LIVING IN TRUTH: PHYSICS AS A WAY OF LIFE

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> What does it mean to live in truth? Putting it negatively is easy enough: it means not lying, not hiding, and not dissimulating. – *Milan Kundera*[i]

The figure of the physicist has a particular fascination for the popular imagination, and the figure of the Soviet physicist carries connotations of James Bond-ian villainy or, for the more highbrow, a technocratic elite that benefited from a good education provided by an oppressive society. In this ethnographic study of a group of physicists centered around one of the leading figures of Soviet theoretical physics, Vladimir Gribov (1930-1997), we wanted to explore the ethos and *habitus* of Soviet scientists who worked at the cutting edge of quantum field theory, plasma physics, nuclear and elementary particle research at a time when mediocrity or decay (by international measures) ruled in many other fields of science, art, and industry.[ii] We argue that in the group we studied, the choice of physics as a profession was influenced less by the benefits of belonging to the technological elite in itself than by the belief that physics offered *both* a tolerable living *and* an officially sanctioned exemption from ideological make-believe. The physicists of the group we studied neither lived in ivory towers nor were willing accomplices in the state's nuclear project. Instead they created a non-state social space in which lifestyle and values were substantially influenced by their belief in physical truth.

Window to freedom

The fate of theoretical physicists of Gribov's immediate postwar generation was shaped by a totalitarian state that needed them in order to modernize and assert itself but was deeply suspicious of and hostile to their intellect – a state that offered them optimal working conditions, and at the same time wiretapped and killed them.

Physics was in the 20th century what biotechnology and computer science is to young people today. After the war, nuclear physics in particular attracted young people around the world as not just the key to powerful weapons and unlimited energy but also the answer to fundamental questions about the structure of the universe. Until the late sixties, faith in progress was as strong a driving force in the Soviet Union as it was in the West, and physics was seen as the central means to that end. Here in particular, countless talented young people studied it. Why?

To begin with, physics had a solid institutional basis. Right after their takeover, the Bolsheviks decided that physics, which had lagged far behind the West in Imperial Russia, should be at the cutting edge of scientific research. Natural sciences were to revolutionize the forces of production. As civil war raged across the land in 1918, Abram Ioffe, Wilhelm Roentgen's student in Göttingen, opened the Petrograd Physico-Technical Institute, the first of many research institutes to be founded in the coming years. After the atomic bomb was dropped in 1945, physics in the Soviet Union gained additional momentum. A nuclear project was created, huge secret research installations and important "open" institutes sprang up across the country, and a generation of outstanding scientists matured and catapulted Soviet physics to a premier position on the world stage.[iii] For instance, Lev Landau was the key figure among the Leningrad theoreticians. Inspired by the cosmopolitan scientific community he had experienced in Niels Bohr's milieu in Copenhagen, he designed a system of physics education consisting of seminars, textbooks, and examinations. Charismatic, provocative, and uncompromising, Landau created a unique intellectual microclimate that attracted and strongly influenced many disciples and co-workers.[iv]

When Gribov's generation entered university, the Cold War had just started, and physicists were in urgent need. Their salaries were increased fourfold, and ample research

funding made available (Gorelik 2000:133-134). More physicists were inducted into the Academy of Sciences, which meant faster access to a bearable flat or a dacha and special food deliveries. Yet salaries stagnated under Khrushchev, and an average physicist in the seventies earned less than the bus driver that took him to his institute. Families of physicists, like everyone else, spent considerable energy in order to satisfy their basic needs, not to mention obtaining luxuries.

Nevertheless, it was not just the euphoria for science and privileges that made young people study physics after World War II; it was also the restrictive intellectual climate of the Soviet Union. The post-Stalinist generation of physicists who had come of age in the last war years lived in a society that denied them opportunities to express the horrors they had experienced under Stalin. To critically minded people physics offered a rare ideology-free niche in which one was officially allowed, even compelled, to search for the truth.

