they had read his letters—even more rarely, they took action on his proposals.

Kapitza could not oppose the purges themselves, but he did plead for the lives of certain individuals. Kapitza chose his cases carefully, so as not to devalue his appeals; largely because of his informal relationships with key politicians, he became an active and effective petitioner. His first effort failed; in July 1936, when he tried to stop the harrassment of mathematician Luzin, Molotov returned his letter with a note, "Return to citizen Kapitza as being useless."[34] Fortunately, this did not discourage Kapitza, and on his next attempt he succeeded. In February 1937, Kapitza wrote two letters, one to Mezhlauk and the other to Stalin, to plead for V.A. Fock. The theoretical physicist from Leningrad University was then released a few days after his arrest.

In April 1938, the purges touched Kapitza's own Institute, when L.D. Landau, its leading theoretician, was arrested. Kapitza immediately wrote to Stalin. Receiving no reply, he repeated his appeal a year later in a letter to Molotov. Soon after the second letter, in April 1939, Landau was released. In 1940, Kapitza received a letter from I.V. Obreimov, the organizer and first director of the UFTI, who had been kept in prison camps since 1938. Responding to the prisoner's request, Kapitza wrote to Molotov asking that Obreimov be allowed to work on scientific research. Obreimov was released in 1941. In other instances, Kapitza was not so successful. In 1937, he protested in vain the use of ideological arguments in T.D. Lysenko's attacks against N.I. Vavilov. He also failed to help several prominent physicists, among them P.I. Lukiskij, A.V. Ulitovskij, and astronomer B.P. Gerasimovich. In all of his pleading, Kapitza restricted himself to pragmatic arguments without questioning the justness of any particular decision or of the entire political system. Usually, he spoke only of

34. Kapitza, "Za nenadobnost'yu" (ref. 5). Instead of the usual "comrade," the "citizen" was typically applied to those alien to the political system.

the importance of a scientist's work for the country and asked that the case be handled carefully so as to avoid a catastrophic error.

Kapitza's connections also proved effective when he set out to organize his Institute differently from other Academic institutions. Kapitza enjoyed greater authority to hire personnel and to allocate funds alloted from the central government. He could also accelerate the construction and delivery of equipment, and acquire from abroad not just the major equipment of the Mond Laboratory, but also basic laboratory materials scarce in the Soviet Union. He bought from English companies because they were more efficient and flexible than the Soviets in fulfilling small-scale orders. Though he was not very active in the Academy of Sciences, he worked for a year as the head of its Commission for Technological Supplies. During that time, he insisted on the reorganization of the Commission so that it would report periodically to the Presidium of the Academy rather than turn to the executive for every minor decision. Such a reorganization, however, ran counter to the Academic structure and the dominant mood of the time, and Kapitza had to resign from the Commission.

During his first years of detention, Kapitza was a missionary, a representative of science in a strange yet familiar country. He grew accustomed to the surroundings quickly and accepted the pedagogical ethos of his nation as his own. He tried to educate officials with whom he had established close and informal relations. In word and deed, he presented himself as a pragmatist interested in the development of science for the sake of the country. He took exceptional liberties, but in a very narrow field—science in the Soviet Union, its organization, connections with industry, and so on. The practical results he won were similarly limited. He succeeded in solving organizational problems in his Institute and in saving the lives of two of the nation's best theoretical physicists; but since the general conditions for science and scientific research were so closely tied to the rapidly deteriorating political system of the Soviet Union, he could not achieve much more.

3. MINISTER

The authorities who detained Kapitza told him that they needed him to advise developing Soviet industries. He expressed a willingness to do so and visited a few industrial plants when he lacked facilities for scientific research:[35]

