Recollections of Professor Yuriy Reznikov

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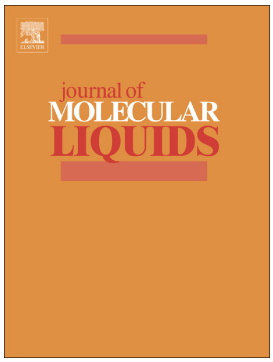

Recollections of Professor Yuriy Reznikov

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Remembering Yuri Reznikov

Mitya Reznikov

Verily Life Sciences, USA

Israel adventures

Choosing from many, many memories, I decided to share one about the time we spent together in Israel. We both turned up there seemingly by accident, but I'm sure it wasn't contingency. As I was spending few of my post-doctorate years exploring this amazing country and facing new challenges, my dad has visited Israel a few times - sometimes just for sightseeing, and sometimes for work.

It was inevitable that eventually we would end up working in the same lab for a month or so. Since when I was in middle school, I loved visiting the Institute of Physics in Kiev where dad worked, and sometimes I played with some equipment (although I preferred computer video games) and overheard some science conversations here and there. Long story short, I became fascinated with the liquid crystal area of physics and ended up working in the field, although more in the application side, as opposed to fundamental science dad worked in with such success.

But it's not only the scientific achievements that I've been so fascinated by. It's the way he built and cherished the relationship in his scientific community. Every time I was around the members of the liquid crystal community - in Ukraine, US, Israel or Hong Kong, I was always amazed how people talked to him and talked about him when he was not around. He was very much liked and respected, something that I would like very much to be as well. That was the most noticeable and characteristic thing about him, I think.

Figure 1. Yuri Reznikov and his son, Mitya. January 2012, (photo by Einat Klein)

In Israel, we worked together on a project dedicated to dynamic liquid crystal microlenses in a research lab that was a part of a very interesting and unusual institute, "Jerusalem College of Technology", or "Machon Lev". Technical and scientific studies were combined with the Judaic learning which was very unusual to somebody from outside of Israel and orthodox Jewish community. For example, our lunch breaks had to be scheduled around the afternoon Mincha prayer.

Aside from work, we spent some time exploring Israel. We went to the Golan Heights at the north, and Beer Sheva at the south; hiked to the hermit monastery of Saint George in the Judean Desert (although dad prefered to ride a donkey crossing the gorge, just like the Messiah would, as the prophecy foretold); did a pilgrimage to the Christian holy sites (seems like he wasn't convinced) and drank coffee and wine everywhere - that was real.

As far as I can remember, on this picture on the beach,, my dad was explaining me his idea of how to use cell phones for sight-seeing applications - basically pitching the augmented reality app years before they came to life. He wanted to have a start-up and I should have listened to him! I think I did listen to him most of the time, though. Since I was very little, we talked about science, arts and photography. I was, of course, very influenced by him. Since I moved to US when I was 23, we didn't spend as much time together as we would have if we lived nearby, but he was always a text or a phone call away. Now my goal is to use all

the best knowledge and experience that I was given and to learn from his experiences as well, to live life to the fullest and be a good person. As my dad, I thrive to be curious, knowledge-thirsty and maintain and cherish that healthy balance inside you that translates into a good life for you and your loved ones.

A personal recollection: A tribute to Yuriy Reznikov

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Abstract. Meeting the right people at the right time is as important as hard work, persistence, and talent. Yuriy Reznikov was one of the key people who shaped my life and had an important impact on my scientific and personal development. His motivation, diplomacy, openness and engagement taught me how to appreciate the work of other people, to collaborate with peers, and even to face the world outside academia. As a tribute to Yuriy, I would like to share with you this brief personal recollection of time spent in the Department of Physics of Crystals at the Institute of Physics in Ukraine, first as a master and then a PhD student.

When I started working with Yuriy in 1996 I was about to finish my master's project at the Kiev National University. My scientific advisers, Igor Pinkevych and Victor Reshetnyak, collaborated closely with Yuriy. It was Victor who introduced me to Yuriy's lab at the Institute of Physics (IoP). I did not know much about the academic environment outside university but the idea of working together with an experimental group was very appealing. Eventually I enjoyed it so much that I stayed and started my PhD at the IoP.

The decision to stay was motivated not only by the scientific environment. Socializing with Yuriy and his group was as exciting and rewarding as exchanging ideas with them. Already at the first meeting Yuriy Alexandrovich (or Prof. Reznikov) insisted that I should address him by his first name -- something very atypical to a rather formal academic environment in Ukraine. In fact, Yuriy was not only an excellent scientific leader but also the soul of the group. The group was his hobby, his life, his second family.

The main scientific focus of the Department of Physics of Crystals headed by Yuriy was liquid crystals (LCs). This research field was booming in the 90s. Tube-based televisions were replaced by liquid crystal displays and industrial needs were requiring developments of new technologies. Wide view angle modes of LCDs, rubbing-free alignment of LCs on substrates, and bistabile devices were the topics constantly discussed at the meetings and conferences. Yuriy was always well informed about hot directions and relevant research labs: thanks to his personal contacts the group actively collaborated with universities and companies all over the world. Of course, we all benefited from Yuriy's open-mindedness. Ukraine had just become independent and the subsequent economical crisis implied that the National Academy of Sciences could not be maintained as it used to in the Former Soviet Union. Thanks to collaborations initiated by him and in spite of budget cuts the members of the group could still travel to international conferences and profit from the third-party funding of collaborative projects. I can say without exaggeration that his generosity encouraged young researchers to stay in academia as well as helped many established scientists to survive through the turbulent times of the 90s.

Figure 2. Different facets of the group life. Top: My first international conference with the IoP group in Strasbourg, France in 1998: (left to right) Andrey Iljin, Irina Estrela-Lopis, Oleg Lavrentovich, Yuriy Reznikov, Viktor Reshetnyak. Bottom: A weekend during the visit of the Liquid Crystal Institute, Kent, Ohio, USA: (left to right) Denis Andrienko, Anatoliy Glushchenko, Oksana Glushchenko, Katerina Artyushkova, Yuriy Reznikov.

Yuriy's amazing intuition was not only confined to science. At that time the urban population of Kiev preferred to live in flats arranged into large communal complexes. He was one of the first to realize that a few remaining non-urbanized areas were worth investing and moved to a house on the outskirts of the city. By now it is one of the most demanded living areas of Kiev.

On the scientific side, his interests were always very broad. One of the key topics was surface anchoring effects [1], and here Yuriy's contribution was pioneering: he was one of the first researchers to realize that the nematic alignment on a cross-linkable polymeric film can be controlled by UV light. Prior to this discovery, surface orientation of the nematic director was achieved by mechanical rubbing, which often damaged thin film transistors controlling the pixels in a display. Calculating the director distribution and optical response of a liquid crystalline cell was my very first contribution to the science in the group [2]. I

must confess that working together on that very first theoretical model was great fun. It taught me that real-life problems often require sets of theoretical and computational tools that differ from the ones used by pure theoreticians. The trial and error process of refining the model made me realize that I will always rely on certain approximations. How reasonable these approximations are should, however, be verified by the experiment.

In this respect I am highly indebted to Yuriy. He knew very well how important it is for a young scientist to feel capable of contributing to the research of the group. He constantly encouraged me to dig into different problems, read relevant literature, and closely communicate with the experienced members of the group.

Realizing the importance of reliable and accurate surface anchoring measurement techniques, we went on and systematically analyzed different approaches for measuring the in-plane anchoring strength. Here the key issue was the optical response of the cell: only for very smooth variations of the director the polarization of the laser beam could follow the director rotation. In this, the so-called Mauguin regime, the polarization of the outcoming laser beam coincided with the orientation of the liquid crystal director at the surface. This, however, was not the case for rather large distortions induced by the magnetic field or substrates in super-twisted cells. More advanced models for light propagation, beyond the Mauguin limit, were required. Developing them and understanding the errors introduced by the Mauguin approximation formed the base of several follow-up publications [3].

At the same time, the liquid crystalline community became aware of the fact that the director optical response could be further enhanced by using azo-dye doped liquid crystals. In doped systems one could even observe the light-induced director sliding on the substrate [4]. This sliding could be controlled and even completely quenched by the amount of induced anchoring energy. Moreover, in the dye-doped liquid crystals there was a substantial increase of the optical torque already at moderate laser intensities. This effect allowed us to detect a transfer of the angular moment of light to the elastic deformation in a liquid crystal [5].

These observations resulted in several technological developments. For example, in a cell with a weak in-plane anchoring it was possible to achieve smaller driving voltages than those of the conventional in-plane switching mode displays [6]. Eventually, we could also provide quantitative models for the liquid crystalline alignment at interfaces [7,8].

Yuriy always patiently listened to the members of the group, sometimes for hours, trying to make sense of our half-baked ideas. The blackboard behind his desk was full of diagrams, equations, sketches of experimental setups, and cell designs. It is during these discussions that the ideas were generated and crystallized into experiments and models. How he managed to dedicate so much time to other people is still a puzzle to me.

From early stages on he encouraged the group members to be independent by wisely delegating not only scientific but also administrative responsibilities. I still can remember the confidence boost I experienced when Yuriy asked me to take care of one of the large collaborative projects funded by the Soros foundation. He also let me do the experiment with the precious equipment, which was a unique experience for a theoretician: a sudden realization that one can spend hours adjusting the Berek compensator, while it took only a second to write a sentence about the circular polarization of light being achieved with this tool. He also encouraged us to be mobile and taught us how to promote and advertise our work.