In the thirties and forties, physics had faced attempts of ideological cleansing. Relativity and quantum mechanics had to be defended from "philosophers'" accusations that they were "bourgeois" and "idealistic" theories. Most of the key physicists in Leningrad, Moscow, and Kharkov were arrested in the purges of 1938-39. In 1948, the threat of a massive attack on physics arose again, as plans were made for a congress at which leading physicists were to be denounced for ideological mistakes. If the congress had taken place, the fate of Soviet physics may well have mirrored that of Soviet genetics: Stalin's protégé, the agricultural "scientist" Trofim Lysenko had just succeeded in having genetics banned in the Soviet Union (Gorelik 2000:162-163). Two days before the physics congress was due to begin, however, it was cancelled. Lavrentii Beriia, the chief of the secret service, had learned just in time that work on the bomb was based on the "bourgeois" theories that were heading for damnation. According to an anecdote recorded by Gorelik, Stalin responded with the words, "Let them go. We can always shoot them later." Landau called this the first case of nuclear deterrence in history.[v]

Despite such threats, ideology had little impact on physics. Although textbook passages about the Heisenberg uncertainty principle proclaimed that the principle's interpretation should follow Lenin's thought, only a score of opportunists and mediocre scientists were actually impressed with the attacks on "idealism."

Boris Altshuler, today a professor of theoretical physics at Princeton, recalls his decision to study physics in the sixties: "Career choices in the Soviet Union were obviously limited. Many careers either didn't exist or offered no intellectual freedom. The natural sciences were the only profession that secured relative independence both in intellectual and economic terms."

Consequently, many of those who had actually wanted to pursue other professions also ended up in physics. When Lev Okun, who today divides his time between the Institute of Theoretical and Experimental Physics (ITEP) in Moscow and CERN in Geneva, finished secondary school in 1947, he wanted to study literature:

My friend and I went to Moscow University, to the Department of Philology…and we wanted to talk to the dean. But before that, a professor [appeared] in this position [bent forward], and he opened the door as if a god was there, and he was very frightened and humiliated.… And my friend and I looked at each other, and we turned back and never entered this building again.… I never saw anybody [in physics] who behaved like this.

The desire for freedom played a role in prompting many of the most talented students to specialize in theoretical physics in their senior years of study. Experimentalists were vulnerable to material conditions, whereas the only thing theoreticians needed to work was their brains. In the country in which they lived, this was a big advantage: Landau performed the calculations for his theory of the shock wave in prison; later, physicists who did not find jobs in science could work at home. Not until the seventies was the Soviet Union's lag in computerization felt in theoretical physics.

While work on projects related to bombs and nuclear power stations was expected, outside that obligation physicists enjoyed wide-ranging freedoms and little pressure to achieve quick results. Boris Altshuler describes the informal work style of theoreticians at the Leningrad Institute for Nuclear Physics in Gatchina, where he worked between 1978 and 1989, in this way:

We had no particular obligations. We didn't have to teach, and we were basically free to decide what we wanted to work on. People in the U.S. can't imagine that kind of freedom. Here, you spend a lot of your time writing

applications for grants that you may or may not get. In Leningrad, if you wanted to switch from solid-state to particle physics, no problem: all you had to do is perhaps move to another group.

From the beginning, Soviet ideology had supported a close relationship between research and industry. Science was to serve the people, not be confined to ivory towers. Yet in practice, the economy was unsuited to make use of most scientific innovations. Nonetheless, arguing that advances in physics are often based on unexpected discoveries, physicists generally succeeded in convincing the leadership to let them conduct the research they wanted.

Gribov's circle

After the war, the exhausted Soviet people experienced a few years that were free from the campaigns and nightly arrests of the thirties. Soon, however, the respite was over, particularly for Jews. In the twenties and early thirties, Jews, along with the rest of the disenfranchised populations of Russia – peasants and workers – gained access to education and upward mobility. Some of Landau's students, including Isaak Pomeranchuk and Leonid Piatigorskii, came from shtetls.