35. Kapitza to A. Kapitza, 16 Feb 1935 (KA).

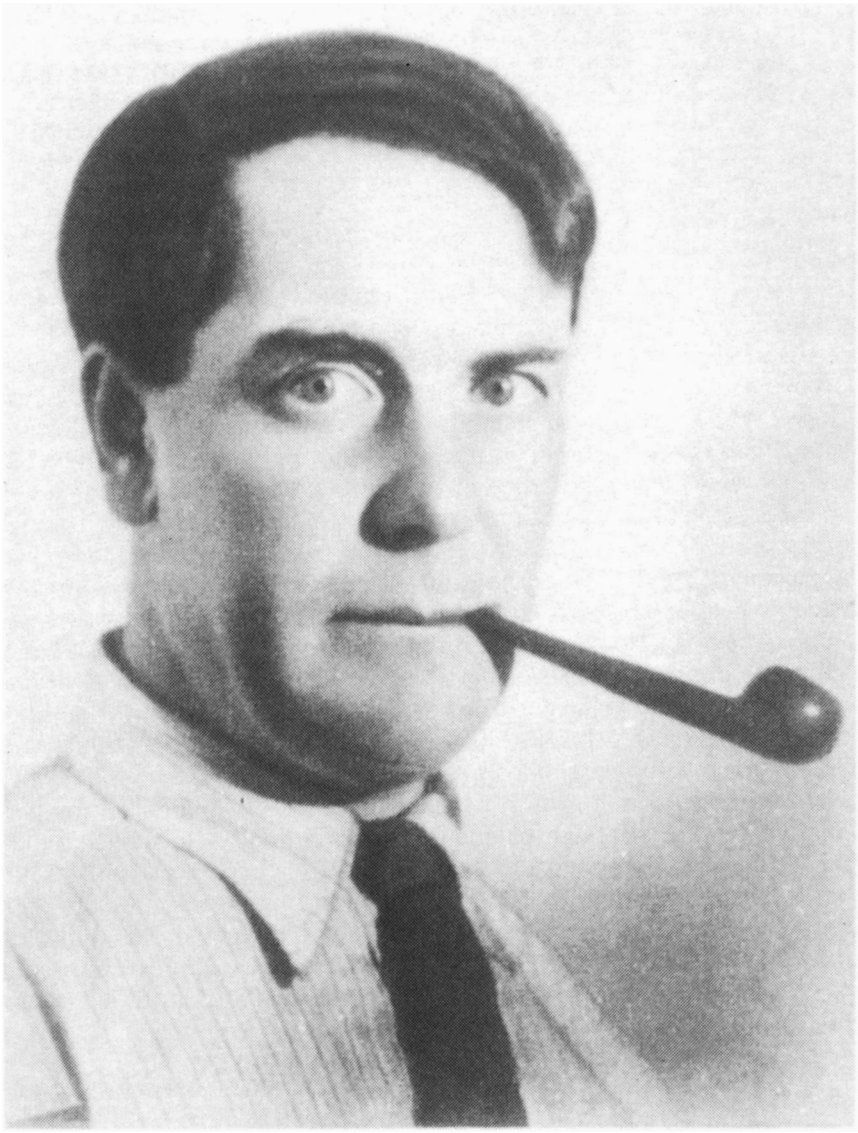

FIG. 1 Kapitza in 1937. Schoenberg (ref. 6), 326.

> Yesterday morning I went to the industrial plant which deals with low temperature physics....they are starting some research there. Expected to stay there until 2 pm., but stayed until 3 pm. I am very fond of our youth and enthusiasm. This plant (VAT) is one of a new generation of plants constructed after the revolution, and there is a great difference in spirit and atmosphere....This visit to the VAT warmed me up. Moreover, the people there are working on topics which are similar to my own.

The visit to the VAT had consequences. Several engineers from the plant visited Kapitza to discuss the possibility of increasing the efficiency of the apparatus that produced oxygen.[36] Kapitza soon designed a new device for such a purpose.

In industry, oxygen is usually extracted from liquid air. Air is most often condensed isothermically, and then allowed to expand adiabatically. While expanding, the air cools; repeating this procedure a number of times, the temperature can be dropped enough for liquefaction to occur. Since the different gases that constitute air boil at slightly different temperatures, they can be separated from liquid through evaporation. In the 1920s and 1930s, the conventional detanders—the apparatus used for air expansion—operated by the Joule-Thomson effect, where air expands adiabatically while passing through fine holes in a porous partition. Kapitza proposed using a turbine as a detander. This was not a new idea but no one had managed to design a turbine that would operate efficiently at low temperatures. Using the "abilities of a mechanician," Kapitza constructed a laboratory version of his apparatus, a turbo-detander, in the spring of 1938. He wrote letters to Molotov and Stalin to inform them of his success and asked for permission to take a foreign patent on his invention.[37] He soon received the patent and published the theory behind his apparatus in the *Journal of technical physics*.[38] He continued working on the problem with the intention of developing a system to complement his liquifier, including equipment that could separate fractions and provide gaseous oxygen. At the same time, he tried to organize the industrial production of his new liquifier.

36. From Kapitza's diary, quoted in "Dvadtzat' dva otcheta akademika Kapitzy," *Kratkii mig torzhevstva* (Moscow, 1989) 252–287. See also the popular accounts of his invention in Kapitza, *Deshevyi kislorod narodnomu khozyaistvu* (Moscow, 1986), 64, and in Kapitza, "Oxygen," in Kapitza, *Experiment, theory, practice* (Dordrecht, 1980), 35–46.

37. Kapitza to Molotov, 20 Apr 1938 (*PN*); Kapitza to Stalin, 28 Apr 1938 (KA).

38. Kapitza, "Expansion turbine producing low temperatures applied to air liquefaction," in Kapitza, *Collected papers* (4 vols., Oxford, 1965), *2*, 521–550; a more popular account by Kapitza is "A new method of producing low temperatures for air liquefaction," in ibid., *3*, 44–63.

Producing the liquifier turned out to be much more difficult than designing it. Even amid the great changes of the 1930s, Soviet industry adopted technical innovations reluctantly. Without any economic competition, only direct orders from the government could coerce change, and though the government acted quickly in emergency situations like the atom bomb project, such massive intervention was notably rare. In less important cases, efforts to modernize the industrial process would interfere with the more immediate demands detailed in five-year economic plans. As a result, industrial managers did not run to produce "novelties." The onus for "vnedreniye," which means "inculcation [of new technology]," fell on individual scientists and scientific bodies like the Academy of Sciences.

Scientists and engineers were under enormous pressures during the early 1930s to develop heavy industries. The major research institutes in physics, chemistry, and geology belonged to the "narkomat," or "ministry," of heavy industry, the NKTP. These institutes benefitted greatly from the financial support of the NKTP; however, scientists conducting fundamental research there faced the challenge of persuading government administrators of the industrial potential of their work. In the late 1930s, when Kapitza became more involved in research, the calls for "practical science" softened. A reorganization placed some institutes under the direction of the Academy of Sciences, although industrial narkomats still retained control of applied research. The government lessened the pressure upon members of the Academy to conduct "practical" work. Institutionally separated from industry, researchers under the Academy of Sciences did not have access to the resources of a narkomat, yet they were expected to "inculcate" whatever discoveries they had made.

Conducting research under the auspices of the Academy, Kapitza tried his best to overcome industrial inertia. Whenever he needed non-standard material or equipment, he found it easier and quicker to order from Britain. But the complicated turbo-detander could not be ordered from abroad. The Soviet government did its part by approving the construction of several samples of the apparatus, the administration of the Moscow plant, "Boretz," however, argued that "as it is your invention, it is also your task to materialize it." Kapitza described his first battles with industry in monthly reports to the SNK, from February 1939 until July 1941.[39] Like his letters to government officials, these reports enabled Kapitza to tell people informally about his technical and organizational activities.[40]

39. "Dvadtzat" (ref. 37), 258.

40. Kapitza's audience seems uncertain. He might have been addressing Molotov or V.A. Malyshev, the Commissar of Heavy Machine Building.

