



Tributes to the Memory of Professor Vladimir Z. Kresin—Part 2

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1 Introduction

This editorial article continues the collection of thoughts and tributes to Vladimir's life and career from friends and collaborators.

We also report some excerpts from Vladimir's own autobiographical notes translated by Luba Vikhanski and edited by Vitaly Kresin.

2 Tributes

2.1 Mikhail Geilikman (Milleboswe Consulting LLC, Houston, TX, USA)

I remember Vladimir Zinov'evich Kresin, or Volodya as we call him in our family, since my senior school years when Volodya became a Ph.D. student of my father Boris T. Geilikman. The running story in our family was that Volodya was late with his application to a single vacant position of Ph.D. candidate under the supervision of my father who by the time already accepted for this position another quite strong candidate. However, after Volodya persistently asked my father to examine him, my father was so impressed by Volodya that he apologized to the first candidate and accepted Volodya for this position. I think my father felt always guilty about his decision but never regretted it.

Because my father's full-time position was at Kurchatov Institute whereas the Ph.D. position was at the All-State Lenin Pedagogical Institute where my father simultaneously was a lecturer, it was much more convenient for them to work in our home. So Volodya would come over; they worked

for several hours in my father's home office, and then they emerged at the dinner table, and long conversations ensued which included theater, movies, fine art, and politics.

Out of numerous Ph.D. students of my father, only Volodya became a close friend of our family for many years to come until Volodya's death.

In my view, Volodya had a special gift of friendship as well as befriending and acquainting new very different people. To name a few whom Volodya mentioned to me or I saw by myself were renowned physicist Vitaly L. Ginzburg, historian and dissident A.M. Nekrich, human rights activist and dissident Vladimir Bukovsky, theater critic Anatoly Smelyansky, long-life friend theater director Petr Fomenko, and many others. I feel fortunate that the circle of Volodya's friends included also me, my wife, and our son even after the death of my parents. We were happy to see Volodya and Lilia Kresin in our home in Houston, Texas, and Waterloo, Canada, and honored to be invited by and visit Volodya and Lilia in their home in Oakland, California.

Volodya was a person of strong convictions. After I moved from my Research Professorship at the University of Waterloo, Canada to Shell Research and Development in Houston, Texas, Volodya tried to persuade me that it is impossible to live in a such hot climate as Houston neglecting the fact that Houston is the fourth most populous city in the USA which included such inhabitants as former president George H. W. Bush, former US Secretary of State James Baker, and many other less famous people. Only after California got peppered with forest fires Volodya reluctantly commented that probably the chances of our move from hurricane-prone hot Houston to earthquake-prone smoky California are not very high.

More importantly, Volodya had strong and clear convictions in science, politics, literature, and life. During our long phone conversations, we would discuss all of the above, among them the US politics, and most recently the Russian invasion of Ukraine, in most cases having either the same or very similar opinions. At the end of such long conversations, Volodya would humorously comment that we don't have anything to discuss because we have the same opinions.

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Volodya was a versatile person with many interests. Besides his love of physics, he was a theater and movie buff not to mention his interest and knowledge of literature, poetry, music, and politics. But above all, Volodya was an impeccably honest and kind person, always with the best intentions throughout his whole life.

Volodya left us with valuable memories of his personality allowing us to gratefully recall, listen to, and heed his voice (figuratively and if we can, literally) especially when we need to make important decisions in our lives.

2.2 Sergei Ovchinnikov (Kirensky Institute of Physics, Krasnoyarsk, Russia)

Vladimir Kresin's name was known for me before we met personally. I started my research in theory of superconductivity in transition metal compounds in 1972 after graduating from the Krasnoyarsk State University. Vladimir had a lot of valuable publications in the field of superconductivity that time. When I have submitted my candidate of science (Ph.D.) dissertation in 1978, my older colleague from the Kirensky Institute of Physics in Krasnoyarsk, George Zaslavsky recommended me to Vladimir Kresin. We met in Moscow and discussed my results. Then, Vladimir agreed to be the referee of my dissertation. Soon he had a flight to Siberia to our institute in Krasnoyarsk to take part in the thesis presentation. I'd like to say that his remarks were very essential and valuable. We had a lot of interesting conversations and wonderful trip to the rock resort Stolby near Krasnoyarsk.