In 1998, after two years in the group and a year or so before my PhD defense I decided to move abroad and within months obtained an offer to pursue a degree at the University of Bristol together with Prof. Mike

Allen. The move was motivated by several factors. First, I felt some peer pressure: many of my friends were less lucky in finding stimulating and flourishing scientific environments in Ukraine and so left. Second, I wanted to follow a new research direction, in this case related to computer simulations. Finally, I felt that as a theoretician I should experience working in a ``pure theoretical" environment. Even in this situation Yuriy remained diplomatic and understanding: he did not object to my move yet convinced me to finish the ongoing work, write a thesis, and defend my PhD. Looking back I do realize that it was really worth the effort. And when I was defending my ``simulations" PhD thesis in Bristol, I could proudly say to the PhD committee that I have seen liquid crystals not only on the computer screen, but also in an experimental lab, and even in a large-scale LCD factory.

After I left IoP we kept good relations and contact. I have joined the alumni of the group, the Liquid Crystal Net (http://lcnet.org.ua/), a community of people working in the area of liquid crystals. A few years later Yuriy's recommendation linked me to an interesting project with the Korean company LG, where I developed the code for the prediction of optical properties of multilayered birefringent materials.

It was an exciting experience to work at IoP and I am greatly indebted to Yuriy for being and excellent scientific mentor, a role model, and a friend.

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My recollections of Yuri Reznikov

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Strictly speaking, my relations with Yuri Oleksandrovych Reznikov cannot be classied as friendly. I held the position of chief engineer at the Crystal Physics Department headed by him. Most likely, we could be considered as allies sharing the same views concerning the scientic activity and social life of the department. Nevertheless, I remember a few instances when Yuri consulted with me on the problems that arose in his private life. However, I believe that, in those cases, he rather addressed my life experience, because I was ten years older.

I am sure that science always dominated in Yuri Oleksandrovych's life. As his colleague, I was impressed by Yuri's high purposefulness and efficiency when working at the issues which he regarded as principal. At the same time, he simply forgot about things that he did not considered as important. An a priori benevolence to everyone and an absolute disapproval of conflicts were also typical of his character. Sometimes people misused this peculiarity in his behavior. In those cases, Yuri suffered, but tolerated avoiding any quarrels.

Photos with Yuriy

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Figure 3. Y. Reznikov giving a talk at International Liquid Crystals Conference, Krakow, Poland (2010).

Figure 4. Y. Reznikov giving a talk at International Liquid Crystals Conference, Krakow, Poland (2010).

To the memory of Prof. Yuriy Reznikov

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I came to the Department of Molecular and Liquid Crystals as young PhD student in 2001. Remember that it was spent a lot of time to find Yuriy's office: there were no any room having plate with his name. I think that even now the plate with name of his grandmother A. F. Prikhodko is left at his room. It was surprising: beneficial representation of own name and achievements is an inalienable part of scientific work in the age of severe competition, but Yuriy represented not himself, but his grandmother. Later I knew that Yuriy's grandmother A. F. Prikhod'ko was the outstanding scientist, at the same time Yuriy's modesty and anxious care of grandmother's memory impressed me pleasantly. Yuriy belonged to that rare group of people, who understand the importance of not only professional achievements, but also warm personal relations and joint communication in the group. It was evident on such examples as joint cooking of meat dumplings before the New Year celebration, when we met cheerfully our colleague A. Dyadyusha, who shared impressions of his life and scientific work in Southampton; or it was happened that group was going to make shish kebab signalizing the beginning of vacation time; it could be the birthday of Yuriy or somebody from his co-workers; it was definitely celebration of the Big Pre-tilt Day. Oh, do you know, what does this holiday mean? I think that everybody, who worked or communicated with Yuriy know about this nice local festive occasion. The roots of this holiday come from the liquid crystal photo-orientation science, in which Yuriy is one of the pioneers. It was the day, when the rod-like molecules of liquid crystal were successfully aligned with high pretilt angle on the surface of photosensitive polymer. The joy from this successful experiment and team spirit were so strong that, thanks to Yuriy, it was initiated a holiday, which competent people still celebrate as a trade holiday or day of liquid crystals. Such tradition certainly inspires to new achievements and discoveries.

Recollections of Yuriy Reznikov

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When we first met Yuriy Reznikov, ten years ago, we were immediately impressed by his kindness and enthusiasm. We had just arrived in Kiev by an evening flight and he invited us at a typical Ukrainian restaurant where we discussed all kinds of matters ranging from science, of course, to geopolitics and cultural life. That night, already, we could appreciate Yuriy's curiosity and open-mindedness.

As a scientist, Yuriy was also a very enthusiastic and positive person who could push many projects simultaneously and who naturally raised the spirits of his collaborators. He kept preciously in his office a portrait of his grand-mother who was a Director of the Institute of Physics of NASU. His grandfather was one of the most prominent scientists of the Soviet Union and Yuriy often liked to recall his childhood vacations that he spent with him at a scientific center close to Moscow. In spite of such a distinguished scientific family heritage, Yuriy always remained a modest and very accessible person. He cared about his team members almost as much as his family. A few years ago, when he stayed at Orsay on an invited CNRS Research Director position for several months, he insisted on doing experiments on his own, arguing that it made him feel a little younger. These experiments are at the basis of one of the scientific articles gathered in this special issue.

On a more personal point of view, we took great pleasure in each of our meetings, either in Kiev, in Orsay, or at conferences. When we visited him, Yuriy was always a thoughtful host, eager to make you draw the most from your visit and feel at ease. He went as far as arranging tours of the city and providing tickets to classical music concerts. He loved to share with visitors his taste for Russian literature, Ukrainian food, Rock and Roll music, among others. Yuriy also loved to travel, and to Paris not in the least. Since he was very fond of antics, we went together to the flea market, the Paris Auction House, and antics fairs. Quite soon, our professional relationship turned to true friendship. In fact, Yuriy had many friends in the scientific community.

Despite his very serious heart condition, Yuriy always insisted on climbing up the steep hill from the train station to our laboratory as he thought that it was good training for him. Actually, Yuriy never complained about his illness. He merely expressed frustration that he could no longer ride his scooter in town. Even when he was diagnosed with kidney failure during a long stay at the hospital, Yuriy managed to put together, on his hospital bed, a beautiful research proposal about nanoparticle-doped liquid crystals. This anecdote shows that the disease could not curb his enthusiasm and energy. Several months before his death, Yuriy told us that he was probably not to survive much older than sixty. Unfortunately, he was right and we now all miss him dearly.

Yura Reznikov as a scientist and scientific manager

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I was lucky to work for almost the whole my life in one place being a good one, indeed. Crystal Physics Department in the Institute of Physics (Kyiv) was founded by the great lady of science, Antonina Fedorovna Prikhot'ko (I am sorry, but the transliteration from Cyrillic is awful of necessity). I became the staff member there in 1971 and enjoyed the atmosphere of research and freedom, rare in the Former Soviet Union. After Prof. Prikhot'ko passed away, the situation in the Department deteriorated, the more so it deteriorated in the Ukrainian science altogether. And in 1995 to avoid the decline, Yura Reznikov, her grandson, was appointed as a head of the Department.

He radically changed the direction of research making liquid crystals the main topic, whereas the traditional optics, remained the principal investigation method. Some members of the former staff were included into the program suggested by Yura and some people came with him from the Quantum Electronics Department. It was remarkable how the bleak decay transformed into the notable success. First of all, Yura used his scientific and personal connections to the people both in the Former USSR and abroad. Hence, the required measurements could be made even in the case when the desired equipment was not yet at hand. The materials synthesized all over the world arrived into the Department making the research more diverse. But the main factor was Yura himself as a center of attraction for young guys from the capital and provincial Ukraine.

Some of them are now prominent scientists in different countries and may write their own specific recollections. It was a pleasure for me to see their advance in physics. Yura was never envious to his disciples, which is rare in Russia and Ukraine, and retained good relations with those who had left the Department. Therefore, Yura's scientific geography widened and the collaboration network enabled his status as one of the main researchers in the liquid crystal physics and related areas of science.

Prof. Reznikov gradually and carefully changed the primary direction of his studies as a response to the industrial demands and recent scientific discoveries. That is why Yura established close relations with industrialists who gave a significant financial help. As for the science, molecular photoalignment was amended by electric conductivity studies both in the bulk and at the surfaces of liquid crystals and the corresponding isotropic phases. Later on, Yura started the promising program devoted to the lyotropic liquid crystals and related colloidal solutions. The colloid physical chemistry of suspensions including small ferroelectric and magnetic particles turned out to be the fascinating research area. Unfortunately, this activity was interrupted by Yura's premature death.

Yura loved science and hated the administration considering it as a necessary evil only. Nevertheless, actually he was one of the best team leaders at the Institute of Physics. His administrative duties were performed reluctantly but successfully, as all his other activities. The Department became well known in the liquid crystal community and under the direction of Prof. Reznikov regular international conferences, mutual scientific visits etc. were organized. It is not unexpected that quite a number of new PhDs appeared during Yura's short period of the supervising position.

One should fully recognize that such a success, significant *per se*, was achieved in the country full of corruption, willingly forgetting its scientific past, always humiliated by greedy politicians and later on torn by war. Yura's life shows how to manage science even in the circumstances when it seems impossible.

Recollections on Yuriy Reznikov – Personal views and the beginnings of nanoparticle dispersions in liquid crystals

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Stories like these are never easy to tell, and I would much rather write a laudation on Yuriy's ongoing work than on his accomplishments prior to his passing. His work on photoalignment[1] and on nanoparticle dispersions[2-5] are the ones most scientists in the field of liquid crystals will remember, but those of us who knew the person, will surely remember a very engaging story teller of liquid crystal science, an advocate for scientific collaborations across boundaries (and there are many; boundaries that is), as well as a gentle and kind person.