In the fall of 1938, of the Economic Council of the SNK commissioned the Commissariat of Heavy Industry (NKTP) to build the turbo-detander. Boretz, the major plant in Moscow, was ordered to produce ten samples by the end of 1939. The plant, however, was preoccupied with fulfilling its quota of standard output. Kapitza fiercely battled the plant's administration through his acquaintances in government and by inspiring critical publications in the press. He persuaded the plant's local unit of the Communist Party to apply more pressure on the administration. He had to wait until the summer of 1940 before he saw the first turbo-detander in operation.

Meanwhile, Kapitza had designed a second apparatus that could separate oxygen from the liquid air produced by the turbo-detander. Malyshev, minister of heavy industry and tank building, saw an important military application and ordered that the apparatus be built immediately for military aviation. Soviet industry then used oxygen chiefly for autogenous welding, and thus the production of oxygen was entrusted to the plants of the Autogenous Trust (Glavavtogen). Malyshev ordered this trust to produce a number of small, transportable oxygen plants based on Kapitza's invention. Members of Kapitza's institute advised the industrial engineers. In the summer of 1941, the production of transportable oxygen plants was under way.

In the autumn of 1941, when German troops approached Moscow, Kapitza's institute moved to Kazan, on the Volga. There, an old University served as the seat for the many evacuated institutes of the Academy of Sciences. Scientific research shifted to the war effort: Kapitza's oxygen helped the air force to fly and the army to produce explosives. He continued to work on his machines and in 1942 constructed a larger device capable of producing nearly 200 kilograms of liquid oxygen per hour. The State Committee of Defense ordered the Glavavtogen in March 1942 to develop its industrial applications. In Balashikha, a small town near Moscow, engineers began the construction of the large oxygen plant. Kapitza wanted to develop a factory to produce liquid oxygen with equipment ten times more powerful than his most recent invention. He planned to transport the liquid oxygen throughout the country in specially designed railway tanks.

In the fall and winter of 1942, Kapitza wrote several desperate letters to Molotov about the pace of construction. He suggested radical solutions. He argued that in the four years since the SNK ordered the Glavavtogen to produce the turbo-detander, Glavavtogen had proved unsuited to the task. "To solve successfully the job of developing our apparatus, it is necessary to set up a special organization, call it for instance the Glavkislorod,[41] directly subordinate to SNK and indepen-

41. The Chief Department of Oxygen.

dent of all other industrial narkomats."[42] He enclosed another less official letter, adding that "all this time, I have worked as a mule-driver, and I have been denied both a stick and a switch. I think that in one way or another, I should be granted official power to direct all the processes of industrial inculcation."[43] On April 19, he wrote to Stalin to continue his criticism of the Glavavtogen.

This time he succeeded completely. Within a month, a new Glavk, or chief department, was set up under the SNK with Kapitza as its chief and the chairman of its technical council. The main priority of his new organization was to complete the construction of the plant in Balashikha, then to produce what remained of Kapitza's oxygen apparatus. At the same time, the Glavk would further develop new applications for oxygen for other branches of industry. Kapitza's new position was notably more administrative than scientific. Working directly under the SNK, he commanded his own little ministry and collaborated successfully with Stalin's government.[44] Not every minister could communicate so freely with the highest politicians as Kapitza did through his letters. He continued writing regularly, informing Stalin, Molotov, and his new direct supervisor, G.M. Malenkov, about the course of his work.[45] In one instance, he complained about his own colleagues—heads of other industrial narkomats—who would skip meetings of the technical council of the Glavkislorod in order to address more pressing responsibilities.[46] When repeatedly denied requests for appointments, Kapitza again wrote directly to Stalin,[47] and when Stalin himself did not respond, Kapitza simply wrote another letter: "I did not receive any answer [to my first letter]. What am I to do in this case? There is nobody above you to whom I can submit a complaint! And as I took the oxygen job, I just can't keep silent."[48]

Meanwhile, the technical council met every two weeks to discuss the scientific and engineering problems encountered during the industrial production and application of oxygen. Between 1944 and 1945, the council published its proceedings under the title *Kislorod*, or *Oxygen*. The new applications of oxygen included the enrichment of fuel and the oxygen blast, was a method developed by I.P. Bardin for smelting steel. The plant in Balashikha was opened in the fall of 1944

42. Kapitza to Molotov, 6 Apr 1943 (KA).
43. Kapitza to Molotov, 6 Apr 1943 (*PN*).
44. The term "minister" is an exaggeration; Kapitza did not hold high official rank, nor did he belong to the SNK, which consisted of 45 ministers during wartime.
45. As a member of the State Committee for Defense, Malenkov was held responsible for new military technology.
46. Kapitza to Stalin, 10 May 1944 (KA).
47. Kapitza to Stalin, 24 Feb and 13 Oct 1944 (*PN*).
48. Kapitza to Stalin, 14 Mar 1945 (*PN*).

and quickly produced forty tons of liquid oxygen per day, or about one-sixth of the total Soviet output at the time. Approved by the State Commission and confirmed by the SNK on April 19, 1945, the plant was Kapitza's greatest triumph as a minister.

Kapitza earned many honors for his work on oxygen, especially after he became the head of the Glavkislorod. He received his first Stalin Prize in 1941 for his turbo-detander, the second in 1943 for the discovery of superfluidity; that year and again in 1944 he was awarded the Orders of Lenin. After the approval of the Balashikha plant on April 30, 1945, the Presidium of the Supreme Soviet gave him the country's highest civil title, "Hero of Socialist Labor," together with another Order of Lenin "for the scientific development of the new turbine method for producing oxygen and for the construction of the powerful oxygen apparatus." The Institute of Physical Problems also received the Order of the Red Banner of Labor while more than a hundred of Kapitza's coworkers at the Institute and at the Glavkislorod got various decorations.[49]

The recognition greatly uplifted Kapitza. His personal triumphs coincided with the victorious end of the war with Germany. In the spring of 1945, enormous enthusiasm swept across the country as many hoped that Soviet society would move toward greater freedoms and more openness. The scientific community shared this enthusiasm when scientific contacts with colleagues in Allied countries slowly resumed in 1943. Soviet authors began to publish papers in Western journals once again, and in 1945, a foreign delegation was invited to Moscow to attend the official celebration of the 220th anniversary of the Academy of Sciences. Responding to this encouragement, Soviet scientists became more active inside and outside the Soviet Union. The new Cold War froze their hopes. Many lost the enthusiasm that came with the victory. Kapitza was among the first to experience the loss.