In 1937, however, Stalin's nationalities policy made a clean break with pluralism. Later, war propaganda used Russian nationalism to raise morale, and after the victory, it took on a new life as a tool of oppression. The campaign against "deference to Western bourgeois science" (Gorelik and Kozhevnikov 1999) launched in 1947, was linked to the massive anti-Semitic campaigns of Stalin's last years. Most of Gribov's university friends were convinced atheists, but according to their identity documents, they were Jews. Gerasim Eliashberg, who belonged to the circle, notes that "In 1950-52, the cruelties of the late thirties appeared to repeat themselves. Those who were older had already developed a system of survival…and were very closed to outsiders. But it took us freshmen a while to realize that we had to be, too … Our little group enabled us to survive and to stay human."

[A]s a Jew I wouldn't get the permission to specialize in nuclear physics. So in my second year at the university I made a cynical decision. I went to the Komsomol leader. After the guy had understood what it was about, he said: "There is this Tito clique at the university. Write an article unmasking them for the wall newspaper." And I did. But then Volodia Gribov and his friend Lionia Altshuler came along…and said, "Do something like this one more time and we won't say hello to you again."

Tania Altshuler, later Lionia's wife and who today teaches physics in New Jersey, was one of the friends. "We had a toast," she recalls. "We used to say: 'To it!' And that stood for 'To (Stalin's) kicking the bucket.'"

Gribov graduated from the university in 1953. The Ministry of Middle Machine-Building – Soviet-speak for the ministry of nuclear energy – assigned him to teach at a school in the town of Rzhev, Kalinin Province. But, in a textbook case of bureaucratic absurdity, he succeeded in exchanging that post for one at an evening school for workers in the Rzhevka neighborhood of Leningrad's Kalinin District. During the day, Gribov went to seminars at the Physico-Technical Institute. "Volodia was very good," recalls Karen Ter-Martirossian, today at ITEP, "and I encouraged him to sit for Landau's theoretical minimum," a unique examination that only 43 candidates passed.

Landau was not just a top physicist who got the 1962 Nobel Prize for his theory of superconductivity and whose nine-volume course of theoretical physics remains a standard text worldwide; he was also an electrifying personality whose impulsive habitus stood in contrast with the conformism of Soviet society. At the seminars, he was always ready for battle, initiating wild brainstorming sessions during which everyone interrupted and chased everyone else from the blackboard. Often offensive and brusque, he demanded the kind of uncompromising search for truth from his students that drove his own quest. He preferred to work at home, on the couch in his study. Lying there, he received fellow physicists, and when he tired of them he simply turned to the wall (see Landau-Drobantseva 1999).

In the 1960s, Gribov's seminars became to the physicists of the "new" Leningrad school what Landau's had been to his own generation. Volodia Anisovich, a physicist at LNPI, recalls his first meeting with Gribov towards the end of his student years:

There are some ten people and someone is talking, and I even understand what he is saying. Suddenly a man with black hair and a sharp narrow face jumps up and says something, and I see that I understand nothing. I am even a bit irritated: everything has been fine, why did he have to jump up! Suddenly a second man…jumps up, a bit older and starts arguing…Volodia [Gribov] and Karen [Ter-Martirossian]. After this a total mess sets in. The

presenter disappears, Volodia and Karen shout at each other, pick up pieces of chalk, write something. At the end, Volodia is left alone at the blackboard, explaining something.… I have understood nothing of the whole thing…so I go home.

Landau and Gribov were alike in another way. Both "felt" physics as a unity. Yuri Dokshitzer, today a professor at the Université Paris VI, describes Gribov's approach to physics in this way:

He had a profound knowledge and skill in using mathematical methods in physics. However…what mattered most was…"a picture." He would approach the problem from different angles, abstracting its essential features and illustrating them with the help of simplified models and analogues from different branches of physics.