I most certainly did not know Yuriy personally nearly as long as some of the other authors contributing to this special issue, but my interactions with him were intense throughout; very critically judging each others research early on, but growing to a deep appreciation of each others science and our approach to personal interactions among scientists. Our first intense interactions took place at the 21st International Liquid Crystal Conference in Keystone (Colorado) that was organized by The Liquid Crystal Materials Research Center at the University of Colorado at Boulder (chaired by Noel Clark). Having just started to publish some of our own first results on nanoparticles in liquid crystals,[6] I was particularly intrigued by his collaborative work with John West‡ on ferroelectric nematic colloids. The tremendous increase in the clearing point by almost 40 °C due to the presence of just minute amounts of ferroelectric $BaTiO_3$ nanoparticles and their orientational coupling with the nematic liquid crystal matrix seemed extraordinary, but just too high considering the low concentration of the particles of 0.2 wt.%.[7, 8]

My group, then still at the University of Manitoba (Canada), had begun to investigate various compositions of nanoparticles in liquid crystals, and our initial focus was on systems that interrogated particularly the surface chemistry of suspended (or in some specific cases, as it turned out, not suspended[9, 10]) nanoparticles in nematic phases.[11, 12] What we learned quickly was that even the tiniest changes to these systems had large and in many cases significant consequences. We therefore decided to work only on pure nematic liquid crystals, not mixtures, and on systems where nanoparticles were capped with, as-reported, stable ligand shells. Needless to say, over the days of the conference, Yuriy and I argued with one another, friendly yet stern, as to which approach is better, which nanoparticles to focus on, etc. While we could not agree back then, I think we both came back home filled with a sense that these nanoparticle-liquid crystal systems required special attention and that new factors were at play that are not occurring in most other doped liquid crystal systems – shape, thermal/chemical stability, size, surface, etc.[13, 14] Whenever we met thereafter, these discussions continued and a deep appreciation of each other's research amplified. The field of nanomaterials in liquid crystals, which was pursued by just a very few back then and largely curiosity driven, has now developed into a major contemporary theme in the field with an ever-increasing number of groups around the globe working on it. Perhaps many such early arguments among scientists positively influenced this special field of liquid crystal research. I deeply cherished and will always remember the challenging and stimulating discussions with Yuriy.

A very special moment in my interaction with him was actually an indirect one: an application from his son, Mitya Reznikov‡, for a postdoctoral position in my group in late 2011, just after I relocated to the Liquid Crystal Institute (LCI) at Kent State University. Mitya did not remember this when we invited him to visit the LCI again in September 2017, but my first question to him when he arrived in my lab in early

2012 was: “Does you father actually know that you applied to my group for a postdoc position and that you are now working with me?” He answered: “Yes, my dad recommended I contact you.” Mitya obtained his Ph.D. from the LCI’s Chemical Physics Interdisciplinary Program, but never worked on nanoparticles or nanoparticles in liquid crystal prior to this. I am certain that Mitya quickly started to appreciate that the research on nanoparticle interactions with liquid crystals his dad and my group were pursuing was truly complex and filled with surprises, even opening up opportunities for new applications.[15, 16]

Yuriy and I had plans for collaborative work and projects, but sadly we will not be able to do so. I truly miss seeing him at conferences, us challenging one another, trying to find common ground for collaborative work, and just listening to each other and appreciating how far this particular sub-field has evolved from the early beginnings we both contributed to.

Notes and references

‡ Both John West and Mitya Reznikov read this letter prior to submission and agreed to their names being mentioned.

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Memories of a Colleague

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My collaboration with Yuriy Reznikov began in the early1980s at the Institute of Physics of the NASU. At that time, researchers in the photoactivity department had early results on the laser generation of dyes in nematic liquid crystals (NLCs) and on the use of cholesterics as a laser resonator mirror. During the beginning of his career, Yuriy studied holography like the majority of researchers in the department of quantum electronics. Studying the records of holograms in NLCs, he discovered some very interesting peculiarities which allowed him to assume the existence of a new “giant” nonlinearity in liquid crystals.

Yuriy shared his results with me. His data was so unusual that at first I did not believe the findings. Yuriy was persistent and clearly demonstrated the transformation of molecules of a liquid crystal under the action of light. We put his cell with a liquid crystal (ZhK-440, as I remember) in a spectrophotometer, set a wavelength of 410 nm, and observed the formation of a scattering in the cell. This reproduced the slit of a spectrophotometer in 5 minutes of the irradiation. This clear and visible result quickly convinced me of future applications.

After this discovery, at a conference on coherent and nonlinear optics in Kiev I introduced him to several Moscow physicists. Yuriy collaborated with them and provide himself with substrates, which orient liquid crystals, and other materials that are crucial for liquid crystals work.

Later, as the head of the department, Yuriy built a modern, technological base to study liquid crystals. For a decade, I had the privilege to collaborate with Yuriy on various research projects. He was a beautiful person, talented physicist, and excellent organizer. Yuriy had a full life focused on creative, scientific work that forever influenced the study of liquid crystals.

For the Late Professor Yuriy Reznikov

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For the first time in my life, I am writing a commemorative note on the sudden loss of a valuable friend. This is a difficult situation for me. When I heard the sad news, it was hard to believe. It had only been a few days since we had texted. He stated that he had some restrictions due to his health. On the phone profile picture, he was wearing neckwear that I gave him as a gift during my visit to Kiev.

His sudden passing shows us that there is a first-order phase transition in our own life. Every death reminds us of our own death. It provides a mirror of our own existence. Of course, life goes on as entropy increases. But it is always sad to lose our dear friends.

Yuri gave me an opportunity to work with him in a research project for a short time. We worked on the project of nanoparticle-doped liquid crystals. During my study period, we spent time together in beautiful Kiev. Every week when he visited in the laboratory, he asked questions about the research and gave advice about the experimental details. He was always a smart dresser. When I went to his office to share ideas on the research, he explained his novel ideas about the subject. He had a profound knowledge of optical properties of liquid crystals.

Before I left Kiev, we watched a nice show in the famous National Opera of Ukraine (see photo below). I also invited him to Turkey as my guest, but due to health problems, he had postponed the visit until a later date.

As Rumi says, ”I learned that every mortal will taste death, but only some will taste life.” He surely tasted the scientific aspect of life by completing amazing research.

Yuri will continue to live in our hearts. His name will be eternal in the liquid crystal world. Maybe he is now taking his relaxation time, near the Fermi energy level, in another dimension of space-time.

Figure 5. With Yuri in the opera building.

In Memory of Yuriy Reznikov, the Scientist, the Teacher, the Humanitarian

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In this paper we describe the history of a long-term collaboration between Prof. Yuriy Reznikov and Department of Physics at the Zhytomyr Ivan Franko State University. Hundreds of publications and inventions were contributed to science, made by the students of Prof. Yuriy Reznikov.

Keywords: *Yuriy Reznikov*

Our collaboration with Yuriy Reznikov began in 1986 when an alum of the University, Oleg Yaroshchuk [1], became a graduate student at the Institute of Physics of the National Academy of Sciences of Ukraine. Next, our alum Volodymyr Bodnar, went to study in Kyiv, but was quickly recommended by Yuriy Reznikov for graduate studies at Kent State University. A great collaboration and friendship began between our two institutions, and in particular, with Yuriy Reznikov.

In 1993, two more graduates of our University, Anatoliy Glushchenko [2] and Dmitrij Stepanchikov, entered the graduate school at the Institute of Physics. For Anatoliy Glushchenko, Prof. Reznikov became a supervisor and thesis advisor. At that time, the Soviet Union had collapsed and Ukraine gained its independence. Being a scientist was difficult because there was not enough money to provide the necessities for life. As a result, many young scientists decided to quit studying and instead went to work in other professions. Despite the immense difficulty, Yuriy managed not only to keep his research group, he expanded it and became one of the largest and most productive at the Institute of Physics.

Dmitrij Stepanchikov [3] conducted research in photophysics of bacteriorhodopsin-based materials. His lab and the physics of liquid crystals lab at the Institute of Physics were next door to each other, separated only by a thin wall. Very often, Stepanchikov asked for advice from his closest neighbour, Yuriy Reznikov, who always responded and supported his interests. Yuriy was always willing to share equipment, which was sometimes "rented" for weeks or months, but no one demanded its return. When D. Stepanchikov defended his PhD thesis, Reznikov acted as a reviewer As always, Reznikov took his responsibilities seriously and found several shortcomings in Stepanchikov's work that needed to be corrected quickly. After graduating, Stepanchikov returned to work at our University. His students became graduate students at the Institute of Physics and devoted themselves to the study of liquid crystals.

In 1998, Yuri Zakrevski [4] joined the graduate school of the same Institute of Physics. After two years, he became a researcher at the Fraunhofer Institute of Applied Polymer Research (Germany) with recommendations from Prof. Reznikov. He successfully defended his PhD thesis and is currently working at the Cologne University of Applied Sciences, Koln (Germany).

In 1999, after successfully passing the entrance exams, Oleksandr Buluy [5] entered the graduate school at the Institute of Physics. During his studies at the Department of Physics of Crystals under the supervision of Yuriy Reznikov, Oleksandr studied the magneto-optical properties of nematic liquid crystals doped with magnetic particles, characteristics of photo-alignment materials. Oleksandr was supported by international grants and worked in research labs in Germany, France, and South Korea.

In 2000, Oleksandr Buchnev [2] and Ruslan Kravchuk [6] were accepted to the graduate school. Oleksandr got married during his studies and the young couple had nowhere to live. Yuriy Reznikov provided half of his house at no cost to the young couple. They lived there for about two years. Ruslan Kravchuk continues to work at the Institute of Physics of the National Academy of Sciences of Ukraine.

Platon Komiychuk [7 8] joined the Department of Physics of Crystals in 2002. For Platon, Prof. Reznikov was not only an example of a great scientist, but also of an extraordinary humanitarian. Platon came to Yuriy as a recent young graduate and matured into an experimentalist who could conduct and enjoy sophisticated research and make enlightening reports at seminars and conferences.