49. *Pravda*, 1 May 1945. The title "Hero of Socialist Labor" was established in 1939. After 1945, its prestige diminished, though the following list of recipients shows that it once ranked among the Soviet Union's highest honors: Stalin, Molotov, Malenkov, Beria, Mikoyan, Kaganovich, Khruschev, Zhdanov, Andreev, Voznesenskij, Kalinin, Voroshilov, and Bulganin.

4. OUTCAST

Rather than resting on his laurels, Kapitza tried to expand his range of influence in administrative matters following the war. He wanted to build the large special apparatus for producing gaseous oxygen and to find more uses for the oxygen blast in metallurgy. In January 1945, he began writing letters to Stalin to suggest that these broader tasks required new systems of organization.[50] After six months of deliberation, the SNK approved the arrangement Kapitza lobbied for, and Stalin signed the new proposal on September 29. The Glavkislorod grew to include all industries that used low-temperature methods. The Glavkislorod also assumed the duties of the competing Glavk-Glavavtogen, which had been responsible for industrial applications of Kapitza's inventions between 1939 and 1943. The head of the Glavavtogen, M.K. Sukov, understandably objected, and on August 22, 1945, he wrote directly to Stalin. In his letter, he accused Kapitza of being more interested in his science and in his inventions than in industrial production, of behaving like a monopolist who threw obstacles into the development of low-temperature devices other than his own. Sukov characterized the Hero of Socialist Labor as a carrier of the capitalist spirit, a shameless self-advertiser. Sukov suggested that Kapitza be restricted to scientific work and that the Glavavtogen be given all the tasks of industrial development and application.[51]

Sukov's letter greatly angered Kapitza. He grew even angrier when L.P. Beria cited portions of it at a meeting of the Bureau of the SNK. At this meeting to discuss the future of the Glavkislorod, Beria proposed that the Bureau appoint Sukov as Kapitza's deputy in the expanded Glavkislorod. Kapitza immediately opposed this idea in a letter to Malenkov,[52] and when Malenkov refused to intervene, he wrote to Stalin.[53] In the second letter, Kapitza addressed the general problems of the Glavkislorod, but more importantly, he mentioned for the first time his interest in the atomic bomb.

Under the direction of I.V. Kurchatov, work on the Soviet atomic bomb had begun on a relatively small scale in early 1943. In August 1945, after the Americans had demonstrated the bomb, a Special Committee under the GKO was established to reorganize the entire project with Beria as its head. His appointment to the post indicated the seriousness of the matter, since Beria had been a Commissar of the NKVD, or Internal Affairs, from the fall of 1938. He was at the

50. Kapitza to Stalin, 20 Jan, 14 Mar, and 13 Apr 1945 (*PN*).
51. M.K. Sukov to Stalin, 22 Aug 1945 (KA).
52. Kapitza to Malenkov, 27 Sep 1945 (*PN*).
53. Kapitza to Stalin, 3 Oct 1945 (*PN*).

time a prime candidate for the Politburo, the ruling body of the Communist Party that had had only ten members since 1939. During the war, responsibilities had shifted from the older members of the Politburo to the State Committee of Defense, the GKO. Malenkov and Voznesensky, who were among the GKO's most active members, already belonged to the Politburo. Beria, as the head of the Special Committee, became so influential in the GKO that immediately after the war, he sought to become more than just the chief of state police. He climbed to perhaps the fourth man after Stalin, Molotov, and Malenkov. After the war, the GKO dissolved and the SNK resumed its government duties. Stalin had headed the SNK during the war and appointed Molotov as its first deputy chairman. Malenkov and Beria shared their official titles with a dozen other deputies at the SNK, but they often presided over its sessions and set its agenda. As Beria accepted more and more responsibilities, he formally relinquished direction of the state police to men loyal to him.[54] As the head of the atomic bomb project, he could direct Soviet industry as well as Soviet intelligence. Moreover, he could assign to the project any number of the millions of prisoners in the forced labor camps.

At first, Kapitza did not take part in the project. Near the end of 1942, he was asked to advise Soviet leaders about it and its scientific leaders. At that time, he—like many scientists around the world—did not know whether the bomb was possible; in addition, he doubted Kurchatov's abilities to manage the project successfully. But only three years later, Kapitza found himself sitting as a member of both the Special Committee gathered for the bomb project and its Technical Council, where he was expected to collaborate with Beria.[55] The old police chief had no reputation for being polite or tolerant, and Kapitza had a reputation for eagerly defending himself. Tensions developed quickly.

In a letter to Stalin, Kapitza complained of Beria's rudeness, as he had done many times before with other state officials. And he added several more serious observations:[56]

54. In January 1941, the NKVD split into two Commissariats: the NKGB, in charge of "state security" with V.N. Mezkulov as its head, and the NKVD, in charge of "internal affairs," with Beria as its head until January 1946, when S.N. Kruglov replaced him. From the Institute for the Study of the USSR, *Party and government officials of the Soviet Union (1917–1967)* (Munich, 1969).

55. Among the nine members of the Special Committee, only two were scientists—Kurchatov and Kapitza. For a complete list of the members, see *Izvestiya TsK KPSS, 1* (1991), 145.

56. Kapitza to Stalin, 3 Oct 1945 (*PN*). A portion of the English translation comes from David Holloway, "The scientist and the tyrant," *The New York Review of Books* (1 Mar 1990), 23–25, on 24; cf. Boag et al. (ref. 16), 370.

