Chapter 2
In Leningrad University (1926–1930)

2.1 Entering the University

Leningrad was the USSR's scientific capital, housing the Academy of Sciences and the main academic institutes until 1934. It was there that Bronstein became a physicist. Even though he was the author of several scientific papers, he still had to get a university diploma. One can imagine that. having been educated at home he was not over-enthusiastic about the prospect of studying according to official programs. No doubt he was aware of the gaps in his knowledge – after all, study is the major element in the theoretician's trade, yet at 19, Bronstein felt older than most of his fellow students. At the same time he could not but profit from being part of the physicists' community.

At that time, Leningrad boasted two higher educational establishments that offered a sound training in physics: the Polytechnical Institute with its Department of Physics and Mechanics and the university. The former, set up by Ioffe some seven year before, provided close ties between physics and technology. However, the training program included a wide range of engineering subjects and technological disciplines that a theoretician could have considered an unnecessary burden. Theoreticians were produced by the University despite it was a pretty old-fashioned. There were no famous scientists on its teaching staff (with the exception of D. Rozhdestvensky who was an experimenter). This was rooted in the past, when Petersburg University was inferior to Moscow University with its cluster of celebrities (A. Stoletov, A. Eikhenvald, P. Lebedev). Between 1907 and 1912 Paul Ehrenfest had managed to raise the level of Petersburg physics but in the twenties its teaching staff comprised mostly educators rather than researchers; Orest Khvolson (1852–1934) was one of them. He had written a definitive *Course of Physics* that was favorably accepted abroad (Einstein praised it and Fermi studied it). Though not young, he enthusiastically acclaimed the revolutionary theory of relativity and quantum physics.

Being a man of wide-flung interests, Bronstein was evidently attracted by the variety of subjects taught under one university roof: astronomy and philology, history and mathematics.

In 1926 Bronstein passed the entrance exams,[1] which probably presented no difficulties. Very soon he became a local celebrity with scientific papers in the best European physical journals to his name. His teachers were cautious not to become entangled in scientific discussions with him. He was known for his ability to pass

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any exam without much difficulty: early in November he went to Professor Khvolson to sit for an exam in general physics. Khvolson responded with: "You can't be serious, dear sir. The other day I read your article in *Zeitschrift für Physik*. It's not for you to sit for an exam in physics! Give me your record book". A week later he passed his exam in mathematics for the first year. His record book contained also signatures of V. Bursian, Y. Krutkov, P. Lukirsky, V. Fock, V. Frederiks [100].

Though he obviously could have finished his studies earlier he spent four years at the university. It seems that he considered the university a favorable milieu. Studies were by no means his main occupation during these years: it was at this time that he obtained some significant results in astrophysics that later (when academic degrees were reintroduced) earned him a degree of candidate of science without the usual procedure of defending a thesis.

It is very important for a young theoretician to have friends with whom he can discuss his ideas: young scientists tend to form rather stable groups of similarly minded people. In the spring of 1927 Bronstein was lucky enough to stumble across one such group, which he immediately joined. Significantly enough, it was poetry, rather than physics, that helped him.

2.2. The Jazz-Band

The group Bronstein joined was the famous Jazz-band, formed around George Gamow, Dmitry Ivanenko and Lev Landau[2], better known by their nicknames of Jonny, Dymus and Dau. They were called "the three musketeers". Some physicists and philosophers found it hard to follow the rapidly unfolding developments in physics and got polite indifference and littler respect from the "three musketeers". They reciprocated by calling them a "Jazz-gang".

Bronstein joined this musketeer group easily and naturally and faithfully served its royal majesty, physics.

Here is how Lady Peierls (1908–1986) described Bronstein's first encounter with the Jazz-band in a letter she sent to us on March 9, 1984. (She was Zhenya Kanegisser before when she married Rudolf Peierls in 1931, a German physicist whom she met at the Odessa physical congress. He was knighted for his scientific achievements, part of which could be attributed to his charming, optimistic and intelligent wife. After the spring 1926, when she joined the Jazz-band, she wrote much of its poetry.)