Few liquid crystals scientists were as deeply passionate and professional as Prof. Reznikov. His enthusiasm and energy charged his entire research team. Especially impressive was Yuriy's ability to easily and clearly explain difficult physical phenomena.

Prof. Reznikov's personal life was also closely connected to scientific work. He invited colleagues to his home to continue scientific discussions and create plans for further investigation.

In addition to inspiring his students, Yuriy helped them on a personal level. Once, Prof. Reznikov noticed that his graduate student Platon Korniychuk, was financially struggling when his second child was born. Prof. Reznikov began supplementing Korniychuk's income from his own savings. When there was a vacancy in a European project, Prof. Reznikov recommended Korniychuk for a research position. Currently, Korniychuk works at our University. He is sincerely grateful for the opportunity to learn scientific and life wisdom from Prof. Yuriy Reznikov.

In 2003, Yuriy Garbovskiy [9] became a graduate student at the Institute of Physics, Physical Engineering Training-and-Research Center. After graduating and defending his PhD thesis, he continued to work as a Staff Scientist at the Institute of Physics, but at the same time held a part time faculty position at our University. Two years later, he became a faculty member at the University of Colorado, Colorado Springs (USA) where he continues to work.

Another student, Oleksandr Kurochkin [10], was enrolled in graduate studies at the Institute of Physics in 2005. During his study and work at the Department of Crystals under the supervision of Yuriy Reznikov, he conducted research on the electro-optical properties of nematic liquid crystals with ferroelectric particles. He worked in the leading laboratories of France, Britain, and Israel.

In 2007, Vasyl Kirichenko became a graduate student in Yuriy Reznikov's department. After finishing his studies, Vasyl returned to Zhytomyr and currently works as a physics lecturer at the Zhytomyr Sergiy Korolev Military Institute.

Denis Kasyanyuk enrolled in the same graduate school in 2009. After finishing his studies and defending his thesis, Denis, by the recommendation of Yuriy Reznikov, worked in LiCryl lab at the University of Calabria (Italy), and now works in the Advanced Research Laboratory at the Bilkent University (Turkey).

In 2011, our student Alina Lyashchova became a graduate student at the Institute of Physics. After graduating, Alina returned to Zhytomyr and teaches physics in one of the city gymnasiums.

Reznikov contributed hundreds of publications and inventions to science through not only his own research, but by teaching and assisting countless students who have continued research and teaching.

Currently, the average age of the young scientists, alumnae of our university, supervised by Professor Yuri Reznikov is 36 years old. In their careers, these students will successfully conduct scientific research that will bear the imprint of their scientific advisor and outstanding humanitarian, Yuriy Reznikov.

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In memory of Yuriy Reznikov

Y. Kurioz

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I began working in Yuriy Reznikov's group in September 1994. My friend and classmate, Andrei Dyadyusha, recommended me for this group. When I joined the research group, Yuriy had recently discovered the effect of liquid crystals photoorientation [1]. The topic was both interesting and timely. The discovery resulted in a multi-year collaboration with LG-electronics on numerous projects including an in-plane-switching (IPS- mode) for cells with controlled energy for next generation displays. The energy of anchoring of liquid crystals to photoorientents can be controlled by changing the irradiation dose of UV light during photopolymerization. Therefore, the idea proposed by Yuriy was to reduce the control voltage of the cell by decreasing the anchoring energy of the LC with the photoorienting surface [2]. I will say that our cooperation with Yuriy Reznikov resulted in 35 joint publications, more than 40 reports at international conferences and my PhD thesis: "Nematic liquid crystals reorientation in the cells with photosensitive aligning layers". The major, on my opinion, from this scientific works is: the orientation of the LC in a magnetic field [3], measurement of sticking of liquid crystal on photosensitive polymer layers [4], the study of highly sensitive photoaligning materials on a base of cellulose-cinnamates [5], photorientation of a reactive mesogens on photosensitive polymer surfaces [6], measurements exposure and temperature dependencies of the contact angle of a liquid crystal on a photosensitive surface [7] and photoalignment of liquid crystals on un-organic chalcogenide glassy films [8].

Figure 6. A. Dyadyusha, Yu. Reznikov, Yu. Kurioz in the optical laboratory of the Department of Physics of Crystals, Institute of Physics, Kyiv, 1998.

The second big and interesting topic on which we worked together with Yuriy - it was the annual Christmas Conference on Liquid Crystals (CCLC), which were held at the Institute of Physics. For nearly 20 years, 16 conferences were held at which more than 400 reports on liquid crystals and soft matter physics were presented. Scientists from many universities in Ukraine, France, Great Britain, Poland, Italy and the USA participated at those conferences. The CCLC became a collaborative learning experience for young scientists. For several now well-known scientists, it was their first conference where they presented their work.

Figure 7. A. Iljin, Yu. Reznikov (sitting), V. Boychuk, Yu. Kurioz A. Dyadyusha, O. Buluy, D. Fedorenko, A. Glushchenko, O. Tereshchenko (standing) in the office of the Department of Physics of Crystals, Institute of Physics, Kyiv, 1999.

The modern liquid crystal school in Ukraine was formed thanks to the work and dedication of Professor Yuriy Reznikov. The alumnae of his group work in Ukraine and in many countries abroad. The characteristic features of this scientific school include:

- Only pioneering results were considered to be worthy of a publication.

- Mandatory discussion of the results with colleagues from other groups and universities.

- Active cooperation with theoretical scientists.

- No paper was published without a clear idea of the physical and theoretical model of the phenomenon or studied effect.

- Active international collaboration.

- Encouraging and supporting graduate students.

The most impressive feature of Yuriy Reznikov was his enormous capacity and dedication to his work and his determination and commitment. Wherever he was, his thoughts were always with his research group. During lunch time, vacation, at home, and even in the hospital. The last e-mail I received from him ended with the words, "In an hour, I will be taken to surgery. Hope to be online on Friday. Yu." A few days later, he is gone.

Acknowledgments

I want to express my gratitude to professor A.Glushchenko and Y.Garbovskiy for the granted opportunity to write a few words about my teacher Yuriy Reznikov.

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My Dear Friend Yura will always be in my heart

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October 8, 2017. A whole year passed, a year without Yura. The difficult task is to write about Yura in the past tense, to write the word "was". Then, a year ago, on October 8, 2016, I received an email from Vitya Reshetnyak, who informed me that the irreparable happened. But, my heart did not accept it then. Also does not accept it now.

We lived in different countries, met and in Jerusalem, and in Kiev. And every time it was some kind of discovery, find something new in Yura. I remember how during one of his visits to Jerusalem, walking along the streets of the city, Yura saw a boy of 8-10 years old in a wheelchair with his nanny. Yura stopped, met the boy and talked with him. And further, during each of his visits to Jerusalem, he always met with this child, brought him gifts, walked with him.

Tell me, do you know a lot of people in your community who are capable of such spiritual subtlety? I do not know. I write and think, probably, it is necessary to somehow try to find this boy and explain to him that he was not betrayed in friendship.

But could it then come to my mind, to find out the child's name and his contacts? It seemed me that this will always be so. And only having lost, you understand how fragile human life is, and how you should appreciate every minute of communication with people who are dear to you.

I remember a walk with Yura and Tanya in the center of Kiev. It was a wonderful Sunday. We meet a small man, Yura introduces him to me. This is the famous Kiev poet Valery Vinarsky. Yura and Tanya know him and communicate for a long time. The poet invites me to say any phrase. I speak a short phrase. Instantly our interlocutor gives out an amazing quatrain, into which my phrase is embedded. Brilliantly! I receive a gift from Yura and Tanya - a collection of poems with the wishes of the poet.

One day, before I arrived in Kiev, I called Yura home, Dasha (Tanya's sister) was on the line. I asked her: "What is the weather in Kiev now?" The answer was: "It's very warm at the moment". I dressed accordingly and arrived. But it turned out that the "warm" in Kiev and the "warm" in Israel are absolutely different things: it was a few degrees below zero and there was snow. All week I walked around Kiev, dressed in a warm jacket of Yura. But not this warm jacket itself warmed me, but the warmth and cordiality of the soul of its owner.

These are all the features, from which the image of an unusually heartfelt person is formed. Another feature to the portrait is Yura's attitude to his graduate students. "Chicks" are already ready for independent life, have already learned to "fly", however he continues to take care of them, helps to find a post-doctorate in the US or Europe, and get a job in Ukraine or abroad.

Often people tell about a person that he was surrounded by many friends and relatives. In the case of Yura, I would say that this is his unusually warm and generous soul surrounded a lot of people around nearby. And many of his friends and colleagues lost this warmth now [1, 2].

It is very difficult and hard for me to write these memories. I remember our conversations with Yura. I do not understand why this terrible tragedy should have happened to him. He certainly did not deserve it. This is a huge grief, Yura always meant a lot to me.

I am sure that I was one of very few who not only knew well, but also very well felt Yura. I really always felt in advance his reaction to the impact of the outside world. Maybe because we were like-minded people, and communicated a lot for many years. Usually Yura and I communicated at least several times a week via Email and Skype; sometimes it was several times a day. Before the illness began, he visited Israel usually twice a year, each time for a month for joint work at our Micro/Nano/Technology Center and we always spent this time together.

I cannot believe still that I will **never** see Yura again, cannot call him, talk on Skype or write by Email. All this is terrible and unfair. He really wanted to live and work, this was always interesting to him. Memories of Yura will remain with me throughout my life.