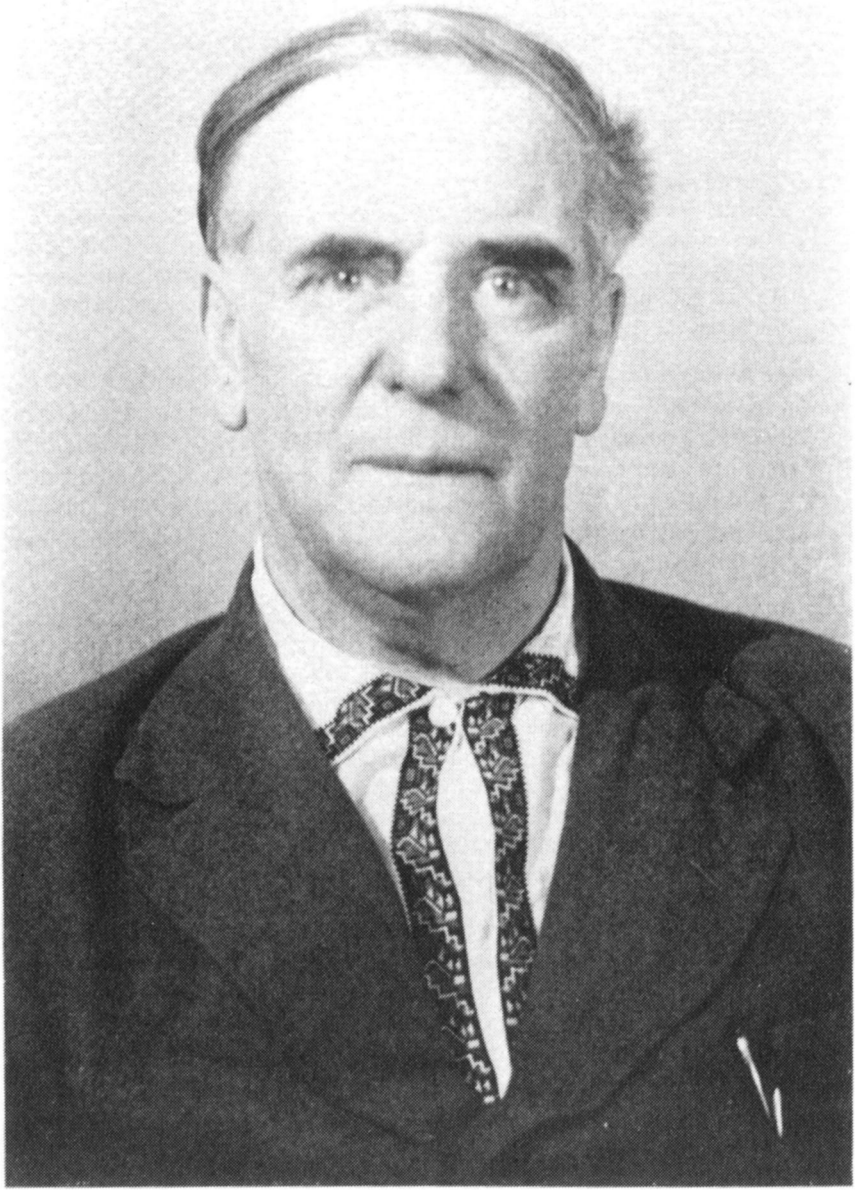

FIG. 2 Kapitza, undated. Haar, D. ter, ed., *Collected papers of P.L. Kapitza* (3 vols., Oxford, 1967), *3*, frontispiece.

> There was a time when alongside the emperor stood the patriarch; the church was then the bearer of culture. The church is becoming obsolete, and the patriarchs have had their day, but the country cannot manage without leaders in the sphere of ideas.
>
> Only science and scientists can move our technology, economy, and state forward. You, like Lenin, move the country forward as a scholar and a thinker. The country has been exceptionally fortunate to have such leaders; but there may not always be such interdisciplinary men. Sooner or later, we will have to raise scientists to the level of "patriarchs." This is necessary because without it, scientists will not always serve the country with enthusiasm. We cannot buy such people. The capitalist America can, but not us. Without that patriarchical position for the scientist, the country cannot grow on its own...therefore, it is time for men like Comrade Beria to begin to learn more respect for scientists.

Concluding that politicians were not ready for mutually respectful relationships with scientists, Kapitza asked to be released from his administrative responsibilities, including those at the Glavkislorod and at the atomic bomb project. Stalin did not respond to this letter, and a month and a half later, Kapitza wrote another. In lengthy phrases and paragraphs, Kapitza exclusively addressed the problems plaguing the bomb project:[57]

> A lot is wrong in the organization of our work on [the atom bomb]....At present, we should be developing a two-year plan for the construction of industrial plants while we continue scientific experiments and theoretical research....We are lacking materials and specialists, and we should use our human resources very wisely. One must always choose a single plan and a single general for commanding a battle. We should adopt the same strategy in science....The way to victory is through a concentration of all efforts in one chosen direction. I have no agreement with my comrades on these matters....The only way is to have one decision-making person—as in the case with a commander-in-chief—being advised by a smaller military council.
>
> The next question is one of choosing these leaders. I propose that we ought to go by what a person has accomplished, not what he promises to accomplish.
>
> The right organization is possible under only one condition: that we have more trust between scientists and statesmen...my turbo-oxygen apparatus was only produced because I had become director of the trust.

57. Kapitza to Stalin, 25 Nov 1945 (*PN*). A portion of the English translation is again taken from Holloway (ref. 56), 25; cf. Boag et al. (ref. 16), 372–377.