We continued our meetings many years later at several international conferences in the USA (San Jose, 1997) and Europe after 2000, especially important discussions were in Ischia at the Superstripes conferences. Several times, Vladimir with his wife Lilia visited these very nice conferences as well as I with my wife Tamara, and we had a lot of discussions. Once, two of my young former students had a chance to take part in such discussion. I was wondering how seriously and attentively Vladimir had listened to these young physicists.

At the same time, my group had published several papers in the *Journal of Superconductivity*, and later, it remained to the *Journal of Superconductivity and Novel Magnetism*. This journal was indeed Vladimir's area of activity and an important part of his life. Once Vladimir invited me as the *Journal Co-editor*, his advices and regular discussions of all journal problems were very useful for me.

And finally, the fourth moment in our relations is our joint hard work on the book Vladimir Kresin, Sergei Ovchinnikov, Stuart Wolf. "Superconducting State. Mechanisms and Materials". Oxford University Press, 2021, Vladimir invited

me to take part in the writing this book. For two years, we regularly discussed each page and each figures; sometimes, we had strong debates, especially on the mechanisms of superconductivity in cuprates. Our debates on the mechanisms were endless. My point of view is that antiferromagnetic correlations of strongly correlated electrons together with electron–phonon coupling should be taken into account. Vladimir was convinced that strong electron–phonon interaction is sufficient. Finally, Vladimir had suggested two finals like in the Fellini's movie "8.5." By e-mails, such active collaboration was rather difficult. We had many on-line meetings. With a 15-h time difference between Krasnoyarsk and California, the time zone for our on-line communications was very narrow, and finally, Vladimir had invited me to his home in Oakland, where we spent a beautiful week with Vladimir and Lilia, full of physics, music, and walking around. It was very interesting and nice together to listen to good classical music both at the concert hall and at their beautiful house. During this work, I got an impression of how deep and wide his vision of the area of superconductivity was. I am happy to have had such an experience and thankful to Vladimir and Lilia for their hospitality.

We all lost a very remarkable person, an excellent physicist, and a good friend.

2.3 Defang Duan (University of Cambridge, Cambridge, UK)

I got to know Vladimir through email in 2018. He invited me to write a review article about "ab initio approach and its impact on superconductivity and Magnetism." However, I declined this invitation as I am concerned about my English and may not be able to complete it on time. But Vladimir wrote a long letter to encourage me. He said that I made remarkable contributions (H3S work) in the field of superconductivity, and it was not occasional to invite me to write a review article. He also assured me not to worry about my English, as he would be willing to help polish the language. As a young scholar, I am grateful for his encouragement and finally completed the manuscript. Afterwards, we often discussed scientific issues via email and collaborated on publishing six papers on the topic of hydride superconductors. He also delivered me two books on superconductivity that he had authored. Vladimir was a person who was friendly, patient, and open-minded to young people. And he was full of enthusiasm for scientific research. One month before his passing, we were still discussing molecular superconductors. We were eagerly anticipating our collaboration, but he has departed from us permanently. Now, with heartfelt memories and gratitude, we will continue the research on the hydride and molecular superconductors.

2.4 Thomas Schenkel (Lawrence Berkeley National Laboratory, Berkeley, CA, USA)

Working at Berkeley Lab as an experimentalist, I met Vladimir back in 2011. Stu Wolf had made the connection with ideas on the ordering of dopants in high T_c superconductors. I had never worked in superconductivity, and I did not know who Vladimir was back then. Vladimir reached out to me with an email out of the blue, suggesting to meet and discuss some ideas. So we met, and my interactions with Vladimir over the next few years became truly special highlights of my time at Berkeley Lab. His enthusiasm, understanding, and ability to express complex ideas clearly and with a calm and encouraging demeanor were simply inspiring. Our conversations led to a proof-of-concept study, and the ideas have developed into exciting new directions that continue to be explored. It was an honor to be able to meet Vladimir late in his career, and I cherish the opportunity to have worked with him, if only briefly.