People unfamiliar with his style were often confused…some felt they were being cheated: a couple of chalk drawings, a strain of hand-waving arguments, and – here you are: that's the answer? Such listeners were not aware that…for Gribov it went without saying that the receiving party is capable of reproducing the necessary mathematical calculations (Dokshitzer 1998:x).

"I am not smarter, I just think more," Gribov once said (Dokshitzer 1998:x). While he became one of the most important theoretical physicists of the 20th century, particularly in the area of particle interactions at high energies, it was not only his knowledge of inorganic matter that impressed those who met him. He questioned conventionally convenient political views both in science and in politics. In the early sixties, Gribov upset fellow Soviet intellectuals with the question of whether it had not been Lenin, rather than just Stalin, who had perverted the socialist idea. A bit later he contradicted the consensus among the intelligentsia at the time that communism and capitalism would eventually converge, and he claimed that the United States had irreversibly overtaken the Soviet Union.

As changing jobs was a difficult procedure requiring multiple permissions, a group of physicists would normally work together for many years. Once one had a job, material rewards associated with performance were limited, there was no pressure to publish, and teachers did not expect quick results from their doctoral students. The work routine of theoreticians was based on intensive thinking (i.e., the couch) and continuous dialogue with colleagues (the seminar). Problems presented at seminars were jointly scrutinized from all possible perspectives. Ideas about "hot" topics were thus rapidly shared, and the thinking of each individual built on that of the many.

Theoreticians congregated around leaders who, in the post-war period, included Landau, Pomeranchuk, Gribov, as well as Igor Tamm at the Physics Institute of the Academy of Sciences (FIAN) in Moscow and Nikolai Bogoliubov, head of the Joint Institute for Nuclear Research (JINR) in Dubna. Senior scholars were relatively free to choose their students and co-workers, because apart from the informal discrimination of Jewish applicants, there were no standard hiring criteria or procedures. And while scientific discussions took place in a completely egalitarian and communitarian spirit, with everyone allowed to criticize, students rarely questioned the scientific authority of their teachers. This mixture of authoritarian structure and communitarian devotion resulted in a critical mass of creative thinkers able to keep the debate at a consistently high level.

Physics as a lifestyle

The Leningrad physicists around Gribov and the "Moscow Lenigradians" at the Landau Institute and ITEP shared more than a style of thinking and working: they also comprised communities of lifestyle and values. Physics was for them far more than a profession: it was a vocation and a way of life. When they were not at the institute, the theoreticians worked at home, thinking, smoking, and talking: "making physics," as Gribov's second wife Julia Nyiri, herself a physicist, called it. Summer and winter schools of theoretical physics were orgies of undiluted physics-making. Events of the Leningrad Physico-Technical Institute (later the LNPI) took place in the countryside holiday homes of the Academy of Sciences. Yuri Dokshitzer, whose father had made him suffer through a rigorous musical education, played songs by Okudzhava, Vysotskii, and Galich on his guitar. Alexei Kaidalov from ITEP sang.[vi] The lifestyle of physics-making was punctuated by mountaineering and kayak trips and flavored by *samizdat* copies of poetry by Mandelshtam, Solzhenitsyn's prose, or Agatha Christie and Irving Stone novels bought during trips to the West. Physicists' flats housed readings by actors and concerts by bards Bulat Okudzhava and Vladimir Vysotskii, members of an emerging

alternative to the totalitarian uniformity of culture.

The struggle for truth

Intellectual exchanges were of a particular intensity. Otherwise a mild man, Gribov could be harsh when he felt that someone was not honestly trying to get an answer. Intense curiosity and belief in the meaningfulness of one's work, enjoyment of the creative process for its own sake, and a sensual pleasure in being able to express a piece of physical reality in a clear form – all these may be particularly characteristic of theoretical physicists anywhere. But Western physicists too found the intellectual intensity of the exchanges that went on in the Leningrad school fascinating.

