Stanislav Molchanov

Highlights

A. First Steps in Mathematics

E. D. You never told me about the early stages of your scientific biography. I don't think you did.

S. M. What do you mean by "early"?

E. D. How did you get interested in math? When did you realize that you wanted to become a mathematician?

S. M. It's a complicated story. I was born in a very remote village, Snetinovo – it probably doesn't exist anymore – some 20 km off the railroad. My mom worked as an elementary school teacher. My father, being the son of a "repressed"[1] person, was ineligible to receive education in the 30s.

E. D. He was the son of your grandfather who was an archimandrite,[2] right?

S. M. Yes. However, as a war veteran who was incapacitated during his service, he managed to get into the Pedagogical Institute in 1949. He graduated in 1953.

E. D. How old was he? When was he born?

S. M. He was born in 1916, which means that at the time he was pushing 40. After that we left our village and moved to a bigger place called Nerl which is located on the railroad connecting Ivanovo and Moscow. It was a small urban-type settlement. I went to school there. My father had a few books on mathematics. The headmaster also had a few.

E. D. What did your father teach?

S. M. He taught physics. He was never particularly interested in mathematics. But the headmaster was. He was a great teacher who, if students showed interest in math, was able to fuel their interest by giving them books to read. He gave me popular books on mathematics, and I got hooked on it.

E. D. In what grade did it happen?

[1] http://en.wikipedia.org/wiki/Political_repression_in_the_Soviet_Union
[2] In Orthodox church, an abbot of a big monastery.

S. M. I believe it happened around grade 8 or 9, fairly late. I started working on the problems from the book by Modenov. It was a book that aimed to assist high school students in their preparation for the university entrance exams.

E. D. He was a bad person. Sakharov writes about him in his memoirs.[3]

S. M. Indeed, he was. But he was a solid author who produced a decent textbook. More importantly, this textbook contained supplementary chapters on spherical geometry, on some elements of projective geometry etc. Anyhow, I solved all the problems from this book and was very well prepared by the time I took my entrance exams.

E. D. When did it happen?

S. M. In 1958. I got A's in all my exams.

E. D. Did you graduate from high school with a medal?

S. M. Yes, I did.

E. D. Did you have to take entrance exams nonetheless?

S. M. This was the first year when high school medalists were required to take exams with all other applicants.

E. D. But you only had to take the math exam, didn't you?

S. M. No, all the perks for medalists were abolished. In all, there were five entrance exams, and I took all of them.

B. Mekhmat

E. D. A boy from a remote village, you were admitted to Mekhmat. How did you feel there in the very beginning?

S. M. You see, I had a complex, one that sometimes may quickly turn into an inferiority complex ... Well, I was an A student. I felt that I was better than all other students, and this was more or less my attitude when I took the entrance exams.

E. D. Sure, but after you got in didn't you discover that someone was perhaps better or smarter than you.

[3] Sakharov, Andrei. *Memoirs*. New York: Alfred A. Knopf, 1990, p. 378.

S. M. Maybe there were such students, but in every class I took I absorbed the material very easily.

E. D. So you didn't feel eclipsed by students from Moscow, did you?

S. M. No, not at all. Moreover, I ...

E. D. Who was in the same year as you?

S. M. Leontovich.

E. D. Also a village kid.

S. M. Not quite. [*Laughs*].[4] There were also Nolde, Malyutov, Krylov.[5]

E. D. These were all my students. What about others?

S. M. You see, at that time you were the professor who offered the most interesting classes. In fact, you opened a seminar for first-year students. For this reason, I think, you took the cream of the crop, with the exception of Leontovich perhaps, who worked closely with Arnold. He was a very active researcher at first. Later the level of his activity went down, which I find difficult to explain.

E. D. I see. But there must have been other talented people there.

S. M. Yes, of course there were.

E. D. Can you name them?

S. M. Vakhutinsky, for instance.

E. D. Who?

S. M. Ilya Vakhutinsky. He was linked to Kirillov.[6] There were a few others. But, as demonstrated in a recent survey conducted three years ago, very few people from my graduating class went further to obtain a D. Sc. degree.

E. D. You see, my nets brought a very good catch in previous years. More specifically, I am talking about the class of Freidlin, Kirillov, and Vinberg.[7] It was a very strong class, and I managed to catch a nice group of students but not the biggest fish of them all, Arnold.

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[4] Molchanov is sceptical about Leontovich's humble beginnings because A. Leontovich was a son of M. Leontovich, a leading Soviet nuclear physicist and a full member of the Soviet Academy of Sciences since 1946.

[5] Interviews with Malyutov and Krylov are part of this collection.

[6] Interview with him is part of this collection.

[7] Interviews with them are part of this collection.