2.5 Francesco Tafuri (University of Naples, Naples, Italy)

It has been a privilege to be a friend of Vladimir Kresin. We lost a great scientist and colleague, an immense friend, and an inspired mentor with a view on the future. His books, his manuscripts, and his seminars will stay forever and are well recalled in other contributions (see for instance <https://physicstoday.scitation.org/doi/10.1063/PT.6.4o.20230222a/full/>). They are a direct proof of an intense and wide activity, of a perpetual curiosity, of a profound desire of knowledge, and of a continuous commitment to science and superconductivity.

Vladimir used to say that superconductivity was never so interesting as now, because of so many superconducting materials and so many open issues starting obviously from the pairing mechanism in HTS. This would also apply to Josephson junctions with so many different types, in terms of superconducting materials, barrier, layout, and topology, the Josephson effect being one of the keys to disclose many mysteries and open questions. In the 1980s, he used to say that superconductivity may appear boring because the BCS theory would basically explain everything. High critical temperature superconductivity was indeed a revolution, paving the way to a transformative era in various fields. This is a message for motivated students who are looking for transformative ideas and new horizons. Superconductivity, according to Vladimir's dynamic view, is some kind of a playground where macro and nano meet in unique combinations. This vision was behind his impressive and endless commitment to the Journal of Superconductivity and Novel Magnetism, that is undoubtedly one of his creations.

I will keep for myself memories of beautiful moments, vivid and visionary conversations on science and everyday life, where you could feel the path and the story of an extremely nice man and a great scientist, with a deep loyalty and honesty, with a vivid passion, and with a dynamical and forever young scientific vision. Goodbye, Vladimir; we will miss you.

Yury Ovchinnikov (Landau Institute for Theoretical Physics, Moscow, Russia) and Andrey Varlamov (Institute of Superconductivity and Innovative Materials (CNR-SPIN) Rome, Italy).

2.5.1 Yuri Ovchinnikov

I met Vladimir Kresin in 1965, when I was a graduate student of Anatoly Larkin. It went like this. I learned that the Moscow Institute of Physical Problems together with the Institute of Low Temperature Physics of the Georgian Academy of Sciences organized the Colloquium on superconductivity and superfluidity in Bakuriani—a small town in the Caucasus mountains. I asked Larkin if I could be invited to the Colloquium. He replied that since Larkin's colleague Boris Gelikman was on very good terms with Elivter Andronikashvili, Director of the Institute of Low Temperature Physics and one of the main organizers of the Colloquium, it was possible. A few days later a letter of invitation arrived from Tbilisi.

Vladimir Kresin, one of the former students of Professor Gelikman, who was already working with him in the field of superconductivity theory, also came to the Colloquium. Later, in 1972, they would publish a monograph entitled “Kinetic and non-stationary phenomena in superconductors.” Our scientific interests with Vladimir Kresin overlapped to a great extent, and this was the reason for our cooperation and our friendship, which lasted for more than half a century.

In 1966, I was admitted to work at the newly established Institute for Theoretical Physics in Anatoly Larkin's sector. On Thursdays, all-Moscow seminars known as “Landau Seminars” were held at the Institute for Physical Problems. It was a meeting place for many physicists, and Vladimir Kresin was one of the permanent participants.

In 1969, the Institute for Theoretical Physics organized a two-week Russian-Bulgarian symposium near Varna, a resort city on the Black Sea. Vladimir and I were participants of the symposium. We went to a restaurant together for lunch. For lunch, I would take a half-bottle of good red Bulgarian wine, and Volodya would take a glass of grape juice. As a result, he had to pay more than me, which made him angry.

Later, together with Volodya, we were the opponents at the defense in Kharkov of the doctoral dissertation of Yu. Ivanchenko, and participated in other scientific events.

After Volodya Kresin moved to the USA and joined the Lawrence Laboratory in Berkeley, California, our meetings were possible only outside the Soviet Union. In 1980, I worked by the invitation of Albert Schmidt at the University of Karlsruhe. At the same time, Volodya Kresin also came to Karlsruhe on a visit. His wife Lilia asked Volodya to find Italian shoes for her, a task which turned out to be problematic for him. My wife Rimma helped him: according to Volodya's words, Lilia was extremely pleased with Rimma's choice.