Partly, the explanation lay in the oppressive nature of Soviet society, which gave any niche culture a particular intensity. Whereas any questioning of an official statement to the outside was dangerous, discussions in the "inner circle" were endless and passionate. "How could brains seized by fear and ideological pressure at the same time think independently and creatively in their professional fields? Apparently the matter is that work was salvation, a sort of internal emigration," writes Evgenii Feinberg (1999:69). In addition, there were simply fewer material distractions. As Vitalii Ginzburg put it, "Work and science was everything to us: a perfume and even a narcotic" (Shapiro 2001).

Moreover, the search for truth in physics carried a broader meaning. It was the defense of a moral stand against falsehood that could not be publicly displayed in other domains of Soviet life. Independently of each other, both Evgenii Feinberg and Gerasim Eliashberg said the same sentence: "Physics was the only way to maintain one's human integrity." A third physicist, Yurii Petrov, a close friend of Gribov's, emphasized: "Numbers cannot lie." The rationality and objectivity of "pure science" offered natural scientists a way out of irrationality and ideological license.

On the one hand, the political views of leaders of schools in physics influenced their students and co-workers. On the other hand, they attracted students and co-workers with similar views. Until the mid-thirties, Landau had held revolutionary views. He appreciated the Soviet government's promotion of rationality and science and its anti-clericalism. As late as in 1935, he published an article in *Izvestiia* arguing that socialism was better suited for the development of science than capitalism (Gorelik 1995:200-202). But a year in prison in 1938 changed Landau from supporter to opponent. Ordered to calculate energy transfer processes important for the making of the bomb, he worked on them only because he was forced to. As he received Stalin Prizes in 1949 and 1953 and the title "Hero of Socialist Labor" in 1954, he called himself a "learned slave" (Ilizarov 1999) and advised friends to "use all your strength to avoid getting into the thick of the nuclear business" (Gorelik 2000:239-241). As soon as Stalin was dead, Landau announced: "He is gone, I am no longer afraid of him. And I am not going to work on this [the hydrogen bomb] any more" (Khalatnikov 1994).

Such views were highly unusual at a time when most physicists were not only convinced that the world needed a nuclear counterweight to the United States, but were also more generally entertaining new hopes of a "true" socialism under Khrushchev (Feinberg 1999:52-53, Shapiro 2001, Gorelik 2000:239-241). Andrei Sakharov, one of the fathers of the H-bomb, wrote: "On the one hand I was excited by the possibility to make excellent physics. On the other hand I…was innerly convinced that this work was *necessary*.… I felt that I was a *soldier* in this scientific-technological [war]" (Sakharov 1996[1990]:142).

To some extent, then, the trauma that began in 1937 had brought about a change in the relative political positions of the two great physical schools vis-à-vis the regime. The "Moscow school" that had originated from Tamm's teacher Leonid Mandelshtam, as well as other Moscow-based scholarly traditions identified with such names as Vernadskii, Papaleksi, and Andronov, included many scientists who had been part of the pre-Bolshevik liberal elite (Holloway 1994:30). These scholars had met the Soviet regime with apprehension (e.g. Andreev 1998:248-286), while those of the Ioffe school were finally enjoying the social mobility they had been deprived of in Imperial Russia and were not too concerned with the demise of the old cultural elite.

After the Stalinist purges, however, the ex-leftists of the Ioffe school became irreconcilable critics of the regime. As Evgenii Feinberg recalls, he and his FIAN colleagues Igor Tamm, Vitalii Ginzburg, and Andrei Sakharov, like most Soviet citizens, cried at the news of Stalin's death and continued to see him as a great statesman until Khrushchev's speech at the Twentieth Congress of the CPSU. For Landau and many of his students, by contrast,

March 5, 1953 brought the granting of a cherished wish.