C. Early Academic Career and First Publications

E. D. Alright. Let's move on. What do you remember about the beginning of your academic career?

S. M. I started attending seminars. There is one mathematical problem that I remember particularly well. I still use it in my own seminars of this kind. The problem involves coding with a finite number of very long words.

E. D. You mean coding theory or the notion of information without probability theory. No, wait, it must involve probability.

S. M. Yes, probability is involved because independent errors occur in every word. So one of the problems we had to address is "What is the error in decoding when decoding is done following Hamming's minimal distance?" which is a very logical and obviously the best possible approach. At that time, however, it wasn't as obvious. There I deal with large deviation estimate for binomial distribution. I used elementary methods.

E. D. In what year were you assigned this problem?

S. M. In my freshman year.

E. D. You certainly didn't know much at the time.

S. M. No, but I used Stirling's approximation or something of that kind. In the second year I even wrote a term project on this subject. At the same time Roland Lvovich Dobrushin[8] published a note on this topic in a more general case. But later I published a further development of his result. At that time I already was familiar with the subject very well, and one must say that Dobrushin's note was very basic.

E. D. What was your first published paper?

S. M. My first published paper had to do with the class of harmonic functions satisfying the special boundary conditions on smooth surface. The result was mentioned in the talk you gave at the International Congress in Stockholm. It is closely related to the local time of the Brownian motion on this surface. Technically, it is the application of the classical potential theory.

[8] Interview with him is part of this collection.

E. D. Was it published?

S. M. It was published as a note.

E. D. Where?

S. M. In the *Vestnik* of the Moscow University. My next note was published in *Probability Theory*. It was dedicated to the study of the trace of the diffusion processes on smooth surfaces.

By the way, this paper was widely cited. Recently, I have returned to this subject, because Simon[9] and I are currently writing a paper on localization theory for a stripe with a random Robin type boundary condition. Such model simulates to some extent the stripe with a random profile. The probabilistic construction based on the trace of the Browning motion transforms the initial problem in the stripe into pure one-dimensional problem for the random pseudo-differential operator of the Cauchy type.

E. D. What about your PhD thesis? I remember some result on factorization.

S. M. I like more the small note published in *Probability Theory* on the Martin boundary for the group of affine transformations.

E. D. Is it related to Margulis' result?

S. M. No. Margulis worked with nilpotent groups, but the situation with solvable groups looks more interesting. Recently, Vershik is also working in this area.

D. The Second School[10]

E. D. Let's change the subject and talk about the time when you were actively involved with the second school. It was I who recruited you, right?

S. M. Yes.

E. D. You were interested in this sort of activity. We even wrote a number of books together.

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[9] http://www.math.caltech.edu/people/simon.html

[10] That is Moscow School No. 2. For more on this school see interviews of Evstigneev, Kuznetsov, and Taksar. It bears reminding that in 1963-65 Dynkin supervised the mathematical program of the school and was the editor of the editor-in-chief of the *Journal of the Mathematical School*. At this time Molchanov worked in the school as a teacher and served as an assistant editor for the journal.

S. M. Yes. The fact of the matter is that as a student I lived on a very limited budget. After all, my parents were poor and had many kids. And so, following the example of many other upper year students, I started working part-time teaching math. I was quite successful at it. I always have been interested in elementary math, and I was very interested in my job in the second school. Moreover, I thought that my involvement contributed to my general education. The teaching staff was wonderful in every respect. I particularly liked the school's literary curriculum which included Nobel prize acceptance speeches. In my life I have read lots of different authors, and so in general I was very much attracted by the high level of instruction in humanities. I even attended some classes which were taught by prominent writers.[11] So far as math is concerned, the school had a tradition of coming up with new problems for math Olympiads. This process usually involved heated debates about what problems should be included. We came up with a lot of new problems. Naturally some of them were old but slightly modified.

E. D. Were our books published again later?

S. M. I used to receive some new copies from Czechoslovakia and Yugoslavia.

E. D. I think I have some of these copies too. It would be interesting to compare them.

S. M. So I had a few copies from the countries of the Eastern bloc. The Yugoslav copy appeared after you immigrated to the US.

E. Kolmogorov's Last Years

E. D. You also wanted to tell me about you relationship with Komogorov. Please do, even if briefly.

S. M. I used to visit Kolmogorov quite often.

E. D. When?

S. M. In the last three years of his life, from 1984 till 1987.

[11] One of them was Anatoly Yakobson (1935-1978), a legendary figure of the Russian political dissident movement, translator, historian of literature, publicist, contributor and the editor of the dissident chronicle "Khronika Tekushchikh Sobytii" (Chronicle of Current Events) in 1969-73. This book includes articles, poems by Anatoly Yakobson, and memoirs about him. See also http://www.antho.net/library/yacobson/about/book-annotation.html.

