The acceptance speech of the 2022 Weyl-Wigner award.

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Abstract

This is the acceptance speech for the 2022 Weyl-Wigner award.

Two books greatly influenced me in my early student years: the book by Herman Weyl "Symmetry" (1952, Princeton University Press) and the book by E. Wigner "Symmetry and Reflections" (1967, Indiana University Press). The notion of symmetry became the guideline in my studies and research. It adds greatly to the pleasure of receiving the 2022 Wigner-Weyl award.

When I learned that I was selected as a recipient of the Wigner-Weyl award, my first reaction was "Wow, it happened!". Finding myself continuing the list of imminent scientists who were awarded the Wigner medal was extremely rewarding.

To those who nominated me, who supported the nomination : thank you for your trust and confidence. To all my teachers: thank you!

This is a good time to reflect on my research career and on wonderful people whom I met, from whom I learned and with whom I worked with during all these years.

I was very lucky to meet many outstanding physicists and mathematicians. My studies at the Leningrad Polytechnic Institute in the nuclear engineering group. During the first year I realized that designing anti-radiation shields is infinitely far away from my interests in mathematics and physics. But this is where I met an outstanding teacher who became life long friend, Prof. S.P. Preobrazhensky. By the stroke of luck, as a sophomore, I came to a graduate course on path integrals given by V.N. Popov. This is how I got to Steklov mathematical institute and to Faddev's seminar. This seminar was an intellectual haven.

My first research success was the hierarchical algebraic Bethe ansatz construction that came out from a suggestion of P. Kulish to construct an algebraic version of Bethe ansatz vectors found in the work of C.N.Yang about for non-identical particles with δ-interaction in one dimensional space. The use of Schul-Weyl duality was essential. This work was my official arrival to the world of symmetries and integrable systems.

I was very lucky to start my research with V.N. Popov and P.P. Kulish from whom I learned a great deal. Soon I ended up working at the Laboratory of mathematical methods of theoretical physics headed by L. D. Faddeev who greatly influenced my research. One of his mottos was that one should do interesting mathematical physics, mathematics and physics. The other was to move on to new subjects, new ideas and not to get stuck in one theme.

During my earlier years at the Lab, I benefited greatly from working with my colleagues and friends, among whom are A. Kirillov, E.Sklyanin, M. Semenov-Tian-Shanski, F. Smirnov and L. Takhtajan.

In early 1980's I had an important collaboration with P. Wiegmann on principal chiral field theories. I got to know many people from Landau Institute in Chernogolovka which was an another intellectual gift. About the same time L.D. Faddeev and I worked on different aspects of the same chiral field model from a different perspective. This collaboration with L.D. continued later with the work on quantum groups. About the same time I was visiting A.M. Vershik seminar on representation theory which I started to appreciate more and more.

With the emergence of quantum groups V.G. Drinfeld came to Leningrad a number of times. Discussions with him were a treasure. About the same time, late-mid 1980's the collaboration with V. Turaev developed and brought some important results about invariants of knots and 3-manifolds. At the same time we wrote an important paper of quantum groups and solutions to the Yang-Baxter equation with L.D.Faddeev and L.A.Takhtajan. There many other important results, but now is not the time to discuss them.

Throughout Leningrad years contacts with researchers around the world were extremely important, it was done by mail and through discussions when international scientists were visiting Leningrad. Among. these people are M.Jimbo, T.Miwa, L. Kauffman, D. Gross and many others. I am still grateful to them and to others who are able distinguish people of a country from its government and science from politics.

In 1989 I moved from LOMI to Harvard and the whole new world of mathematics and physics opened up for me. There I met D. Kazhdan who seriously influenced my perception of mathematics. Among other first class mathematicians and physicists whom I met there and who affected my vision of mathematics and theoretical physics were J. Bernstein, R.Bott, V.Kac, I.Singer, C.Taubes, C.Vafa, E.Witten, S.T.Yau. The complete list would be too long. It was an intellectual feast. The invitation to Harvard came from A. Jaffe (via A. Beilinson) with whom we had many discussions about a "geometrization" of the constructive field theory program. I still think it is a potentially great direction which may eventually give a better mathematical understanding of path integrals in quantum field theory. E. Frenkel and B. Tsygan came to Harvard at the same time and became close friends. With Ed Frenkel we had a very productive collaboration later on. During my stay at Harvard we developed a wonderful collaboration with I. Frenkel which resulted in q-Knizhnik-Zamolodchikov equations.

In 1991 I moved from Harvard to Berkeley where I worked for 30 happy years. One of the great things about Berkeley was friendship with V. Jones. Another treasure was talking to R. Kirby. In Berkeley I had many enlightening discussions with E. Frenkel, A. Grunbaum, A. Okounkov, M. Rieffel, V. Serganova, A. Weinstein, and many others. Special thanks to my graduate students for keeping me in a good shape. I have great memories of all of them. Many of them became prominent mathematicians. In physics I was very lucky to have many discussions with B. Zumino.

In 2022 I retired from Berkeley and moved to Yau Mathematical Sciences Center at Tsinghua University in Beijing, starting a new fascinating chapter in my life.

Throughout all these years I was very lucky to work with many excellent people such as A. Cattaneo, C. De Concini, P. Mnev, C. Procesi, M. Rosso, and many others, again, the complete list would be too long.

My favorie research themes are

- integrable systems, Lie groups, Lie algebras,

- Quantum groups, their applications to integrable systems and topological invariants

- Quantization of gauge theories

- Statistical mechanics, integrable models.

My main goal is to retain optimism about humanity to continue with research, and with sharing the knowledge that I accumulated over the years.

Finally, special thanks to my family for continuing support over all these years.