To say that Landau's circle was more open in opposing the regime than Tamm's and was therefore treated worse would be too simplistic. All of the "Moscow" physicists just mentioned had lost relatives in the purges and had come close to being arrested themselves, and they fully appreciated how physics as a discipline had nearly escaped extinction. Members of both schools had courageously defended Mandelshtam and other physicists under attack before Stalin's death (Gorelik 1995:248). Leontovich, a Mandelshtam student, was opposed to work on the bomb (Gorelik 1995:242); Tamm spearheaded the unseating of Lysenko from his throne as the tsar of biological sciences, thus making possible the rehabilitation of genetics (Ilizarov 1998); and Sakharov became the best-known dissident of the Soviet Union. Nonetheless, the Landau circle and the *apparat* developed an irreconcilable distrust of each other. Although Landau never risked public confrontation after 1938, his outrageously anti-Soviet private statements earned him a systematic effort to isolate him from foreign scientists and reduce his domestic influence (Ilizarov 1999).

The mistrust that characterized the relations between the power holders and the scientists they needed but whose work they could hardly control remained unchanged until the *perestroika.* Ella Ryndina, an experimental physicist and Landau's niece, always had a pillow on the telephone to muffle the sounds picked up by the bug. Everyone knew to speak openly only during outdoors walks. One physicist who was giving an enthusiastic account of his trip to the West, added, for the ears of the spies: "But to think of it that they have to live under capitalism!"[vii]

As division head in Gatchina, Gribov should actually have been a Party member. But he was reluctant to join, and among the 70 physicists on his staff there were just four or five members. This was unusual, even taking into account that physicists generally had very low Party membership rates, that rates among theoreticians were even lower than among experimentalists, and that ITEP in Moscow and LNPI in Leningrad had lower rates than other research institutes. Only some 10% of around 2,000 scientists in Gatchina were in the Party. So low were these rates that some of the leaders themselves grew concerned. Lev Okun recalls that Pomeranchuk, who was not a Party member, repeatedly tried to persuade him to join. "He said, 'Look, there are no party members in our department, that's bad, and for the benefit of others could you do this?' And I would tell him, 'Please go ahead, and I will follow you.'" [viii]

Within the division, there was an intuitive understanding. "Pomeranchuk," Ioffe recalls, "used to come to my room and ask, 'Have you read this morning's *Pravda*?' 'Yes,' I would say. 'Aha! And did you notice anything in particular?' 'The article about the meeting of the Party committee in this and this province.' 'A-*ha!* What about it?' 'The order in which the members of the Politburo were listed.' '*Aha!'* And that was the end of the conversation. Both of us understood that the order of the names pointed to some shift in the power configuration in the Party leadership." [ix]

Few Soviet physicists became open dissidents like Andrei Sakharov or Yuri Orlov. "Most of us were dissidents at heart and in the kitchen, but public resistance was more infrequent than with the biologists, who were being hindered in their work," says Ilya Roizen, a student of Vitalii Ginzburg.[x] Very few physicists were directly confronted with the choice between professional renown and human integrity that every artist or academic in the humanities had to face. They admired Sakharov's courage but saw that political engagement barred one from the practice of really good science. Even theoreticians, who continued thinking under arrest and in camps, could not produce consequential work under persecution. "I understood that I had to choose between doing science and fighting with the KGB and the government.… I thought that my first obligation is to do physics as well as I can," says Okun.

There were subtle ways to resist. Every now and then physicists would be requested to sign a state-sponsored letter of solidarity or protest. Those who did not want to often disappeared for a few days. When the President of the Academy of Sciences, the physicist A. P. Aleksandrov, was asked to criticize Sakharov in an official letter, he had supposedly gone on an extended drinking binge and was "unfortunately" unavailable.

The three fortresses

Not all theoretical physicists had strained ties with the powerholders. Because the Moscow school around Tamm, which was seen as more conciliatory than Landau's circle, certainly did not enjoy the trust of officials,

Nikolai Bogoliubov, a pioneer in the theory of superconductivity and in field theory, was built up as the official great Soviet theoretician beginning in the fifties.