E. D. At that time he was in pretty bad shape.

S. M. He was. His wife was old, and couldn't take care of him. So people from Mekhmat organized rotating shifts to look after him. I think that the main burden of organizing this whole thing fell on Tikhomirov.[12] He was very devoted to Kolmogorov. He was usually the one to call people when there was a need for assistance.

E. D. Who was involved in that?

S. M. Different people were involved. These were some of his last students in mathematical logic, namely, Zvonkin[13] (he visited very often), Semenov[14] (a very good student).

E. D. I don't know him. He must be one of his more recent students.

S. M. It was a group of students including Zvonkin ...

E. D. I knew Lyonya Levin.[15]

S. M. Yes, all of them were more or less peers. There was also Shen, who was ethnically Chinese or Korean.[16] Kolmogorov found a position for him in the faculty. Semyonov and Shen were Levin's peers. There were also older people, including myself, Misha Kozlov, whom I mentioned earlier. Vasya Kozlov, his younger brother, also was actively involved performing medical procedures, injections and so on. Arnold and Sinai also visited, although not as frequently as others. There were many other people too.

E. D. Shiryaev?[17]

S. M. Shiryaev did a lot in terms of finding medicine and things of that kind. The shifts were organized in the following way. On his arrival the person on duty had to read the doctor's instructions, make sure that Kolmogorov took his medicine in a timely fashion, and help him at dinner time.

E. D. Do you mean you had to spoon-feed him?

S. M. No, no, just to tie a napkin or something of that sort. He managed to eat on his own. Another thing is that he had a hard time moving around on his own. One had to lead

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[12] Interview with him is a part of this collection.
[13] http://www.labri.fr/perso/zvonkin/
[14] http://www.wise-qatar.org/content/dr-alexei-semenov
[15] http://en.wikipedia.org/wiki/Leonid_Levin
[16] http://www.lif.univ-mrs.fr/~ashen/cv.html
[17] Interview with him is a part of this collection.

him from the dining room to the leaving room holding him by his arm because he was terribly afraid of falling. It was some kind of psychological reaction. His legs would freeze as soon as he stepped over the threshold so that it was very hard to make him move.

We often discussed literature with him (he enjoyed those discussions a lot) or listened to music.

E. D. Was he able to communicate with people?

S. M. Yes, of course, although at times it was very difficult to understand him.

E. D. Was his speech impeded?

S. M. His speech was seriously impeded but not to the point of being completely unintelligible. With a certain amount of experience one could learn to understand him.

E. D. Was he able to write?

S. M. No, he couldn't write at all. If he wanted to write a letter, he would have somebody take his dictation and pass it on to Uspensky.[18] Uspensky was almost as active in organizing these shifts as Tikhomirov. Sometimes Kolmogorov talked about science but most of the time our discussions focused on other subjects. I remember particularly well some of the things he said because he liked to repeat them over and over again. For instance, he used to say that one of his best papers whose importance was not duly recognized in the USSR was his paper (or even two papers) on isotropic turbulence,[19] which he wrote in the end of the 30s. In 1985 there was an 50th anniversary of these papers, and Moffatt,[20] Director of Cavendish Lab at that time, published a paper in the *Journal of Fluid Mechanics*, where he wrote that the work of Kolmogorov marks a new stage in the development of modern hydromechanics. He maintains that the papers of Kolmogorov exhibit penetrating analysis, outstanding intuition, and that it is absolutely remarkable that they were written by a mathematician.

Kolmogorov also used to say that one of the happiest days in his life was when he was in Nice at the opening of the Institute of Turbulence. All the leading scholars of

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[18] Interview with him is a part of this collection.

[19] Kolmogorov, A. N. (1941). "The local structure of turbulence in incompressible viscous fluid for very large Reynolds numbers". *Proceedings of the USSR Academy of Sciences* 30: 299–303; (1941). "Dissipation of Energy in the Locally Isotropic Turbulence". *Proceedings of the USSR Academy of Sciences* 32: 16–18.

[20] http://en.wikipedia.org/wiki/Keith_Moffatt

classical fluid mechanics were still alive at the time: T. Karman and J. Taylor. On that day he learned that somewhere in Canada scientists managed to take a picture of eddies in the tidal flow in Vancouver channel. The distribution of the sizes of these eddies with high accuracy satisfied the 5/3 law of Kolmogorov. It was impossible to simulate these conditions artificially.