> I'll do my best to describe everything I remember of Matvei Bronstein. I first met him in early spring 1927. There were puddles everywhere, sparrows were chirping in a warm wind. On emerging from a laboratory on the Vasiliev Island I quoted a line from Gumilev to a young man who happened to pass by. He was not tall, wore large glasses and had a head of fine nicely cropped dark hair. Unexpectedly, he responded with a longer quotation from the same poem. I was

> delighted; we walked side by side to the University quoting our favorite poems. To my amazement Matvei recited *The Blue Star* by Gumilev which I had no chance of reading.
> At the University I rushed to Dymus and Jonny to tell to them about my new friend who knew all our favorite poems by heart and could recite *The Blue Star*.
> That was how Matvei joined the Jazz-band. We were putting out the *Physikalische Dummheiten* and read it at university seminars. In general, we sharpened our sense of humor on our teachers and at their expense. I should say that by that time Joe, Dymus and Dau had left all others far behind where physics was concerned. They explained to us all the new and amazing advances in quantum mechanics. Being a capable mathematician the Abbot (Matvei Bronstein) was able to catch up with them quickly.
> I can visualize Matvei with his specs slipping down his nose. He was an exceptionally "civilized" and considerate person (a rare quality in a still very young man); he not only read a lot but also had the habit of thinking a lot. He accepted no compromises when his friends "misbehaved".
> I cannot say who gave him his nickname, which suited him perfectly: he was benign in his skepticism, appreciated humor and was endowed with universal "understanding". He was exceptionally gifted.

This is an ample illustration of the intensity with which the Jazz-band treated life. They had a seminar of their own at which they heatedly discussed events in physics and everything else under the sun: ballet and poetry, Freudism and the relations of the sexes were subjected to scathing and dissecting theoretical analysis. Here is an illustration of the tense atmosphere in theoretical physics put into verse by Zhenya Kanegisser who used Gumilev's *The Captains* as her model:

You all are the paladins of the Green Temple,
All leading your way through de Broglie's waves
The Earl Frederiks and Georgy de Gamow,
Who questioned the ether with nothing to save,

Landau, Ivanenko, two boisterous brothers,
Krutkov, the indifferent CTP's head,
And Frenkel, the general of Röntgen army
Who made the electron dance and spin,

The brilliant Fock, Bursian, Finkelstein,
And tiniest crowds of studying youths,
You started your voyage to follow Einstein
Who taught you to scorn the traditional rules.

Though Heisenberg's theories weren't a triumph,
And Born's hard-earned laurels seemed withered a bit,
Yet Pauli's principle, Bose's statistics
Have long won your hearts, and your minds, and your wit.

The Nature is still enigmatic and hidden,
You still do not know all the secrets of light,
The nuclear laws still remain undiscovered,
And you are now trying to conquer the blight.

When reading your cleverest papers in *Zeitschrift*,
With all our problems becoming more vague,
The only delight is the thought that Bothe
Will give you all guys a proper spank.

Here some explanations are needed – Y. Krutkov, who headed the Cabinet of Theoretical Physics, was not an overenthusiastic chief; Bothe's and Geiger's experiments deprived Bohr's non-conservation hypothesis in the Compton scattering of any grounds. This hymn was probably written in 1926. It appeared in the *Physikalische Dummheiten* (Physical Absurdities) that ridiculed tempestuous events around physics, sometimes with friendly irony and often with biting sarcasm. The editors themselves were not exempt.

The same could be said about the Jazz-band's relationships with their elders. The very name was a gauntlet thrown to public opinion: in the Soviet Union jazz was accepted in the late twenties. One of the scientific papers [156] was written jointly by Gamow, Ivanenko and Landau to honor one of the Jazz-band girls in the Astoria restaurant (where the university students had their meals for a token sum due to the efforts of the Commission for Improving the Life of Students).

Despite a somewhat frivolous reason, the article deserves a closer look which we offer below. No matter how talented the Jazz-band leaders could not create a paper from a restaurant atmosphere; obviously it was based on everyday discussions and ideas voiced by the entire Band. They offered no formalized substantiation and, therefore, they could not regard the results as belonging completely to physics. In all other respects it was a physical article that reflected the contemporary state of fundamental theoretical physics and even offered some glimpses of the future. In Chapter 5 we shall discuss it in greater detail and wonder why Bronstein was not among the authors.

2.3. The Abbot and His Astronomer Friends

No wonder E. Peierls did not know who had given Bronstein his nickname of the Abbot: it was given by another group he was close with during his student years, a group of astronomers.

At Leningrad University, astronomers belonged to the department of mechanics and mathematics, rather than physics. This was rooted in the past, when theoretical astronomy rested on a single arm of celestial mechanics.