> Comrades Beria, Malenkov, and Voznesenskij behave like supermen at the Special Committee. Especially comrade Beria. It is true that he has the conductor's baton in his hand. That is fine. But after the conductor, a scientist should play first violin. The violin sets the tone for the whole orchestra. Comrade Beria's basic weakness is that as a conductor, he should not only wave the baton, but also understand the score. In this repect, Beria is weak.
>
> To summarize, we must do two things to complete the work on [the atomic bomb]:
>
> • Quickly reconstruct and develop the necessary branches of industry and improve scientific work in the Union; and
>
> • Work to find quicker and cheaper ways to produce [the atom bomb]. To do this, we must choose wisely respectable scientists and trust them completely. We can organize this by requiring the signature of the scientist in order to approve the orders of other administrators. Then, we will have scientific commissars like the military.
>
> But under the present circumstances, I see no good coming from my presence at the Special Committee and at the Technical Council....While participating in this work, I feel myself responsible for the whole thing, and yet I have no power to do things my way. The job is impossible because comrade Beria and the majority of my comrades do not agree with my suggestions....Therefore, I ask you again, very insistently, to release me from my obligations to the Special Committee and the Technical Council.

Although this letter was made widely known only in 1989, rumors of it had circulated for a long time. The phrase about the conductor "who must understand the score" became a common metaphor among physicists. Several guesses at what ensued have appeared in the press. In one, Kapitza refused to participate in the construction of the atomic bomb and was punished accordingly; another treated the letter as an example of heroic opposition to Beria, whom Soviet public opinion had regarded as the personification of evil. Yet, when writing these letters, Kapitza seems to have had something in mind other than resignation; consider the phrases, "I feel myself responsible for the whole thing, and yet have no power to do things my way," and "Sooner or later we will have to raise scientists to the level of patriarchs." His threats of resignation may have been intended as mere rhetoric: the main message being that he himself could have done a better job had he been given more power over the project. Furthermore, Kapitza not only disagreed with Beria but also with the "majority of comrades," a phrase that probably included fellow physicists. The suggestion that "we ought to go by what a person has accomplished rather than what he promises to accomplish" repeated typical criticisms of Kurchatov, who was not considered a top physicist before being put in charge of the atomic bomb project. Kapitza's proposal for

the project directly contradicted the way the work was practically organized. Kurchatov is commonly credited with encouraging research in several different directions, developing both graphite and heavy water piles, isotope separation and the production of plutonium, and every possible way of separating isotopes, all at the same time. Through these general procedures—perhaps created by Beria with the intention of keeping scientists dependent upon central authority—those in charge of the project assigned similar tasks to two separate groups of scientists to see how their results would differ. Kapitza apparently knew of these tactics and saw them as a waste of precious resources.

If Kapitza had intended to command the bomb project all along, we must conclude that in 1945, with the expansion of the project and the Glavkislorod, Kapitza ventured far into the field of political intrigue. Stalin and Beria were much more adept in that line than he, and his defeat was inevitable. In December 1945, Stalin met Kapitza's "request" and released him from his duties on the Special Committee and the Technical Council. Kapitza remained, however, at the head of the Glavkislorod.[58] Though he did not "insist" on any further resignations, he also did not remain on the Technical Council of Glavkislorod for very long.

We have no documentary evidence that Beria engineered Kapitza's first major setback, but we have enough circumstantial evidence to make it likely. Kapitza continued writing to Stalin and on one day he unexpectedly received a response. Kapitza had proposed the publication of a history entitled *Russian engineers*, written by L. Gumilevskij. Stalin returned the following note:[59]

> I have received all your letters. They have much to teach. I am thinking of meeting with you sometime to discuss them.
>
> What concerns me is the book *Russian engineers*, by L. Gumilevsky; it is very interesting and should be published soon.

According to P.E. Rubinin, this letter with its prospect of a meeting motivated Beria to move quickly and decisively against Kapitza.[60] Alone Kapitza could hardly compete with Beria, but Beria's political rivals within the Soviet leadership could use critics like Kapitza to dislodge Beria and to secure for themselves a favored relationship

58. Kapitza continued to chair the Technical Council of the Glavkislorod.
59. Stalin to Kapitza, 4 Apr 1946 (*PN*); Cf. Boag et al. (ref. 16), 378.
60. See *PN*, 258.

with Stalin.[61] More significantly, perhaps, Soviet ruling bodies were being reorganized in March 1946; during that time, Beria and Malenkov became full members of the Politburo, making them Stalin's deputies and confirming their growing influence. In the new calculus of power, Kapitza's work in the Glavkislorod fell under Beria's official responsibilities. Hence Kapitza had to write officially to Beria to request the creation of a state commission to examine his new invention.[62]

This invention, the final part of the apparatus that would produce the gaseous oxygen used in metallurgy, was sent on Staln's orders to a commission chaired by one of the higher party officials, M.Z. Saburov, for review.[63] The commission prepared a positive report that mentioned only a few slight defects.[64] But instead of following the commission's recommendations, the government ordered it to review not only this latest device, but also the entire work of the Galvkislorod throughout its production of Kapitza's invention.[65] The minister of Chemical Industries, M.G. Pervukhin, the minister of Heavy Machine Building, V.A. Malyshev, and three engineers, I.P. Usyukin, S.Y. Gersh, and N.I. Gelperin, joined the commission. Kapitza immediately challenged the three engineers, whom he recognized as his scientific opponents.[66]

In a month, this new commission prepared a much more critical report. They found that German devices made by Linde and Fränkl—based on the ordinary scheme of liquefaction, the Joule-Thomson method—were much more economical than the method proposed by Kapitza. They proposed further improvements of his apparatus and an immediate industrial trial of the apparatus seized from Germany.[67] Kapitza accused the commission of prejudice and rejected its report. He pointed out that he had not been invited to its meetings or informed of the arguments against him; furthermore, the logic behind their conclusions shocked him. He wrote a lengthy defense.[68] This,

61. Those who study the Kremlin have often argued that Stalin provoked, and even enjoyed, political intrigues among the Soviet elite. See A. Avtorkhanov, *Zagadka smerti Stalina: Zagovor Beria* (Frankfurt, 1976), and W.G. Hahn, *Postwar Soviet politics: The fall of Zhdanov and the defeat of modernization, 1946–1953* (Ithaca, 1982).