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Appendix. Some photos of Yura

Figure 8. Y. Reznikov, Israel, February 11, 2011

Figure 9. Y. Reznikov, Conference in England, June 28, 2012

About Yuriy Reznikov

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It is sadly and sorrowfully prepare these notes to memorial issue of the Journal of Molecular Liquids in the memory of Professor Yury Reznikov, nice person and outstanding Ukrainian scientist.

I know that Yuri's colleagues and his numerous students will give an exhaustive description of results of his many years scientific activity and his great contribution to science. My impact to this memorial issue should be, obviously somewhat other. I am not expert in liquid crystal science. But I have worked with Professor Reznikov side by side in Institute of Physics National academy of Sciences of Ukraine for more than forty years. Our relations were in some time more, in some time less formal and official, but in the all time comfortable and friendly. We often met at institute official and unofficial meetings, last twenty years – as head of department (Yury) and institute administration representative (initially scientific secretary, later deputy director – me). I want to present here a couple episodes of our many years relations and interactions.

Yury's office room was on the first floor to the left of the entrance to the Institute. The large room was sunny and bright, decorated with old photos, in particular, photos of known scientists who worked at our institute in the 40s - 50s of the last century. The old fashioned infrared spectrometer made with wood and

brass was standing on the separate table as memory for Yury's grandmother, well-known Ukrainian scientist academician Antonina Prikhotko. Perhaps it would be worth recalling here that Yury's grandmother, academician Antonina Prikhotko, and her husband, Academician Alexander Leipunsky have played a great role in the history of the Institute of Physics. In the Institute memorial room we have their photo as just married young peoples – in future both of them will be academicians of Academy of Sciences of Ukraine, Heroes of Socialist Labor and Lenin prize winners – the highest awards of the former USSR. Now in Russia there is Physics and Energy Institute named by Alexandr Leipunsky. Yury cherished the memory of his prominent ancestors and his creative and fruitful scientific activity was a worthy continuation of the traditions laid by them.

The work of Professor Reznikov at the Institute of Physics breaks up for two fairly long periods of time: before and after his appointment to the post of head of the department of physics of crystals (this department was founded in 1944 and was headed by academician Antonina Prihotko until 1995). After his appointment, Yuri showed outstanding organizational talent and made significant efforts to create a powerful, modern and active scientific team in the very difficult economic conditions in Ukraine, characteristic for the late 90s. He changed the scientific direction of the department, choosing for this purpose the physics and optics of liquid crystals, which became a new field of activity of his personally and the all department for the following decades. He attracted a large number of young university graduates to the scientific work in the department, equipped modern laboratories with new instruments and methods, established creative business contacts with leading scientists in the field of liquid crystal physics from many laboratories in Europe, the USA, Japan, and the Republic of Korea. Professor Reznikov was very effective leader of department. It was a great pleasure to interact with him on the all possible spectra of relation of department head and institute administration. Yuri had a soft and very gentle manner of conversation, but his creative and productive approach to solving the emerging administrative problems allowed him to achieve the goal with greater efficiency than if he was harsh and excessive in the negotiations.

Yury was a bright charismatic person. Now we can recall a number of his interesting actions and expressions in various life situations.

I remember with sympathy of his orange long scarf, which he was one of the first in the institute to wear as a symbol of support for the first Maidan in 2004, with which Yuri, like many of us, linked hopes for progressive changes and transformations in Ukraine.

At one time I was very impressed by the episode, about which I would like to recall here. Perhaps one of Yuri's friends or colleagues knows in more detail about this story, I'll tell you how it was with me. One evening I have passed by the open door of the office, in which Yuri has worked. I looked at the door to say hello to him and saw that he was sitting at his desk at the computer. After greeting, he called me and invited to go closer to the computer monitor. On the screen was a photo of a boy, or rather, only his face. At first I even recoiled - there were traces of very serious injuries in the photo, the unfortunate child got burns, apparently, in case of fire or some other accident. Yuri explained to me that the boy's name was Yosya and he met him in Israel, near the hotel, where the boy lived with the nurse. The boy was from Ukraine, where he received severe burns in an accident, and the treatment takes place in Israel, where he got thanks to the financial help of some wealthy man, whose name Yuri did not know. He said that the boy is very sociable, he really wants to have friends with whom he could talk, but he has problems with it. I must say that the traces of injuries on the boy's face were very very heavy and strong and, as I understood, not one complicated surgical operation was needed to restore the face. Yuri told me that, indeed, several operations have already been successfully completed, the following are forthcoming and, if everything goes well, we can expect that Yosya will be able to live a full life in the future. And now Yuri met and became friends

with him and now they regularly talk on Skype. Yosya tells his new adult friend about the news, about the preparations for the new operation and in return hears interesting stories from Yury.

I listened to this amazing story and understood that Yuri opened up for me with a very unexpected side. He, with his rational mind of scientist, was so sensitive and receptive to misfortune of unfamiliar boy, found the strength and courage to overcome a serious psychological barrier and extend a helping hand to someone who so needs it.

Unfortunately, a serious illness for the last few years demanded that Yuri mobilize all mental and physical strength. He fought courageously with it, was an optimist and was confident of victory over the disease. I think, many Yury's friends and colleagues have received his letters like this one. But it was for me:

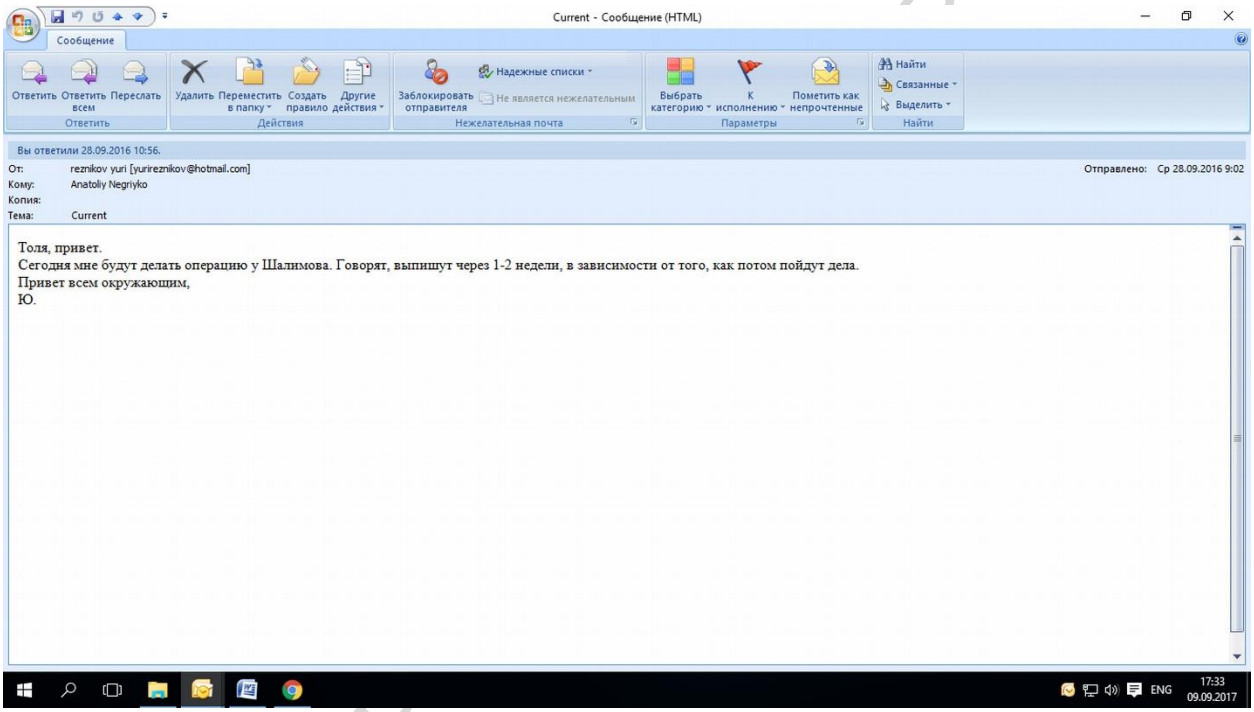

Figure 10. A screenshot of the received email form Yuriy

"Tolya, hello.

Today I will have surgery in the Shalimov's clinic. They say that they will discharge from the hospital in 1-2 weeks, depending on how things go next.

Hi all around.

Yu.»

He was gone in ten days.

Eternal memory to Professor Yuri Reznikov, an outstanding scientist, good friend and a beautiful person.

In Memory of Prof. Yura Reznikov

Janusz Parka and colleagues

Military University of Technology, Warsaw University of Technology, and Technical University of Wroclaw, Polish Liquid Crystal Society

I met prof. Yura Reznikov in 80 last century. At that time I was co-organizer of traditional Polish Liquid Crystal Conference Physics, Chemistry and Application. Yura, as young physicist, young doctor took part in few editions of this conference, which take part in different places in Poland.

Our collaboration in the field of LC have long tradition. During last 30 years we had good cooperation and frindship. Many times I was as a guest of Institute of Physics Ukrainian Academy of Science. I was promoter of Ph. D. dissertation of Andrey Ilyin from his laboratory.

We had common grants for example NATO grant with Prof. Ken Singer from Cleveland USA. Yura was leader and organizer of many LC conferences in Ukraina, eg. "The New Horizons of Liquid Crystals", "Nonlinear Optics of Liquid Crystals" and others.

We say goodbye to great physicist, professor of the Institute of Physics of the Ukrainian Academy of Sciences in Kiev. An exquisite friend and colleague, benevolent and optimistic. World-class scientist who famously studied of liquid crystals, well-known in world literature.