Throughout history, the relationship between physics, astronomy and mathematics went through different stages. In antiquity, "physics" was the name of all sciences about nature; the obvious regularity of astronomical phenomena was taken as the model of all natural laws. Being mathematically precise, this regularity was an abyss between celestial physics, guiding the heavens, and earthly physics, struggling to put some sense and order into the chaos of the phenomena on Earth.

In the Newtonian age, new physics, new mathematics and new astronomy were born; Mitya Bronstein was first introduced to this remarkable time through Flammarion's *Astronomy for Everyone*. Newtonian physics declared that its laws were valid for the entire Universe, with celestial mechanics – the natural base for theoretical astronomy – being nothing more than a particular case of physics. Later, however, celestial mechanics became merely a part of mathematics. While astronomy rested on celestial mechanics, the students of astronomy were natural members of the department of mathematics and mechanics. True, they had to describe the movements of celestial bodies as motion of material points rather than physical bodies.

In the mid-nineteenth century spectral analysis as applied to the study of stars changed the situation. However, the union of physics and astronomy was finally sealed by quantum theory, which decoded the enigma of spectral lines. This opened new vistas for astronomy – astrophysics came of age in the second half of the twenties [234].

Any physicist who closely followed advances in natural science could never have missed astrophysics' heyday. The tree of astronomy was blossoming with the flowers of physics; astronomical numbers were turning into physical numbers.

Bronstein was such a physicist – while in Kiev he was fascinated by astronomy. No wonder then that at the university he attended lectures on astronomy. He quickly made friends among the students of astronomy: V. Ambartsumyan and N. Kozyrev; he was also friendly with I. Kibel, I.A., who studied hydromechanics. They divided their time between the university and the Pulkovo Astronomical Observatory.

What was more, Bronstein introduced his physicist friends to astronomy. When writing about Ambartsumyan and Kozyrev's early papers on stellar atmospheres, D. Martynov recalled that both had been members "of a talented group of students that was formed at Leningrad University in the twenties. It also comprised M. Bronstein, G. Gamow, L. Landau and D. Ivanenko – a veritable constellation of the future stars of the first magnitude! Bronstein and Ivanenko used to come frequently to Pulkovo to take part in free discussions of widely varied questions of theoretical physics and astrophysics that later gave birth to some significant papers. With his jet-black hair, the reserved, balanced, highly logical and convincing Bronstein was a decided contrast to Ivanenko, who was spontaneous and noisy and who spoke easily and fluently. He obviously knew what he was talking about; his mind was always brimming with barely formulated ideas. At that time, Bronstein had recently solved several important questions of the theory of radiation transfer in the atmospheres of the Sun and stars, while Ivanenko and Ambartsumyan had finished several papers on mathematical physics and the physics of the nucleus. It was during that period that Landau touched on some astrophysical problems – the result was his paper on the possibility of superdense stars that appeared in 1932 [234, p. 440].

In fact, the change of generations in astronomy was even more dramatic than in physics: the older generation was struggling under a double impact of physics and the new relativist and quantum ideas physicists themselves were just getting used to. Important observational facts were discovered. In particular, it was established that the spiral nebulae were other galaxies. This made the astronomical picture of the universe much wider than had been earlier believed. It was primarily young people who were introducing young physical ideas into astronomy; naturally enough, the older generation was distrustful of the attempts of their younger colleagues "to determine the number of atoms above each square inch of the Sun's surface" [234, p. 439]. They were shaken by the avalanche of new facts and ideas.

One day there appeared a notice at the department of astronomy informing those interested that M. Bronstein would read a survey of works by Bodichiraka Ramasatva, a prominent Indian physicist and astrophysicist, who, on visit to Leningrad, had kindly submitted his unpublished paper to them.

The lecture hall was filled to capacity – Bronstein had already earned the reputation of a brilliant lecturer. Having presented the basic assumptions, he formulated a problem for a planetary system's proper values. He chalked an imposing differential equation that contained Planck's constant, the velocity of light, the electron mass, the mass of the central luminary and a cluster of Latin and Greek letters. Bronstein discussed the wave function behavior and presented a range of proper values. Then he made certain transformations and inserted the mass of the Sun. At this point the audience recognized the famous Titius-Bode relation that determined the actual mean distance of a planet from the Sun. This was the main conclusion of the paper.

The audience was duly impressed. Speaking on behalf of it, Professor P. Gorshkov voiced his favorable opinion of "this extremely interesting paper" and offered his opinion on certain points.