62. Kapitza to Beria, 2 Apr 1946 (*PN*).

63. Decree of the Council of Ministers, no. 832, 13 Apr 1946 (KA).

64. Committee of experts, "Conclusion," 23 Apr 1946 (KA).

65. Decree of the Council of Ministers, no. 1034, 14 May 1946 (KA).

66. Kapitza to Stalin, 19 May, and 19 May 1946 (*PN*). The first letter is an official one, the second a personal letter.

67. Committee of experts under the chairmanship of V.A. Malyshev, "Conclusion," 14 June 1946 (KA).

68. Kapitza to Stalin, 2 June and 16 Jul 1946; Kapitza to Malenkov, 25 June 1946 (*PN*). Kapitza's notes on the conclusions of the committee of experts appears in KA.

however, made little difference. As higher authorities continued to screen the case, the accusations against Kapitza became more and more serious.

The state commission headed by Saburov recommended that Kapitza be released from his position as head of the Glavkislorod.[69] I.P. Bardin opposed the suggestion and wrote a separate opinion in favor of Kapitza, but to no effect. Later, the Council of Ministers decided to expel Kapitza from the directorship of his Institute as well.[70] Stalin eventually signed the official decision that said that Kapitza had failed to fulfill government orders for the construction of more efficient apparatus for the production of gaseous oxygen. The report claimed that the liquid-oxygen apparatus also had serious defects and that Kapitza deliberately ignored foreign innovations and stubbornly rejected the suggestions of Soviet specialists. Finally, the commission accused him of being more occupied with experiments than with industrial applications. Sukov made good his bid to replace Kapitza as the head of the Glavk, and A.P. Aleksandrov, a corresponding member of the Academy of Sciences and a student of Ioffe's, became the new director of the Institute of Physical Problems. In line with the government, the Academy of Sciences also produced similar conclusions about Kapitza.[71]

Kapitza did not lose all his official positions. He retreated to his country house near Moscow because his home in Moscow sat on the property of the Institute from which he had been expelled. At least formally, he held the position of editor-in-chief of the *Journal of physics* until 1947, when the journal ceased publication at the peak of a new nationalist campaign against the so-called "cosmopolitans."[72] This movement forced another break between Soviet science and the international community. Kapitza did not immediately lose his position in the Ministry of Higher Education, which was independent from the Academy of Sciences. Until May 1947, he held the chair of low-temperature physics at Moscow University, and between September 1947 and January 1950 he held another chair of general physics in the Physico-Technical Department of the University.[73] He officially lost the first chair because he already held "several offices"

69. The Saburov Commission to Stalin (KA).

70. Decree of the Council of Ministers, no. 1815-782, 17 Aug 1946 (KA).

71. The Presidium on the Academy of Sciences, "On the leadership of the Institute of Physical Problems," 20 Sep 1946, AAN, copy in Kapitza's personal dossier (AAN, 411/3/445), 291.

72. The *Journal of physics* was the only Russian journal at the time that published papers in English.

73. This department was the predecessor of the Moscow Physico-Technical Institute.

and he lost the second because he had "too few pedagogical responsibilities." Other documents suggest that he actually lost the last position because he failed to attend the official celebrations of Stalin's seventieth birthday.[74]

S.I. Vavilov, the president of the Academy of Sciences, followed the orders from above with one hand, and at the same time quietly diminished the harm those orders would cause with the other. In September 1946, he issued a report to the Presidium of the Academy, after which the Academy decided to fire Kapitza from his Institute. A year later, Vavilov privately asked the director of the Institute of Crystallography, A.V. Shubnikov, to hire Kapitza as a senior scientific fellow.[75]

Kapitza continued his research at his country house. There, he conducted the small experiments and theoretical work that did not require elaborate equipment. Several of the resulting papers appeared in Soviet physical journals, but his public correspondences dropped off. He wrote fewer letters than before to Vavilov, Stalin, and Malenkov, the last of whom probably was willing to support him. He tried without much success to exonerate himself from unfair accusations: he explained that his oxygen method had proved productive and was used widely in other countries. Yet while he tried to justify things past, he also attempted to gain the interest of the politicians in his new scientific work, in particular its military significance.[76]

Harsh ideological struggles in science and culture became ubiquitous in the Soviet Union between 1947 and 1950. In the famous Lysenko session of August 1948, biologists came under intense public scrutiny because some had questioned the dominant ideas they had supported through their science. Physicists saw that they could face similar investigations. A meeting for them was being prepared for the winter of 1949. Some opportunists armed themselves with the ideological slogans of the time in order to eliminate members of their community. The meeting, set for March 1949, was shaping into a revolt of university physicists, especially those in Moscow, against the hegemony of physicists from the Academy of Sciences. Several prominent figures of the Academy, including Ioffe, Landau, and M.A. Markov, knew that they would suffer severe criticism. Kapitza's name also appeared on the list of "cosmopolites" to be dealt a blow during the meeting.[77] Fortunately for Kapitza, and perhaps for Soviet

74. AAN. See also Kapitza's personal dossier (AAN, 441/3/445), and *PN*, 291.

75. A.V. Shubnikov, "To, chto sokhzanila pamyat" in ibid., *Sergei Ivanovich Vavilov: Ochezki i vospominaniya* (Moscow, 1991), 171.

76. Kapitza to Stalin, 6 Aug 1948, and 30 Dec 1950; Kapitza to Malenkov, 25 June 1950 (*PN*).

77. Documents of the All-Union Conference of Physicists, Central State Archives of

physics, the meeting was postponed and then never rescheduled, probably through the intervention of Kurchatov.