Prof. Yura Reznikov was promoter and educator of many young doctors today often professors who make research in many countries around the world, eg. USA, England, France, Finland. He was great our friend and I can say friend of Poland, admirer of Polish literature and Polish songs, especially Wojciech Młynarski. He participated in many Liquid Crystal Scientific Conferences in the world, specially "The Topical Optical Meeting of Liquid Crystals, including the latest one in Poland, Sopot in September 2015,

I regret that I failed to meet him on the last World Conference on Liquid Crystals in Kent in the United States in July 2016, even though we were so close,

Yura! Dear Friend!

Dear Yura - the planned joint projects and grants will be processed with colleagues from your team, be quiet, great, great pity only that, unfortunately, without you.

Honor your memory !!!

Figure 11. Tombstone of Yuriy Reznikov.

Photo with Yuriy

V. Pergamenshchik

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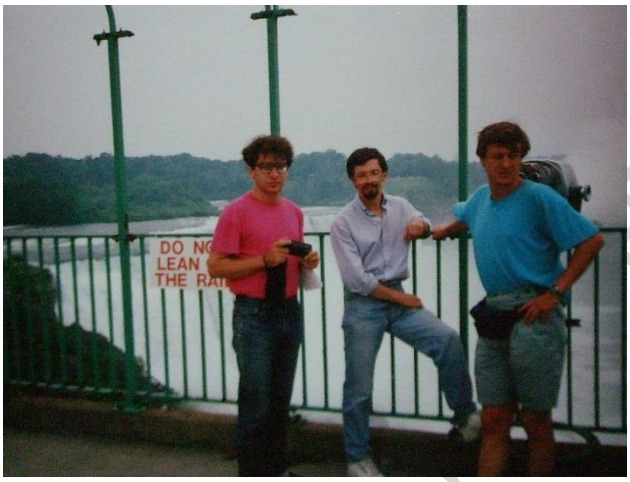

Figure 12. Y. Reznikov, O. Lavrentovich, and V. Pergamenshchik.

Football: Yuri's indelible impression on my six-year-old son

Charles Rosenblatt

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Abstract: Yuri Reznikov had many personal strengths, not the least of which was his ability to interact with people of all ages and backgrounds. Here I reminisce about his encounters with my young son.

I met Yuri in Budapest in 1994 at the International Liquid Crystal Conference and immediately found, in the parlance of the 1980s, a "soulmate". Our discussions ranged from science to politics to culture. I invited Yuri to visit my lab for a week the following year, which resulted in one of our three joint publications.

During his first visit 1995, and during most of his subsequent visits to Northeast Ohio (where Yuri also worked with my colleague Ken Singer at Case Western Reserve University and a number of people, especially John West, at nearby Kent State University), Yuri came to our house for convivial dinners with my wife and children. But that first visit was special. At the time my six-year-old son Danny was becoming a soccer fanatic — what the rest of the world calls "football". Growing up in America, neither he nor his coaches had any idea of how to play the game properly. The kids would run up and down the field kicking the ball willy-nilly, and if it happened to go into the net, all the better. As we were waiting for dinner to cook, Yuri, Danny, and I went into the backyard and pulled out a soccer ball. Yuri proceeded to dribble the ball from one end of the yard to the other, and Danny simply watched this spectacle in awe. His first words were: "How did you DO that? Show me." I had to remind Danny that, in his excitement, he had forgotten to say "please". But that was okay given his sentiments. Yuri spent the next thirty minutes patiently instructing Danny how to dribble and pass the ball — the correct way! — and then showed him how to play defense. Danny could not stop talking about the experience, and even believed that Yuri was

a member of the Ukrainian national football team. During subsequent visits to the house Yuri and Danny would go to the backyard to continue the soccer instructions, as Danny improved year by year. Although never reaching Yuri's level, Danny went on to play for his high school team, and attributed his abilities back to the time he was a six-year-old instructed by Yuri.

My wife and I visited Yuri at Akron General Hospital after the 2016 International Liquid Crystal Conference. Although physically weak, Yuri retained his bright outlook. We reminisced about his soccer adventures with Danny, and bid Yuri farewell as he prepared to return to Kyiv. Less than two months later I received the shocking news of his death. I called Danny, who is now an attorney in Tel Aviv, to pass along the sad news. The silence seemed to last for an eternity, until Danny broke the silence by saying "soccer".

A Decade of Research with Yuriy

Kenneth D. Singer

Department of Physics, Case Western Reserve University

I had the great pleasure of knowing Yuri Reznikov as both a friend and colleague. Yuri and I met not too long after I came to Case Western and joined the ALCOM center (U.S. National Science Foundation Science and Technology Center). We immediately sought ways to work together on nonlinear optics and liquid crystals, and were fortunate to secure several grants for collaborative work in the late 1990s and early 2000s. As Yuri was involved, the topics included surfaces and liquid crystals. These grants included the ALCOM center, a Twinning travel grant and a NATO grant. The latter included new colleagues and friends including Victor Reshetnyak, Janusz Parka and Joachim Stumpe.

In our first ALCOM study, we examined the photoalignment of liquid crystals by liquid crystals exposed to light.[1] We used second harmonic generation to determine the alignment just at the surface and of layers nearby. Interestingly, the initial liquid crystal layer was aligned homeotropically by the interaction of the molecular dipole with the hydrophilic surface. The alkyl tails then present a hydrophobic surface for planar alignment of additional layers and the bulk.

The most consistent theme of our joint research was optical modulation of surface charges and its implications. We demonstrated that photomodulated surface charge gratings drive the photorefractive effect in homogeneously aligned nematic liquid crystal cells.[2] This mechanism explained why only large momentum gratings produced beam coupling and grating formation in the thin film limit, that is, when the active grating vector is defined by the cell thickness and where higher-order diffraction is visible. A hidden grating could be switched on and off with a dc voltage indicating a quasi-permanent surface charge modulation.

This result led to a number of studies and device ideas based on optical modulation of surface charge. First, we showed that a surface-dependent lowering of the Friedericksz transition voltage is effected by a light-induced change of the near-surface ion concentration in the presence of a dc electric field.[3] This ultimately overcomes the anchoring energy and allows reorientation of the director. This effect is the basis of an optical switch based on a nematic liquid crystal twist cell.[4,5]

We also carried out studies of photoinduced diffraction in homeotropically aligned liquid-crystal cells on indium tin oxide with no alignment layer. We observed diffraction from persistent hidden gratings due to light-induced modulation of the the surface charge, likely due to photoelectrochemical processes involving the tin in indium tin oxide.[6] The surface charge is is screened by bulk charge in the absence of an electric field, hiding the grating. An applied field removes the screening charge, revealing the hidden surface-bound charge modulation. This persistent hidden grating can be manipulated by the application of light and/or a dc electric field. In addition, transient gratings formed in the presence of a dc electric field and two coherent pump beams.

Later work focused on the formation and dynamics of surface double layers with space charges.[7,8] The double layer forms from ions contained in the bulk. The charges can be of both signs and arise from impurities or redox reactions near the electrodes. At low voltage, space charge limited currents are observed with a transition to the Ohmic regime at higher voltages. Transients revealed at least two charged species.

In all cases, we spent many hours discussing the questions at hand. Yuri's strong combination of deep insight and extensive knowledge would cut through to the key ideas. His friendly and pleasant manner made these discussions both enjoyable and productive. In particular, I remember the many hours we spent discussing the potential mechanisms for light-induced modification of the surface. He was an inspiration to not only me, but also to my students during his visits to our laboratory.

Our scientific collaborations, of course, required visits back and forth. These extended visits provided ample opportunity for our friendship to develop. I and my family have fond memories of meals and conversations with Yuri. I, as well, have such memories of visits and meals with his family. We enjoyed learning about Ukraine, sharing details of our families' histories, and exchanging facts and opinions on issues of the day, both in the U.S. and Ukraine. Yuri was a gem… so easygoing, friendly, compassionate, and, of course, interesting. I can still see him in my mind's eye, with his big smile and his signature sweater tied around his neck. Yuri was taken from us much too soon…we miss him sorely.

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Gratitude to Yuriy Reznikov for Continuous Support

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The success of my research of provitamin D photochemistry in liquid crystalline medium was possible because of Yuriy Reznikov's strong support.

After my work "Provitamin D Photoisomerization as Possible UV Monitor: Kinetic Study Using Tunable Dye Laser" was awarded in 1994 (Theodore H. Maiman Award), I was looking for a simplified method of measuring the vitamin-D synthesizing activity of solar UV radiation.

By attending liquid crystals seminars, I realized it was possible to make the photoreaction visible by the dissolution of the provitamin D in cholesteric liquid crystalline matrix. However, I had no experience working with liquid crystals, nor did I have the necessary equipment. But I could always get the necessary advice and support from Yura. When my project received STCU funding, Yuriy asked his colleague, Andrey Dyadyusha, to familiarize us with liquid crystals sample preparation. He allowed us to use all of the department's lab equipment and suggested we present our work at his group's seminar. Thanks to his constant support and advice, we realized the idea of visual observation of vitamin D photosynthesis and patented the methods of visual measurement of a specific "antirachitic" UV biodose [1-3] (First with the help of a wedge cell (by changing the number of the Cano-Grangean bands) [1], then by changing the color of a LC mixture in a plane-parallel cell (adding a twisting additive) [2], and finally by turning the disclination line in the theta cell [3]).

I will note that despite his consistent assistance, Yuriy always politely rejected my proposal to be a co-author in patents or publications, though he was deeply interested in our results.

The use of liquid crystals as a medium for the photoreaction study made it possible to reveal new effects in the kinetics of photoisomerization of provitamin D in comparison with the solutions that will be presented in our article.

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An outstanding scientist and a good man

V. Vashchenko

State Scientific Institution "Institute for Single Crystals", NAS of Ukraine, 60, Lenin Ave., Kharkov, 61001, Ukraine

An outstanding scientist and a good man. You can take any positive epithet, and it is very accurately fitted to Yura Reznikov. I was very admired by his ability to explain complex things precisely, briefly but, at the same time, very clearly. It was surprisingly easy and pleasantly to write papers with his co-authorship. I have known Yuri Reznikov since 1990, but I began to collaborate closely with him only since 2008. It's a pity that I had so little time to work with him...