The mysterious presentation was a complete success: it was revealed to the audience's laughter and to the great delight of the practical jokers.

The paper was read at the Astronomical Cabinet, the usual place for all lectures and discussions in astronomy. In 1927–1928 the students of astronomy put out a journal predictably called *Astrocabical Journal* that was very much like its cousin *Physikalische Dummheiten*. The titles reflected the state of affairs in contemporary physics dominated by the Germans and contemporary astronomy dominated by the British.

V. Ambartsumyan quoted a sonnet Bronstein had dedicated to the *Astrocabical Journal:*

I wish you be above critiques and praises,
I wish you be a beacon in the dark,
And like the sun you shine in all your phrases,
I wish you all the best, my newly born *Zhurnal*!

I know that circulation is but tiny;
Your fate was thought to be a lucky one
When maniacal Kostinsky3 was trying
To get and copy you for his scientific scum.

Your origin is rather enigmatic,
The efforts to reveal them are pathetic.

Your parents are unknown to everybody,
Your secret guards are mystery to all.
And once appointed they are always silent
Like priests of Dionysia of the old.

The young Leningrad astronomers were no less fond of nicknames than the physicists. More likely than not, these nicknames were derived from first names or family names: Ambarts for Ambartsumyan, Kib, Dau, Jonny, Dymus. Bronstein's nickname was of a different origin.

It was taken from a book by Anatole France *At the Sign of the Reine Redauque*, translated into Russian by I. Mandelstam, Zhenya and Nina Kanegisser's stepfather; their home was the favorite haunt of young physicists and astronomers.

The young astrophysicists read the book out aloud while commuting to Pulkovo; evidently they were greatly impressed by Abbot Jêrome Coiquard, doctor of theology and magister of sciences, and found many of his remarkable features in Bronstein: profound mind, wide knowledge, balanced skepticism, kindheartedness and tolerance. According to Ambartsumyan, Kozyrev was the first to apply this name to Bronstein, the scope of whose knowledge struck them most.

The abbot's devoted pupil was convinced that "no geometers and philosophers who, emulating M. des Cartes, were able to measure and weight the worlds could rival [his] teacher in talent and knowledge". It seems that Bronstein's friends found in him a true rival for the abbot, since in the twentieth century it was a privilege of physicists to measure and weigh the world.

Just like the fictional character Bronstein could not leave a book unread – he had read an awful lot of them. While it took Coiquard 51 years "to read all the Greek and Roman authors graced by time and human ignorance" it took Bronstein only 21 years to earn this honor.

As could be expected, a French theologian of the early Enlightenment and a Soviet physicist of the early socialist period were not identical: while the abbot was fond of his bottle, his food and other earthly delights, Bronstein was much more moderate – hence all contradictory explanations of how he got his nickname.

One should not imagine, however, that Matvei was engrossed in books and science to the exclusion of everything else. He and his friends were very much like other young people. Numerous photos of that time bear witness to this. In one of them the Abbot is holding a large cross. He is obviously converting Zhenya, who is kneeling in front of him; Ambartsumyan is nearby with a suitcase. It seems that he was posing as one of the traders who invariably followed missionaries to newly converted countries. In another photo there is a bespectacled young lady, modestly covered with a shawl, flanked by two young men. The "lady" is Matvei, and his two sweethearts are the Kanegisser sisters. Another photo was taken in Odessa during the 1930 Physical Congress. Young physicists in bathing trunks are holding laughing girls in swimsuits by their heels.

Late in the summer of 1929 Ambartsumyan, Bronstein, Kozyrev and Kibel travelled across Armenia to Ambartsumyan's home village. It took them slightly more than a week, during which they passed through a storm on Lake Sevan with waves of oceanic dimensions, rode in the mountains, spent a night in the open with horror stories told by turn and walked forty kilometers on foot. Being not very strong Bronstein had to mobilize all his inner resources, yet the main goal was attained: they distracted themselves completely from their intensive studies and scientific research.

2.4. The First Works in Astrophysics, Geophysics and Popular Science

Bronstein worked a lot in 1929 and achieved a lot: he wrote two papers on astrophysics, one on geophysics, his first popular science book and several articles. Indeed, one cannot expect more of a student!