Four years later, Beria lost his bid for power after Stalin's death. He was expelled from all ruling bodies and arrested in July 1953. Quickly taking advantage of the fall of his nemesis, Kapitza wrote to Malenkov asking to be restored to his former status.[78] Soon afterwards, the Academy of Sciences granted Kapitza's personal laboratory at his country house the status of Physical Laboratory of the Academy of Sciences, officially linking it to the Institute of Physical Problems and returning Kapitza to the staff of the Institute.[79] His oxygen machine also returned to service; in the Soviet Union as well as abroad it was widely used to produce oxygen on a large scale. Gradually, Kapitza returned to his administrative positions. In 1955, he again became director of the Institute, as well as the editor of the leading Soviet physical journal, the *Journal of theoretical and experimental physics*. In the same year, he rejoined the Bureau of the Physico-Mathematical Division of the Academy of Sciences. These appointments—this change of fortune—had required the blessing of the Communist Party's Central Committee. Kapitza had been writing letters to the new high officials, including Nikita Khruschev.

As the years passed, Kapitza had become more and more accustomed, or reconciled, to life in the Soviet Union. No matter how muted his criticism however, he insisted on freedom to criticize. He was neither an oppositionist nor a staunch dissident. He based his collaboration with the most unsavory political authorities on the principle, if such it be, of compromise. He knew enough to restrict his remarks to very specific topics of science and science policy. He did not find it easy to establish and maintain this kind of compromise. By withholding fervor from his arguments, Kapitza would have acted against his conscience and dignity. By saying too much, he would have to confront the powers he was trying to placate. He did not enjoy the game, but, with only a few exceptions, he succeeded in avoiding its dangers.

To appreciate more precisely the level of Kapitza's compromises, we can compare his case with two other notable examples. Andrei Sakharov began his public activities in the late 1950s, when his rank among scientists far exceeded that of Kapitza in the 1930s. Sakharov addressed political questions openly, and his collaborations with

the October Revolution (Moscow, 1949), 9396/1/244.

78. Kapitza to Malenkov, 22 Jul 1953 (*PN*). For about a year after Stalin's death in March 1953, Malenkov appeared as Stalin's most likely successor.

79. The Presidium of the Academy of Sciences, 28 Aug 1953, Kapitza's personal dossier (AAN, 411/3/445).

powerful political leaders lacked the subtlety that had made Kapitza so durable. The Soviet leadership quickly recognized that Sakharov's criticism infringed on their private territory; Sakharov represented a kind of political opposition they would not tolerate. In the time of Stalin, political critics disappeared almost as soon as they spoke. And even when Sakharov re-emerged in later, less repressive periods, he was deprived of most responsibilities within the existing political and scientific establishments. Kapitza avoided such a bitter fate; he chose instead to write only about subjects related to science. Kapitza did not support Sakharov's opinions. But neither did he sign the infamous letter of condemnation written by other academicians in 1980. When that letter was published in the press, Kapitza wrote in Sakharov's defense to Yuri Andropov, the chief of the KGB, asking that Sakharov be permitted to continue scientific work without being persecuted for his political dissent.[80]

Another famous scientist, S.I. Vavilov, chose a different path. A talented physicist who co-authored the discovery of Cherenkov radiation in 1934, Vavilov probably did not support the official ideology of the time. Yet beginning in the early 1930s, he frequently published pieces supportive of the new order in the Soviet Union. By 1932, Vavilov had become director of the Physical Institute of the Academy of Sciences; later, between 1945 and 1951, he served as the last president of the Academy not a member of the Communist Party. In order to keep his position, he had to take part in ideological pogroms against science. When the Lysenko sessions produced a list of harsh actions against geneticists, Vavilov carried them out. He presided over similar sessions on the history of science in 1949 and on physiology in 1950. And Vavilov gave talks and published papers celebrating the official policy of the Soviet Union, whatever that policy happened to be.

Nonetheless, Vavilov tried to keep the interests of science at heart and to minimize the effects of political brutality upon science. For example, he was expected to condemn philosophical idealism and cosmopolitan thinking among physicists in a major talk for the physical session of 1949. The Archive of the Academy of Sciences has preserved four versions of his talk. The earliest of them is extremely mild; Vavilov blamed no Soviet physicist by name, and criticized only the practice of translating Western books on physics into Russian without mentioning in the prefaces or in footnotes their philosophical and political "mistakes." In discussions within the Organizing Committee of the session, however, some participants pressed for more

80. Kapitza to Andropov, 11 Nov 1980 (*PN*).

aggressive assertions. Vavilov eventually conceded.[81] By continually appeasing those in power, he sacrificed his personal honesty and led a double life. But, perhaps, a more naive person, or a person of stauncher principles, in his place would have been more dangerous to Soviet science than he was.

Kapitza trod a path somewhere between Sakharov's and Vavilov's. All three faced dilemmas that entailed in one form or another compromises with immoral political forces.[82] Kapitza only once stepped out of the boundaries he established for himself in the 1930s. His arguments against Beria in 1945 were not more bellicose than usual, but Kapitza delivered them in a manner that resembled too closely the hardline political conflicts of the time. Whereas he assumed the role of educator during the 1930s, he competed actively for power as he engaged in administrative struggles a decade later. Playing politics, however, proved perilous. Despite the bitter consequences of his later years, Kapitza did manage nevertheless to maintain a position of moral value. Trapped within the borders of the Soviet Union, he chose a path that combined his personal sense of independence with his efforts for constructive social and scientific change.

81. S.I. Vavilov, "Ideologiya sovzemennoi fiziki i zadachi sovetskikh fizikov" [1949], in the Archives of the Academy of Sciences, Vavilov's collection (AAN 596/1/80).

82. To compare the predicament of German scientists during the Nazi regime with the dilemmas faced by their colleagues in the Soviet Union, see Alan D. Beyerchen, *Scientists under Hitler* (New Haven, 1977), and J.L. Heilbron, *The dilemmas of an upright man: Max Planck as spokesman for German science* (Berkeley, 1986).