In 1991, in view of the drastic changes taking place in the Soviet Union, George Soros, an American financier and philanthropist, created a system of grants designed to support international academic cooperation. This initiative played a very important role in preserving post-Soviet science. In particular, it provided funding for scientific trips. Volodya Kresin and I received such a grant. As a result, it became possible for me to spend quite a long period of time in Berkeley, in the Lawrence Laboratory of the University of California, working together with Volodya on projects on the theory of high-temperature superconductivity, which was then rapidly developing. The first joint projects were completed in 1995. Their results were widely accepted in the superconducting community, and the successful collaboration continued. I usually came to Berkeley for a month at the beginning of each year. During this time, Volodya and I managed to perform almost all the computational part of the conceived project and wrote the text of the paper in rough draft. Then, at a distance, we made the final edits, and the work was sent to print. Volodya Kresin had a brilliant talent not only as a scientist but also as a skillful penman.

2.5.2 Andrey Varlamov

I was introduced to Volodya by my friend and co-author Lev Aslamazov in the late 1970s, just before Kresin emigrated to the USA. I already knew his name well from the book "Kinetic and non-stationary phenomena in superconductors," on the basis of which I studied heat transfer in superconductors as a graduate student.

Shortly after Volodya left, a curious thing happened. Kresin was a member of the Moscow House of Scientists, a prestigious club, which was very difficult to join from the outside. In those days of Soviet stagnation, the House of Scientists often hosted interesting exhibitions and closed screenings of foreign films, which, due to censorship, could not be seen in ordinary cinemas. Before leaving, Volodya left his membership card with Lev, but it had to be renewed each year by paying the membership fee in person. Since Kresin's picture was pasted on the ticket and Lev did not look like him at all, I had to renew it. And for many years more, we used Kresin's ticket to visit the House of Scientists until Perestroika did not eliminate the Soviet to censorship.

Our next meeting with Kresin took place only 10 years later, in Naples, where Volodya, Yura Ovchinnikov, and I were visiting our friend and co-author Antonio Barone. All of us, as well as many other colleagues, were invited to Antonio's fiftieth birthday party, which, in view of the personality of the celebrant and the general euphoria over the recently discovered high-temperature superconductivity, was an unforgettable event.

Later, with the opening of the world to Soviet scientists after the fall of the Berlin Wall, I started to see Vladimir more often: in 1993, when I was working at Argonne National Laboratory; in 1995, at his Lab in California; and later, at various conferences all over the world. We often kept in touch; Volodya sent me articles for review, and we started working together on a project, which unfortunately was not completed. In November 2019, while in California, I spent a wonderful day at Volodya and Lilia's place, discussing the physics we love, reminiscing about the past, and making plans for the future.

The last time I heard Volodya was at the end of 2021, when, as always full of energy and plans, he suggested that I write a textbook on superconductivity together with him and Sergei Ovchinnikov. We discussed the structure of the future book; he proposed it to Springer Publishers, and it was accepted. However, due to his untimely death, the work did not start yet....

The passing of Vladimir Kresin was a great loss not only for his relatives, colleagues, and friends, but also for the entire world scientific community working in the field of superconductivity.

Requiescat in pace.

3 Vladimir Kresin's Reminiscences

This was translated by Luba Vikhanski and edited by Vitaly Kresin.

3.1 School No. 7

After returning from wartime evacuation to Moscow, I enrolled in city School No. 7. For years afterwards, whenever I met fellow graduates, they all spoke about the warmest feelings they have kept about our school.

Just saying that the teachers were good doesn't give them enough credit: they were a unique, brilliant staff. And most of all, I'd like to mention K. M. Uspensky, our physics teacher. I can say with full confidence that physics became a part of my life only because he introduced me to this discipline. And I was no exception. Fourteen boys (schools were segregated by gender at that time) who graduated from school No. 7 in 1951 became professional physicists. The teacher was loved, respected, and feared, all at once. His

explanations were exceptionally clear and precise. He also gave us exams every month, and each one of us received his own set of problems. They were intended to test both attention and calculations, but mostly, they tested our comprehension of the material.