Figure 13. Y. Reznikov is receiving the Freedericksz medal.

Figure 14. Conference discussion

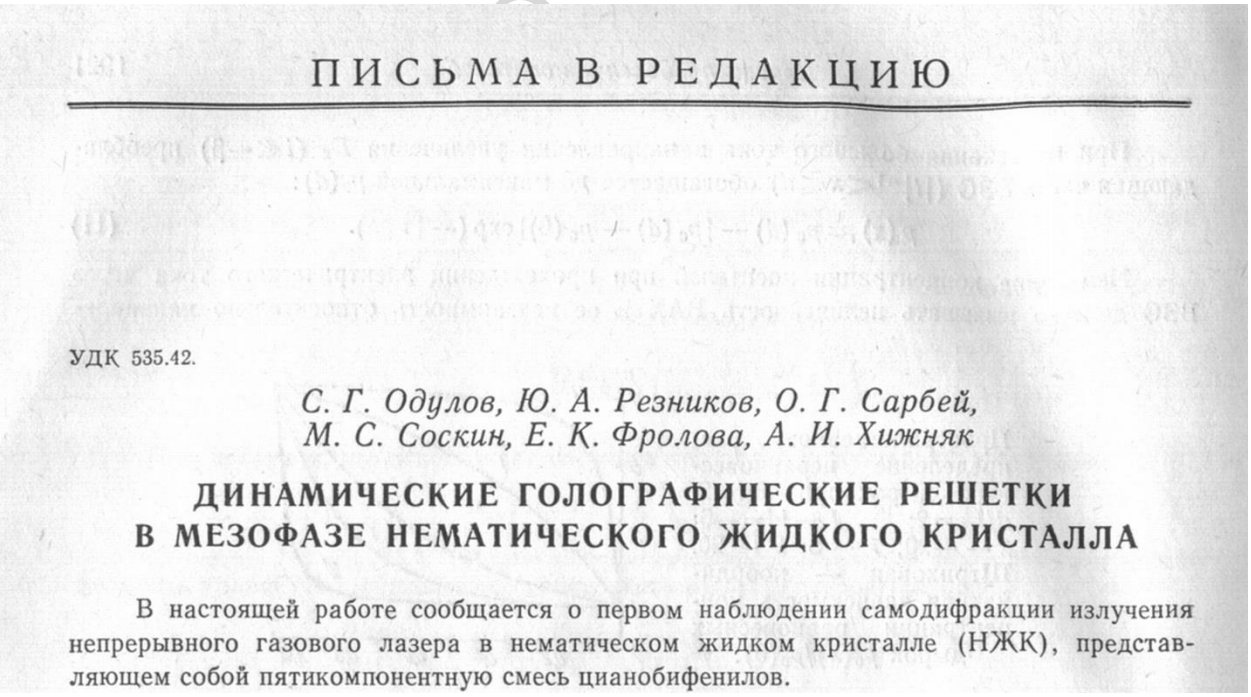
In Memory of Yuriy Reznikov – Foundation of the scientific path

M. V. Vasnetsov and M. S. Soskin

Department of Optical Quantum Electronics, Institute of Physics, National Academy of Sciences of Ukraine, Prospect Nauki 46, Kiev 03028, Ukraine

Yura Reznikov came to the Institute of Physics of the Academy of Sciences of Ukraine while he was an undergrad student. He studied at the radiophysics department of the University of Kiev, and completed his thesis practice in the Institute laboratory. His grandmother, Antonina Prikhot'ko, an academician and Hero of Labor, was the director of the Institute and brought him there in 1975. At the time, the Institute was filled with young people, particularly in the Department of Optical Quantum Electronics, headed by Professor Soskin. Yura was immediately enrolled as a part time engineer at the department and then as a laboratory assistant. After completing his study at the University in 1976, he became a department member, an engineer, and worked with a group that investigated the recording of holographic gratings in the silicon crystals excited by the picosecond pulses. For two years he worked as an engineer, which was a requirement to enroll in the graduate school.

In 1978, Yura enrolled in graduate school, but studying silicon crystals did not bring the desired results. Yura got a separate room to locate powerful-pulsed lasers, and he independently prepared them for work. The turning point for his career was reading the publication of Boris Zel'dovich and co-authors on the optical nonlinearity of liquid crystals. This article was shown to Yura by Professor Oleg Sarbey with a proposal to see the effect. The effect turned out to be very strong; a new type of optical nonlinearity was discovered. Immediately a letter to the editor was sent to the Ukrainian Physical Journal (Figure 15).



ПИСЬМА В РЕДАКЦИЮ

УДК 535.42.

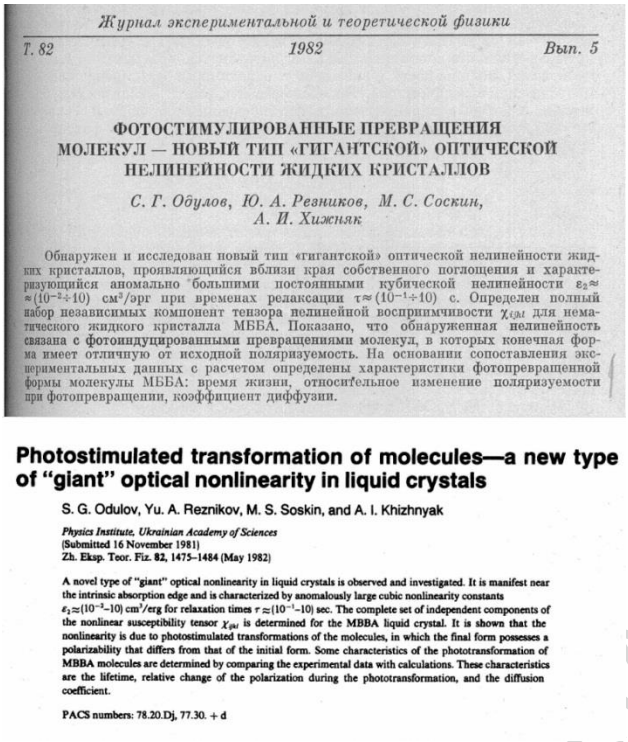
С. Г. Одулов, Ю. А. Резников, О. Г. Сарбей, М. С. Соскин, Е. К. Фролова, А. И. Хижняк

ДИНАМИЧЕСКИЕ ГОЛОГРАФИЧЕСКИЕ РЕШЕТКИ В МЕЗОФАЗЕ НЕМАТИЧЕСКОГО ЖИДКОГО КРИСТАЛЛА

В настоящей работе сообщается о первом наблюдении самодифракции излучения непрерывного газового лазера в нематическом жидком кристалле (НЖК), представляющем собой пятикомпонентную смесь цианобифенилов.

Figure 15. Reznikov's first publication was the letter to the editors of the Ukrainian Physical Journal about the discovery of a new effect in liquid crystals, 1980 [1].

Since 1979, intensive research continued in the field of optical crystals. The following article was published in the prestigious Journal of Experimental and Theoretical Physics, with a detailed description of the observed "giant" nonlinearity in liquid crystals (Figure 16).



Журнал экспериментальной и теоретической физики

Т. 82 *1982* *Вып. 5*

ФОТОСТИМУЛИРОВАННЫЕ ПРЕВРАЩЕНИЯ МОЛЕКУЛ — НОВЫЙ ТИП «ГИГАНТСКОЙ» ОПТИЧЕСКОЙ НЕЛИНЕЙНОСТИ ЖИДКИХ КРИСТАЛЛОВ

С. Г. Одулов, Ю. А. Резников, М. С. Соскин, А. И. Хижняк

Обнаружен и исследован новый тип «гигантской» оптической нелинейности жидких кристаллов, проявляющийся вблизи края собственного поглощения и характеризующийся аномально большими постоянными кубической нелинейности $\varepsilon_2 \approx (10^{-2} \div 10)$ см^3/эрг при временах релаксации $\tau \approx (10^{-1} \div 10)$ с. Определен полный набор независимых компонент тензора нелинейной восприимчивости χ_{ijkl} для нематического жидкого кристалла МББА. Показано, что обнаруженная нелинейность связана с фотоиндуцированными превращениями молекул, в которых конечная форма имеет отличную от исходной поляризуемость. На основании сопоставления экспериментальных данных с расчетом определены характеристики фотопревращенной формы молекулы МББА: время жизни, относительное изменение поляризуемости при фотопревращении, коэффициент диффузии.

Photostimulated transformation of molecules—a new type of "giant" optical nonlinearity in liquid crystals

S. G. Odulov, Yu. A. Reznikov, M. S. Soskin, and A. I. Khizhnyak

Physics Institute, Ukrainian Academy of Sciences
(Submitted 16 November 1981)
Zh. Eksp. Teor. Fiz. **82**, 1475–1484 (May 1982)

A novel type of "giant" optical nonlinearity in liquid crystals is observed and investigated. It is manifest near the intrinsic absorption edge and is characterized by anomalously large cubic nonlinearity constants $\varepsilon_2 \approx (10^{-2}$–$10)$ cm^3/erg for relaxation times $\tau \approx (10^{-1}$–$10)$ sec. The complete set of independent components of the nonlinear susceptibility tensor χ_{ijkl} is determined for the MBBA liquid crystal. It is shown that the nonlinearity is due to photostimulated transformations of the molecules, in which the final form possesses a polarizability that differs from that of the initial form. Some characteristics of the phototransformation of MBBA molecules are determined by comparing the experimental data with calculations. These characteristics are the lifetime, relative change of the polarization during the phototransformation, and the diffusion coefficient.