His first astrophysical papers dealt with stellar atmosphere. Ambartsumyan and Kozyrev were working in the same field; this was the period when physics discovered a totally new object – the star as an integral physical system. To solve the main riddle – the star's internal structure and its energy source – one has to form an idea about its surface and the atmosphere that connects it with the outer world and the observer as a part. Without this, no in-depth studies were possible. On the other hand, while physics itself had advanced to the point where it could tackle the problems of the atmosphere, it had not advanced enough to look inside the stars.

The theory of stellar atmosphere had been developed enough to allow easy success for a chance intruder. It boasted of own masters such as K. Schwarzschild, J. Jeans, A. Eddington and E. Milne.

The problem of the radiation equilibrium of stellar atmosphere goes back to Schwarzschild. Astrophysics define stars (the Sun included) by the effective temperature T_{eff}, the temperature of the black body of the same dimensions and the full radiation equal to any given star. Its value is calculated by observations on Earth. Bronstein set himself the task of defining the dependence of the temperature of the stellar matter on the (optical) depth τ within the framework of the star's definite physical model. It had been established by that time that the dependence was

$$T_{\text{eff}}[3/4(\tau + q(\tau))]^{1/4}$$

where the value of $q(\tau)$ differed little and was established through the solution of a definite integral equation (Milne's equation). It was obvious that the numerical value $q(0)$ allowed one to determine the exact temperature of the solar surface T_0, through the value of T_{eff} that could be measured on Earth. The best minds in astrophysics coped unsuccessfully to determine the exact value of $q(0)$. The result was several approximations – Jeans and Eddington produced two each and three belonged to Milne. It was Bronstein who in 1929 offered the exact value for $q(0) = 3^{-1/2}$ and, consequently, the exact correlation

$$T_0 = \left(\frac{\sqrt{3}}{4}\right)^{1/4} T_{\text{eff}}$$

(This result became known as the Hopf-Bronstein correlation [297, pp. 85, 96] although the order of the names should have been different since Hopf arrived at the same result later.[4])

The high level of Bronstein's first astrophysical papers is attested to by the fact that they appeared in major scientific journals. The third (and last) article on the stellar atmospheres was published in the *Monthly Notices* (Great Britain) on Milne's recommendation. It was an answer to a letter from Milne. It seems that he was greatly impressed by Bronstein's exact result and hastened to toss him another challenge – the boundary value of $q(\infty)$ (the infinite optical depth in the star's atmosphere corresponds to an insignificant actual geometrical depth). No exact result was obtained (and it has not been obtained so far), but Bronstein was able to produce certain approximations.[5]

These papers belonged to mathematical physics; he skillfully applied mathematics to resolve the already posed physical problems: there mathematics was not involved at the expense of physics. (Practically the same mathematical apparatus was invoked in the late thirties and forties to describe the transfer of neutrons in uranium).

We shall not discuss these works in detail here: every researcher is aware that time is harder on the creations of scientists than on artistic creations. This is especially true of theoretical physics. Even the most revolutionary ideas and works are preserved for posterity only as several lines and formulae in textbooks and definitve monographs. One or two sentences designed to educate a new generation or to express the author's emotional attitude to the results sum up a long and torturous path, painful efforts to overcome real and imagined obstacles, delusions and errors. Yet smallernothing remains of the uninterrupted flow of good or even excellent works. Only historian of science knows that they are needed to set up a favourable environment outside which no spectacular achievements are possible.

The high level of Bronstein's contribution to astrophysics was demonstrated by the 1934 granting of the newly introduced academic degree of Candidate of Sciences bypassing the usual procedure of defending the thesis. He also wrote articles on white dwarfs and on the influence of electron-positron pairs in the thermal equilibrium under high (stellar) energy densities (see Section 5.2).

In 1929 Bronstein turned to geophysics. Although the title of his large article [8] also contained the word "atmosphere", like his works in astrophysics this was a purely linguistic coincidence since the stellar and earth atmospheres are completely different spheres of research. The different physical conditions in them posed different physical problems: anybody probing the stellar atmosphere had to study the mean steady-state conditions that determined the star's temperature. The most important problems of the Earth's atmosphere are connected with its dynamics. Eddington was right when he said that a star was basically an simple research object that posed fewer riddles than man. One could say that the atmosphere of the Earth compares with man where its complexity is concerned: it is not for nothing that weather forecasts, supposedly based on atmospheric dynamics so far remain unreliable. It is as difficult to forecast weather as it is to guess how a man will behave under specific circumstances.