While relations between the Landau and Tamm schools were generally good, those between Landau and Bogoliubov deteriorated in the sixties to such an extent that Pomeranchuk spoke of three fortresses of Soviet theoretical physics: Dubna, FIAN, and the alliance of ITEP in Moscow, and the Physico-Technical Institute in Leningrad (later the Leningrad Institute of Nuclear Physics).[xi] Landau appreciated Bogoliubov's own work but reacted sharply to his scientific compromises and political maneuvers.[xii] Bogoliubov surrounded himself with mediocre but politicaly opportune physicists. Allegations that they were unfairly hoarding titles and occupying key positions spread rapidly. Bogoliubov himself was, in addition to his position in Dubna, director of the Institute for Theoretical Physics in Kiev, Academician Secretary of the Division of Mathematics of the Academy of Sciences, and division head at the Academy's Institute for Mathematics.

Who ended up in which school was often a matter of serendipity, but physicists educated in one school often found it hard to feel at home in the other. In contrast to the egalitarian style of Landau's school, the Bogoliubov school was strongly hierarchical. Volodia Anisovich came to the Protvino accelerator, which was run by Logunov, a Bogoliubov student and member of the Party's Central Committee, from the Physico-Technical Institute in Leningrad. He recalls his outrage over one incident:

When I moved to Protvino I thought that all this talk about the difference was nonsense…but after about 10 years I firmly decided that I didn't want to be in Protvino. I discovered, at a seminar, an…error in a work co-authored by Logunov…. Somehow the seminar immediately ended…. Next day, Logunov called me into his huge office.… Everything was civil, I explained to him, he understood. And immediately I was given a huge bonus by the standards of the times. My jaw dropped.… My…idea was converted into a sum of money.

Contacts with the West

Soviet physicists suffered from the limits on contacts with their Western colleagues. Until the mid-thirties, they had regularly published in foreign journals, but then contacts became sparser and broke down almost completely during World War II, a state that lasted until the mid-fifties. With the exception of that period, Soviet physicists did have access to the main periodicals such as *Physics Review*, but even the short delay with which they arrived could be frustrating. "In the early '50s we used to calculate how much we are delayed by because of being separated from world science,"says Novozhilov.[xiii]

Contacts became possible once again in 1959, the first time a Rochester Conference, a major physics meeting, took place in the USSR. Soviet physicists were gradually allowed to go abroad again. But some remained *nevyiezdnye*, a term that could roughly be rendered as "unabroadable." Gribov, for example, was not allowed to go abroad for a long time despite the fact that several conferences in the West were devoted to the "Gribov copies" in the seventies.[xiv] "In 1968, I wanted to invite Alexei Anselm from Gribov's team to London," recalls the British physicist Elliot Leader. "The usual reply to invitations was: 'Thank you very much for inviting Professor X. Unfortunately, he is unable to go, but we will send Professor Y.' That was someone politically correct." The first time that everyone invited to a major conference in the West was actually allowed to attend was in 1988.

But, says Lev Okun, "Maybe the lack of communication with the West was in a certain sense a blessing, because it gave originality to what we did. Many serious things were first done in Russia, like Regge calculus by Volodia [Gribov], cp violation by ITEP people and Landau. These were trend-setting to the West." Three Soviet physics journals were translated into English in the United States; but by the time the scientific community was convinced of the correctness an idea and all officials had approved it, the same idea may already have appeared in the West.

With the collapse of the Soviet Union, the symbiosis of theoretical physicists and totalitarian regime ended. Military budgets shrank; in the Academy's institutes, cables fall from ceilings and paint from the walls. One can no longer live on an institute salary; there is no money for periodicals; and under President Putin, publishing is once again regulated. In the unlit corridors of ITEP, and on the wooded alleys of Chernogolovka and Gatchina, one still encounters physicists of the old guard, but most of them are visitors from abroad. Gribov, too, spent most of the time before his death in 1997 in such places as Princeton and Bonn.