Our study wasn't limited to the curriculum. I recall that K. M. invited his former pupils, already students at the Moscow State University, to conduct extracurricular classes. The final class was a memorable evening that included 10 short presentations and was attended by a large audience, including A. Shalnikov, an academician and professor at Moscow State University.

I can't help telling a story about how K. M. literally "saved" me from straying off course. In 8th grade, I took up chess and started spending all my evenings at the chess club, working on increasing my chess rating. I was sinking deeper into what became an addiction. One day, K. M. asked me what was going on, why my grades were slipping, and what was taking up my time. When he heard about my hobby, he spoke to me so convincingly that I immediately stopped going to the chess club and also gave me an excellent book by Korsunsky, *The Atomic Nucleus*, as a gift and suggested to meet a month later to discuss it. I still have this book in my bookcase. I was cured for life.

3.2 Different Kinds of Truth

Unfortunately, our school didn't exist separately from the outside world.

At one point, a competition for the best essay about a Russian inventor was announced in Moscow. Our school delegated several participants, including me. These were the late 1940s, the country's population was completely isolated from the West, and according to the daily propaganda, all important discoveries of the past had been made in Russia. Thus, the radio had been not by Marconi but by Popov, the first airplane was the work of someone called Mozhaisky, and so on. People accused of "adoring" the West were labeled "rootless cosmopolitans."

I wrote an essay about Nikolai Kibalchich, who in the nineteenth century proposed a sketch of a rocket engine. In 1881, he was hanged for being part of the group which assassinated Tsar Alexander II; we all were taught about his revolutionary heroism. In my essay, I described his heroic action, then addressed the aeronautic machine which he had invented. It consisted of a platform on which the pilot was to stand. The rocket was positioned in such a way that its nozzle was facing down at the platform from some distance above it. The gases expelled from the nozzle were to propel the rocket in the opposite direction. After describing all of this and giving the inventor due credit, I added that unfortunately, had the device been built, it wouldn't have lifted off because there was no opening in the platform. The

gases rushing out of the nozzle would hit the platform, and no propulsion would result. The law of the conservation of momentum was sufficient for understanding this.

The essay was sent off; soon a devastating critique arrived. I was severely scolded for having criticized a great person by saying that his platform wouldn't take off. This was utterly unpleasant, especially since I understood that I was right. It turned out that not every kind of truth could be spoken out.

3.3 Lessons in Antisemitism

In 1951, I graduated from high school, and it was time to apply for admission to college. At the time, all high school graduates took entrance exams to the college of their choice during the month of August. An exception was made for those who had finished high school with a gold or silver medal, signifying exceptional performance in classes and on high school exit exams. These were either admitted without entrance exams at all or were called in only for an interview at the institute in which they wanted to study. These interviews usually took place in mid-July.

I wrote earlier that 14 graduates of our school became interested in physics and applied to the physics faculty of Moscow State University. I was one of them. Since I had finished high school with a gold medal, I was supposed to have an interview. Without false modesty, I should say that I was better prepared than my peers: I had helped them prepare for exams, and K. M. considered me the best among his top students.

My interview took place in the Physics Department building of Moscow State University. It was conducted by three middle-aged men. Later, I saw the photo of one of them on the faculty honors board, so I found out that his last name was Shalnov. He was the co-author of a then-famous collection of physics problems for college study.

They started out by giving me two physics problems. They weren't too hard, and I solved them rather quickly. Then, my examiners announced: "Well, let's check his general education. Name at least one novel by Vilis Lācis [a Latvian writer and communist politician]." I was able to name two. "Let's check his knowledge of politics. What is the name of the Communist Party Secretary in Brazil?" Their faces remained unperturbed when I answered this question as well. Then came the last question, by Shalnov: "Tell us please, is the Dalai Lama in Tibet an elected or inherited title?" I had to admit I didn't know the answer. (Later, I learned that making a guess would have been of no use, as both suggested options were incorrect).