So he used to complain that Soviet scholars did not pay enough attention to these works and that only Yaglom[21] and Monin[22] fully recognized their significance. He continued working on turbulence even later in his career. He had also a very high opinion of his own work on divergent Fourier series.[23]

E. D. These were his early papers.

S. M. Yes. Besides, he also liked to talk about perturbations of Hamiltonian systems.

E. D. Something that is commonly referred to as ...

S. M. KAM method, after the initial letters of Kolmogorov, Arnold, Moser.

E. D. What about reading literature? You mentioned that earlier.

S. M. I read Pasternak to him. It was interesting because Pasternak and he had many friends and acquaintances in common. Kolmogorov was able to give excellent commentary on everything that concerned the family of Heinrich Neuhaus.[24]

E. D. Neuhaus is related to Sakharov I believe.

S. M. Yes, everything is quite close in this world. There was an interesting and rather telling episode that occurred when I read to him the poem by Voloshin[25] entitled “Russia.” I asked Kolmogorov about the water-color paintings that he had in his house. These were paintings by Voloshin. He said that he knew well the widow and other relatives of the poet and that he acquired these paintings after WWII. He said that he was a big fan of Voloshin’s literary talent, even though his poetry is usually considered as too cold and formalistic. Voloshin was a contemporary of Blok.[26] His poetic style resembled that of French

[21] Interview with him is a part of this collection.
[22] http://en.wikipedia.org/wiki/Andrei_Monin
[23] Kolmogorov, A. N. « Une série de Fourier–Lebesgue divergente presque partout », *Fundamenta math.* 4 (1923), 324–328; Kolmogorov, A. N. « Une série de Fourier–Lebesgue divergente partout », *C. R. Acad. Sci. Paris* 183 (1926), 1327–1328.
[24] http://en.wikipedia.org/wiki/Heinrich_Neuhaus
[25] http://en.wikipedia.org/wiki/Maximilian_Voloshin
[26] http://en.wikipedia.org/wiki/Alexander_Blok

Parnassian[27] authors. Kolmogorov said that he held Voloshin in high esteem as an artist and that his friend Roman Jakobson[28] was of the same opinion. It turned out that Kolmogorov was in touch with Jakobson. He met Jakobson during his visit to the US, whereas Jakobson in his turn visited Kolmogorov in the USSR. Jakobson thought very highly of Kolmogorov's articles on the theory of poetry.[29]

Anyhow, I told Kolmogorov that I had a yet unpublished poem by Voloshin entitled "Russia." I already knew that at that time, at the dawn of *Perestroika*, there was a fair amount of discussion about this poem. Kolmogorov asked me to read it to him. I started reading, but when I reached the phrase "Count Alexey Andreyevich Arakcheyev,[30] the first Bolshevik of the Russian land" he stopped me. He asked what it was exactly I was reading. I said that I was reading to him the poem "Russia" by Voloshin. "Where was it published?" he asked. Mind you, this was the second time he asked. I had explained everything to him before I started reading. I told him again that it was published during the NEP period,[31] and one could find it in the stacks of any decent public library. He exclaimed: "Nobody reads this kind of stuff in our house!" He even stomped his foot on the floor as he uttered these words.

E. D. Which shows that he was indoctrinated to a certain extent.

S. M. Yes, exactly. His face was flushed red, and he was visibly agitated. After that ...

E. D. When did this happen?

S. M. I think this happened a year before his death.

E. D. So Sakharov must have returned to Moscow from exile.

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[27] http://en.wikipedia.org/wiki/Parnassianism
[28] http://en.wikipedia.org/wiki/Roman_Jakobson
[29] Komogorov, A. N. (with A. V. Prokhorov), 'On contemporary Russian poetry: general characteristics', *Vopr. Yazykoznaniya* no. 6 (1963), 84-95. Kolmogorov, A. N. (with A. V. Prokhorov), 'Statistics and probability theory in research into Russian poetry', *Proc. Symp. on Complex Investigation of Artistic Creation* (Nauka, Leningrad, 1963), p. 23. Kolmogorov, A. N. (with A. V. Prokhorov), 'On contemporary dol'nik Russian poetry: Statistical characteristics of dol'nik in the works of Mayakovskii, Bagritskii, and Akhmatova', [Dol'nik is a form of tonic verse that has a trisyllabic metre and allows the omission of one or two unstressed syllables in each line], *Vopr. Yazykoznaniya,* no. 1 (1964), 75-94. Kolmogorov, A. N., 'On the metre of Pushkin's "Songs of the Western Slavs"', *Russkaya Lit.* no. 1, 98-111.
[30] A Russian general and statesman who became a symbol for the atmosphere of reactionary repression closing over Russian society (http://en.wikipedia.org/wiki/Aleksey_Arakcheyev).
[31] I.e. during the period of the so-called New Economic Policy which lasted from 1921 to 1928: (http://en.wikipedia.org/wiki/New_Economic_Policy).

S. M. Sakharov? In 1986, yes. Or maybe it was 1985. Somewhere around that time. I don't remember exactly now. By that time Kolmogorov was practically confined to his house.