Bronstein introduced his article on the atmospheric dynamic with an epigraph from E. Kummer: "A certain degree of approximation can make a cobblestone an ellipsoid". This was a natural reaction of a physicist-theorist to theoretical geophysics. In general, theory can be applied only to comparatively simple models while the Earth, the main geophysical object, is far removed from the geophysical theoretical models – farther than is allowed in theoretical physics.

Bronstein was far from condescending to geophysics. In fact, his first popular science book, *Composition and Structure of the Earth*, is a good example of his profound knowledge of geochemistry, geophysics and seismology, unexpected in a specialist in theoretical physics, who one year later produced an article on quantization in the magnetic field and a detailed cosmological survey. In his book he presented vast observational material and discussed hypotheses that had nothing in common with theoretical physics, such as Wegener's hypothesis on continental drift.

One cannot but wonder how he was able to combine these far-flung fields – astrophysics, geophysics and fundamental physics. His varied scientific interests amazed his friends as well.

One reason for this can be found in his personal files, which show that in July 1929, while a student, he was working as a physicist in the Main Geophysical Observatory (MGO) in the department of theoretical meteorology under L. Keller

(1863–1939), one of the closest associates of A. Friedmann. He also studied the theory of atmospheric circulations. Bronstein's article [8] and some of his papers read at a seminar in MGO [209, p. 74] were related to this subject.

Who introduced him to geophysics? First, I. Kibel who worked in the same department in MGO and for several months had been doing his post-graduate work under Friedmann. He was studying the hydrodynamics of compressable liquids, or the dynamics of the atmosphere, these are closely related subjects. Their shared interests in the Earth's atmosphere were not disrupted by the fact that both tried to court the same girl (who rejected them both).

2.5. At the Shenroks on Vasiliev Island

There was one more man who could have introduced Bronstein to geophysics, and to fields far removed from theoretical physics. This was Alexander Shenrok who had come to the MGO (the Main Physical Observatory up until 1923) back in the last century. He was a pure meteorologist in the sense the word had in the nineteenth century, that is, he mostly observed weather changes. Throughout his student years Bronstein rented a room in Shenrok's flat on Vasiliev Island.

A German from Estonia, Shenrok studied in Germany (the scars on his face bore witness to his violent student days); after many years in St. Petersburg he became completely "Russified". In the post-revolutionary years he had to rent out part of his large apartment to alleviate the housing crisis. He was fond of university students, probably because he had no children of his own. Bronstein's friend, S. Reiser,[7] a philology student, also rented a room in the same flat.

They had first met in 1924 in the reference library of Kiev University; Reiser was allowed to use it having proved his worth at a seminar. He immediately noticed a dark-haired young man always immersed in books and journals teeming with formulae; from time to time he would write similar formulae on a sheet of paper. Very soon these two became friends: never in his life did Bronstein look down at the humanities. In this respect he differed greatly from Landau, who used the word "philology" to demonstrate his contempt for an inadequate physical paper and who believed that "philology was an occupation unworthy of a thinking man, something akin to collecting butterflies". In Leningrad, Reiser found himself in Eikhenbaum's circle; it was through him that Bronstein was exposed to the developments in literary studies that were blossoming at the time. He was always eager to plunge into the new books his friend brought back home. His photographic memory allowed him to memorize the contents and the layout.

In 1929, when M. Aronson and S. Reiser published their *Literary Salons and Groups* (edited by Eikhenbaum) Bronstein immediately greeted it with an ironic poem that ridiculed the then fashionable "montage method" that mostly relied on scissors and glue rather then on literary comments. Here Bronstein imitated Mayakovsky's peculiar style:

Before
  I thought
    that books are made this way –
They sit,
  and think,
    and wear off the trousers,
And many years elapse,
before this simpleton
Will taste the juicy fruit of his hard-working hours.
But seemingly
  Today
    This work becomes quite light:
It was some time ago
    That Reiser and Aronson
Have treaded path to praise
With scissors and some paste.

A great lover of poetry, Bronstein could recite many poems from memory, his favorite poets being Pushkin and Blok. Judging by his dedication pages, he knew a lot of German, English and French poetry. He was convinced that an ability to write verse was part of general culture. He himself wrote several poems that he never treated seriously. Reiser recalls, how in 1927, Bronstein showed him a small dark-green phial that supposedly contained cyanide he had procured from a chemist friend. When asked why he needed it, he smiled and answered with a poem with the Byronic title of "Euthanasia" of which Reiser remembered the following lines

Never, never I will be wounded
Never, never I will be in glee
In my waistcoat pocket always with me
Is the bottle that will make me free.
And the ghosts of the past dreadful years
. . . .
In this world I am not a prisoner,
Nor a slave in the time-worn chains,
I am coated in iron warrior,
Smiling scornfully at my pains.
I am strong, I am calm, I am confident,
I am free to invite my death.
If the foe turns out more powerful,
By my choice I can draw my last breath.
I will not have to follow the conqueror
With a rope tied round my neck ...