The commission members ruefully shook their heads and said that I was free to go and that I would find out the result from a list that would be posted in a few days. Coming back in several days, I saw a notation next to my name: "Not

admitted due to lack of available slots.” This was a heavy blow, all the more hurtful since every other graduate from my school was admitted. As the reader may surmise, I was the only one among them whose internal passport labeled me as being of a “Jewish ethnicity.”

At the time, I was not prepared for this unspoken but government-promoted omnipresent antisemitism. Later on, as was the case for many others, I became well acquainted with it, as offers of positions at high-ranking institutes and research centers would magically evaporate as soon as their administrators eyed the aforementioned ethnical label on my application forms.

After the MSU interview, I fell into a depression and then enrolled at the easy-to-get-into geophysics department at the Moscow Petroleum Institute. This was a very hard year in my life, but a year later, I found out about that one could become a professional physicist by attending the lesser-known Moscow Pedagogical University.

3.4 The Pedagogical University

I was lucky because at the time, the Pedagogical University’s faculty included a roster of wonderful physicists and professors: E. M. Lifshitz (who created the famous theoretical physics course together with Landau), B. T. Geilikman (who was later to play a very special role in my life as my PhD mentor), V. G. Levich, E. V. Shpol’skii, and others. At the time, Moscow State University would not admit Jews either as students or as instructors, keeping its wall closed not only to novices but also to first-class physicists. The situation was very harsh. Fortunately, the Pedagogical University at that time was an exception. I started my studies there in September 1952, just as the state antisemitism reached its peak. Newspapers thundered about traitor doctors who were accused of causing the death of several leaders of the state. Almost all these doctors had Jewish last names.

3.5 Landau’s School and His “Minimum”

Great scientists (I’ll talk about physicists) belong to two categories. Some produce brilliant research but are not preoccupied with training the next generation. For example, Albert Einstein, the iconic genius, had no close disciples. The same goes for such outstanding scientists as Heisenberg, Feynman, etc. On the other hand, Niels Bohr not only authored amazing work but also created a scientific school. Many researchers considered him their teacher.

The same goes for Lev Davidovich Landau, who was famous not only for his classic results but also for having created a major scientific school. A school always reflects the distinguishing features of its founder, and Landau’s was quite different from the one that Bohr had created earlier.

What are the typical features of Landau’s scientific school? This question should someday be addressed in detail by the historians of science. In brief, Landau, together with his students and his close friend E. M. Lifshitz, created a major course of theoretical physics, published in 10 volumes. These books have gone through numerous editions and are revered by theoretical physicists. Next, once a week, on Thursdays, Landau ran a seminar attended by most of his students. And finally, he developed a special “theoretical minimum” (“Landau’s minimum”), consisting of ten exams.

I already mentioned that Evgeny Lifshitz taught at the Pedagogical University, and upon his advice, I started preparing for these exams. The first one was in mathematics. This brings me to a story about the ten minutes that played a decisive role in my life.

Following the low-key general rule, I made a phone call to Landau’s apartment, heard his voice, and told him that I would like to take the math exam. He sounded friendly and set a time for me the following day to come to his office at the Institute for Physical Problems of the USSR Academy of Sciences. When I came in, he sat me down in a separate room and gave me a problem that I remember even today, many decades later.

The problem was as follows. Given the equation:

$$\frac{1}{(x-1)(x-2)(x-3)(x-4)} = \frac{A}{x-1} + \frac{B}{x-2} + \frac{C}{x-3} + \frac{D}{x-4}$$

find A , B , C , and D . This problem (decomposing a fraction into a sum) was, unfortunately, featured in our first-year mathematics course (it might still be included in today’s textbooks). I say “unfortunately” because I started solving it as I had been taught, that is, by adding together the fractions on the right side and obtaining a complex system of equations for the coefficients A , B , C , and D . Just then, Landau walked in and asked, “How is it going?” When he saw what I had written down, he laughed and said: “Young man, if you solve problems in this manner, you’ll never get anything done because life is short. No, this should be solved in a different way.” With this, he walked out.

I knew for a fact that I was done for. He was going to come back a few minutes later, and seeing that I hadn’t changed anything, he’d declare that I didn’t pass the exam and theoretical physics wasn’t for me. I already knew that this was how he parted ways with those who’d failed an exam. This would spell the end of my future in physics. I’d have to become a secondary school physics teacher, and even though I’d kept a very good memory of my own teacher, at the time, my goal was different. And I’d have to part with it because of this cursed fraction.