Discussion

The theoretical physicists we discussed in this paper created ethical norms, lifestyles, and discourses that were different from the Soviet mainstream. On the outside, they adapted to the logics of ideological license and of the economy of scarcity, but inside of the community, that logic was ridiculed and its adherents ostracized. There the ruling values were those of the disinterested intellectual, of the context-independent beauty of the physical world, and of the egalitarian community of an intellectual elite.

Today, former members of that community, both those still in Russia and those now abroad, express a strong nostalgia for the lifestyle and intellectual intensity of Soviet physics. But their nostalgia is not couched in the terms of nostalgia encountered in other realms of post-Soviet society. On the contrary, they emphasize the exceptional nature of their group, maintaining that it had been able to live by the values it had due to a unique confluence of circumstances and personal choices.

The totalitarian environment was neither necessary nor sufficient to foster "intellectual cooperation (…) imagination and hard work in close alliance by high standards of honesty, directness, and concern for truth," in John Passmore's description of science at its best.[xv] Outside physics, other sciences were not spared overt political intervention in the choice of research problems. The external limits placed on freedom by the system, the misery of dictatorship, and missing alternative intellectual and sensual distractions were only some factors among many that determined the intensity of intellectual interaction within the community of theoretical physicists described here. Indeed, the elitist-egalitarian nature of science, the role of the "central figures" and the lifestyle of physics in Western Europe in the first half of the 20th century was little different from the Soviet Union.

But post-war science in the West was forced to adapt to democratic institutions, lost its positivistic appeal, and had to compete with other professions for the recruitment of the best brains. Scientists, whose enterprise was elitist by nature, had to accept the constraints of democratic institutions that then dealt with their ideas. The dynamics of research were impacted by the time constraints and election terms of various university and granting bodies that wanted to see results in the short term. The Soviet Union, meanwhile, maintained a system of top physics research that was free of these constraints. Paradoxically, beyond defense needs, problem choice in physics was free from obvious interference and the need to show "results." And, partly due to the lack of credibility of public social scientists, natural scientists could maintain their reputation as the engineers of human progress much longer.

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Notes

i The Unbearable Lightness of Being. Translated by Michael Henry Heim. London: Faber and Faber, 1985, p. 109.

ii The paper rests chiefly on some 20 interviews with ex-Soviet theoretical physicists in Russia, the United States, Germany, and France. We would particularly like to thank Julia Nyíri, Semion Gershtein, Liudmila Kolesnikova, Ilia Roizen, Evgenii Feinberg, and Yurii Petrov for not only talking to us, but also providing us with further contacts and resource material.

iii Several studies have been written on the early history of Soviet physics and on the Soviet nuclear project, including, in addition to those in Russian, Gorelik and Frenkel 1993, Gorelik 1995, Holloway 1994, Hall 1999.

iv See e.g. Khalatnikov 1989, Livanova 1980, also Gorelik 1995.

v See Gorelik 2000:162-164.

vi Interview with A. Belavin, Chernogolovka, 1 June 2001.

vii Interview with S. S. Gershtein, Moscow, June 2001.

viii Interview with L. Okun, Moscow, 3 June 2001.

ix Interview with B. L. Ioffe, Moscow, June 2001.

x Interview with Ilya Roizen, Moscow, June 2001.

xi Interview with Ya. I. Azimov, St. Petersburg, 7 May 2001.

xii Interview with S. S. Gershtein, Moscow, June 2001.

xiii Interview with Yu. V. Novozhilov. St. Petersburg, 7 May 2001.

xiv L. N. Lipatov, Energiia-Impul’s 9-10 (June) 1998 (Novosibirsk).

xv Science and Its Critics, 1972, quoted in Yehuda Elkana, “The Epistemology of Opposition to Science,”in William R. Shea and Beat Sitter, eds., Scientists and their Responsibility. Watson Publishing International: 1989, pp. 171-188.