In fact, Bronstein demonstrated his literary talent in popular science as well. We have already mentioned his first attempt at this, *Composition and Structure of the Earth*, which appeared in 1929. It followed the well-trodden path of an enlightened writer sharing his knowledge with a layman. The tone was neutral; the author's enthusiasm becoming obvious in the last paragraphs

> The lack of space does not permit me to discuss other thought-provoking ideas of the composition and structure of the Earth. I would like very much to have a closer look at living matter's role in the history of the Earth's crust, underestimated in the past. Today it is studied by geochemists such as academician V. Vernadsky, who writes about the biosphere, that is, about those of the Earth's mantles where life is going on.
> I shall not discuss this role here though it is very important for us if we want to know more about the celestial body we are destined to live and die on. So far mankind is chained to a small planet travelling in space around the extinguishing sun. People are urged to know more about the globe that serves them as home and, may be, eternal prison. But this may be incorrect: several centuries after Columbus set to the high seas to discover the fabulous riches of the New World, interplanetary rockets will probably carry new courageous conquerors into outer space. When the Sun exhausts its resources, mankind will probably unfold a banner of life on some other planet, under a brighter sun and bluer sky. This will add new meaning to geophysics and geochemistry studying the small planet – mankind's toehold for its plunge into infiniteness [55].

On April 4, 1929, he presented a copy to Reiser with a dedication that, in contrast to the high style of this passage, carried a good deal of self-irony.

His literary talent and profound knowledge enabled him to work quickly. He made a jocular dedication in his second popular-science booklet *The Structure of Atom* when he presented it to Reiser: "Labor productivity 24 pages a day. Royalties 301 r. 50 kop. To dear Monya in memory of the hard winter of 1929–1930". In fact, his intensive intellectual life was in contrast with relative poverty at home. He got no grants; the money he received from his parents was barely enough to cover his basic needs.

This was a period of heated debates on the theory of relativity and quantum mechanics. Matvei Bronstein learned from his own experience that real life and philosophy differed greatly where the predominance of the material over the spiritual was concerned. Like many other students he was obviously hungry, and the Shenroks used to invite him (like some of their other tenants) for dinner. Probably it was his host who introduced him to geophysics.

The winters presented the greatest problem of all – heating the rooms was the tenants' concern. It was extremely hard, if not impossible, to heat them. Before the revolution that was some twelve years away the flat belonged to L. Kasso, a notorious czarist minister of education. It was rather amusing to imagine him sitting on a small corner sofa planning police measures against students, the very sofa on which Monya Reiser slept. The students had to steal wooden scaffolding from a nearby construction site for fuel, yet they were not enough to heat the spacious rooms. Another remedy was to climb into bed under a heap of everything that would conserve heat and plunge into debates about everything under the sun.

Life in Leningrad was expensive: books and tickets for concerts and theatres without which life was impossible cost a fortune. Yet money was not the only thing that drove Bronstein to writing. He had an internal urge to explain difficult things and to lay bare the course of scientific thought. This was the time when popular science journal mushroomed throughout the country. Society had regarded science and technology as omnipotent. The cult of knowledge was prominent. It was not accidental that the journal entitled "Knowledge Is Power" appeared at that time at that time (in 1926). In 1929 Bronstein published a popular account of a paper by Einstein in which the great physicist made an attempt to combine gravitation and electromagnetism. He was an excellent guide in fundamental physics. His articles of 1929–1930 [54, 57–60] testify that he closely followed the developments in fundamental physics while being mostly engaged in astro- and geophysics. They also explain why Yakov Frenkel, head of the theoretical department of the Leningrad Physicotechnical Institute, annotated Bronstein's application for a job with the following words: "Bronstein is an exceptionally talented theoretician with wide-flung interests and profound knowledge. He shows much initiative and independence in everything he is doing. There is no doubt that he will be one of the best researchers in the department ." [284, p. 210]. Bronstein was 23.

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