At this point, either because of the moment’s importance or because I’d become really stressed, I suddenly

had a revelation and saw how to solve the problem. It was simple, and I might have come to it sooner, had it not been for the college textbook.

Here's the solution. For example, to determine the value of B , we multiply both sides of the equation by $(x-2)$, then set $x=2$. Then, we have only B remaining on the right-hand side, whereas the left-hand side directly produces its value: $B=1/2$. The other coefficients are determined in the same way.

That's how I was saved. To be fair, the method which I invented was well known, but usually described in the more advanced math courses on the theory of complex variables. The quantities A , B , C , and D are the residues of the function on the left-hand side and are calculated according to this simple rule. But I didn't know that at the time.

As I wrote earlier, I was saved. Landau accepted this solution and gave me a couple more problems from other branches of mathematics, which I solved. I was admitted to other exams and kept moving toward my goal. But those few minutes remain forever seared in my memory.

Coming back to the general subject of Landau's school, I can only say that it was my great fortune to participate in all of its aspects. I studied the books written by Landau and Lifshitz, regularly attended Landau's seminar, took the "minimum" exams, and, besides, attended the lectures on several subjects (electrodynamics, statistical physics, quantum mechanics, quantum electrodynamics) that Landau gave at Moscow State University. Therefore, his impact on me was tremendous.

In the next section, I'd like to describe a few aspects of his personality.

3.6 On Vacation

In the summer of 1957, after finishing the first year of graduate school, I went on vacation to the Crimea with a friend of mine. We arrived in Koktebel and began spending our mornings on the beach. Soon, we became part of a group of young people that formed there.

A few days later, a man in a bathing suit sat down next to me. I recognized him instantly... It was Lev Davidovich Landau! He excused himself and said that he ventured to approach because my face looked familiar. You can imagine how shocked I was. Landau was my god, and here he is, wearing a swimsuit, and we are chatting casually.

Lev Davidovich came to Koktebel after a large scientific conference that took place that summer in Kiev. He arrived with his wife and son and took up residence in the

nearby state-run artist resort ("House of Creativity"), but every morning, he'd come to the beach by himself and spend time with our young group. We talked about all sorts of things (except physics). Landau was older than all of us but tried not to domineer, and people in the group treated him as one of us. Now I remember it all as a miracle, but at the time, it seemed a regular thing, so simple and natural was his behavior, be it a game of cards or some other game, or a telling of jokes.

Now I'd like to relate another episode. It happened about a week before the end of our vacation. One evening, when my friend, who had embarked on a typical "summer romance," ran off to his date, I went for a stroll toward the sea. Suddenly, I saw Lev Davydovich. He smiled at me and said: "What are you doing here?" I replied that I was just walking around. To my surprise, he suggested: "In this case, if you don't mind, let's take a little walk together along the beach." You can imagine how much I "did not mind" this suggestion. We began our walk around 8 pm and parted ways close to midnight! Landau asked me what I was occupied with in graduate school and what topic I was working on. That's how our conversation started, and it was devoted to physics until the end. In reality, it was a conversation between one of the greatest minds in the history of science, a remarkable figure in modern physics, and a novice who was taking his first steps. The age difference also was substantial: I was 23, and he was 49. But his demeanor was astonishing. He didn't lecture but simply told me about his scientific interests at the time and shared his impressions from a recent international conference—and it was all done on friendly, equal terms.

That's what Landau's personality was like. It was unique in every way. It was well known that he could be severely critical of what he heard, but that he was always extremely democratic. One could tell him: "Dau, you are completely wrong." And his response would be a sincere "Why?" There was no posturing or irritation to go with it. He was only interested in the essence of a question or a phenomenon, not in extraneous factors.

Back in Moscow, I continued to attend his seminar. He always greeted me in a friendly manner, but he was always surrounded by colleagues, guests, and many others.

I've guarded the memory of that evening on the Black Sea shore as a gift of fortune. Sometimes, it seems to have been a dream, even though it really did take place.

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