PACS numbers: 78.20.Dj, 77.30. + d

Figure 16. Description of the effect of "giant" optical nonlinearity in liquid crystals, 1982 [2].

Yura completed his graduate studies successfully in 1982 and submitted his thesis to defense. The success was obvious. At the annual Institute conference in 1982 his report "Optical Nonlinearity of Liquid Crystals" took first place. Moreover, for the conducted research, he was awarded with the Prize of Ukraine for young scientists named after N. Ostrovsky (Figure 17).

Figure 17. The Ostrovsky Prize (V. Bazhenov, Y. Reznikov, A. Savchuk, V. Kondilenko, O. Oleynik, M. Vasnetsov).

Here is what the head of the department, professor, Corresponding Member of the Academy of Sciences of Ukraine M. Soskin remembers about Yuri's work at the Department of Optical Quantum Electronics:

As a legacy from his ancestors, Yura got an excellent genetic heritage: From the grandfather, the Hero of Socialist Labor, academician A.I. Leipunsky, who first created compact reactors for the first Soviet nuclear submarines, and the grandmother, Academician A.F. Prihotko, who created the world-famous scientific school in the physics of crystals, also Hero of Socialist Labor. They were scholars of the brilliant Kharkov school of physics, which included Academicians Kurdyumov, Lazarev and others. These scientists were intelligentsias in the best sense of this word. Therefore, Yura imbibed their spirit of high intelligence and determination to the science. He fully deserved the title of the science enthusiast and aristocrat of a spirit.

Of course, Yura did not just happen to be at the Institute of Physics of the National Academy of Sciences of Ukraine, where Academician A.F. Prikhot'ko worked for many years and was a director. A great influence on his decision to pursue the sciences was Prof. A.I. Khyzhniak, who worked at that time at the Department of Optical Quantum Electronics at the Institute of Physics of the Academy of Sciences of Ukraine. Under his influence, Yura began to study the optical physics of liquid crystals, which only gaining strength at that time. Now it is a modern, rapidly developing section of the physics of crystals. As a result of his development in the Institute of Physics of the National Academy of Sciences of Ukraine, Yura became the head of the department of physics of crystals, which naturally retained its name. Now the objects of study were primarily liquid crystals, and their study became more complex.

This same period of his scientific work includes the creation of a team of young scientists which began to grow rapidly. Yura's unique approach to the science was formed during these years working with his research group. I would call it integral, when the effect of electric and magnetic fields on the liquid crystal materials under various conditions were studied. Principle results were obtained which greatly expanded the knowledge of physics of liquid crystals in general. Therefore, a young, fast developing Reznikov's scientific school was established, which took a predominant place in the world science of liquid crystals. Understanding the importance of the theory, for the successful development of liquid crystals with a wide range of new properties, Yura closely collaborated with Prof. Victor Reshetnyak. The popularity of Reznikov's school was rising. He became a participant, and then a co-leader of all major scientific conferences in LC in the world. He actively collaborated with the main world scientific schools in this field of physics. At the same time, he created an annual Christmas conference at the Institute of Physics, at which practically all the department employees and all visitors performed. The number of attendees of this conference quickly increased and the meetings were held in the conference hall of the Institute. Moreover, the Kiev Christmas Conference in the physics of liquid crystals began to attract foreign participants.

Yura developed an original style of communication with employees. When he was at the institute, the door to his office was always open, he invited his fellow workers to discuss any questions they had, and was always accessable. He tried to avoid gruff talks during work. I used his unique knowledge when we were working with liquid crystals materials.

Yura continued promoting his students to ensure successful scientific work in foreign laboratories in France and Italy and supported their scientific growth in every way possible.

The life of Yuri Alexandrovich Reznikov tragically ended during a stage of growth. We, his colleagues, will always keep his bright image in our minds. We will keep Reznikov scientific school and his high scientific approach at the forefront!

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Personal Recollection

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I have known [1] Yura for almost two decades when we used to meet during topical conferences on Optics of Liquid Crystals (OLC) all over the world. Our last meeting took place in September 2015 Sopot (Poland) when Polish liquid crystals community organized OLC-2015. Prof. Yuriy Reznikov gave in Sopot a fantastic tutorial “Nanoparticles in liquid crystals” that has been an inspiration of our current research activities related to liquid crystals.

However, I still have in my memories my first visit to Kiev in in December 2014, when Yura organized first Ukrainian-Polish seminar entitled "New horizons of Liquid Crystal Sciences" jointly with prof. Henryk Sobczuk from Polish Academy of Sciences, Scientific Center in Kiev. After very interesting set of presentations and scientific discussions we had an opportunity not only to visit his labs at the Institute of Physics, but also Yura organized a nice half-day trip to the historic part of Kiev. In view of our joint scientific discussions we started in Poland to deal with nanoparticles to enhance properties of photonic liquid crystal fibers that have been a great field of our interest over the last decade.

Figure 18 taken during a frosty day presents Yura, prof. Henryk Sobczuk (the tallest), prof. Janusz Parka and myself in Kiev, on December 13, 2014.

Figure 18. Kiev sightseeing with Yura during the First Ukrainian-Polish Seminar "New horizons of Liquid Crystal Sciences" held in Kiev, December 12-13, 2014; from left to right Tomasz Woliński (Warsaw Univ.

of Technology), Yuriy Reznikov, Henryk Sobczuk (Polish Academy of Sciences, Scientific Center in Kiev), Janusz Parka (Military Univ. of Technology).

[1] Tomasz R. Woliński, personal recollections, Photonics Society of Poland President, Optics and Photonics Division Head, Faculty of Physics, Warsaw Univ. of Technology, Poland

I was his first graduate student

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I received the message about Yuri's death in Hong Kong, shortly after starting work at Hong Kong University of Science and Technology. It's hard to convey the feelings that overwhelmed me at that moment; it was a bitter mixture of pain, unbelief and injustice. It was a deep shock. I plunged into memories. I remembered calling him before departure and before his first surgery. Yuri, as always, radiated optimism. I said him that we will pray for the success of the operation and his speedy recovery. "OK, pray", he smiled. It was our last talk…

Even now, 10 months after his death, it is hard to believe that this happened. Big part of my life was associated with this bright person. I met Yuri in a distant 1984, when I came to Kyiv as a graduate of a provincial university to find a graduate school and a future supervisor. I had several inconclusive meetings. Finally, at the Institute of Physics I met with Academician Antonina Prikhotko, a prominent scientist and a very kind person. She introduced me to Yuri, her grandson, who was just going to defend his PhD thesis. Yuri asked me some general questions concerning my life and education, and agreed to be my supervisor. Thereby, these two wonderful people opened for me the way to a great science. After successful passing entrance examinations, I was accepted to graduate school and became the first Yuri's graduate student. My research work was devoted to the study of conformational nonlinearity, one of the mechanisms of the giant optical nonlinearity of liquid crystals (LC). The corresponding PhD dissertation "Conformational Optical Nonlinearity of Nematic Liquid Crystal MBBA" I defended in 1989. I remember with a very great warmth those first years of my joined work with Yuri. Working with him was very easy and interesting. He had a rare ability to explain complex things very simply and clearly. He taught me a lot about the liquid crystals and experimental methods of their investigation. It was really invaluable experience for a young researcher like me.

After defending the dissertation, I received the position of junior research fellow and started working in the Department of Physics of Crystals headed by Yuri. It was a time when Yuri, together with scientists from Moscow, just discovered effect of LC photoalignment using the films of photocrosslinkable polymers [1]. After Yuri's offer, I immersed myself in the study of this exciting effect. Together, we have experienced many joyful moments in a course of this research, connected with solving various problems, such as setting the pretilt angle of LC, controlling the LC anchoring energy, developing advanced photoaligning materials, etc. At that time we actively collaborated with LG corporation. As a result of this collaboration in 1996 the world-first active matrix LCD based on photoalignment layers was developed.

Since the beginning of the 2000s, Yuri became fascinated by another problem - the influence of nanoparticles of different materials on the properties of liquid crystals. However, he never stopped the study of photoalignment effect. In 2012 we published in J. Materials Chemistry our joint review paper entitled

"Photoalignment of liquid crystals: basics and current trends" [2], which has already received over 220 citations. For this achievement Thomson Reuters together with the Ministry of Education and Science of Ukraine and National Academy of Sciences of Ukraine has awarded Yuri and me the “Web of Science Award, Leader of Science of Ukraine 2016" in the category "Scientist of Ukraine, for significant success."

In the last years of his life Yuri combined the two above mentioned problems, namely the LC photoalignment and LC suspensions. Together with his co-workers he demonstrated that the photoalignment patterns can be successfully used to design LC defects, which in turn can be used to trap nanoparticles dispersed in liquid crystals and thus obtain nanoparticle assemblies of desired configuration. Moreover, the method allows to move the particles along with defects in a desirable fashion [3].

I have mentioned above only a few, most important, in my opinion, areas of Yuri's research. Of course, his creative legacy is much broader and includes many other exciting areas such as photosensitive cholesteric LCs, liquid crystallinity of nanocolloids, rollable bistable LCDs, LC methodology, etc. No doubt that many of his undertakings will be continued by his colleagues, students and scientists of different countries.

Finally, I want to note some remarkable qualities of this great man. He impressed people with his intelligence, education and erudition. He had ability to clearly explain and argue his point of view. He was very easy and pleasant in communication. I would say, he possessed some magical attractive force so that people gathered around him. He easily got many friends around the world. And, of course, he was a big fan of science, which was a sense of his life. He remains for us a vivid example of selfless service to science and progress.

Figure 19. Yuri Reznikov and Oleg Yaroshchuk near Liquid Cristal Institute at Kent State University. Kent, OH, USA, June, 2013.

References

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