



# Tributes to the Memory of Professor Vladimir Z. Kresin

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## 1 Introduction

Prof. Dr. Sc. Vladimir Kresin, the Editor-in-Chief of the Journal of Superconductivity and Novel Magnetism (JOSC), left us in 2022. The JOSC is closely connected to Vladimir—indeed, he channeled his strengths, energy, and time into the journal over several decades and so it was natural to assume that he was the founder and all-time Editor-in-Chief (EiC). Recently, however, we became aware that the founders of JOSC were in fact Stuart Wolf and Donald Gubser. Almost simultaneous to launching the JOSC, Wolf and Gubser invited Vladimir to share the Editorial Board duties—very rapidly, he took over the EiC role. Over the following years, we were invited by Vladimir to join the Editorial Board, and under his watchful eye and contagious enthusiasm, we too became immersed in the rewarding task of supporting the JOSC and helping to increase its impact on the superconductivity and magnetism communities. We were, and continue to be, proud members of the JOSC team and enjoy seeing each new issue as the science and journal evolve going forward. Although it has been nearly a year supporting the journal without Vladimir, we still greatly feel the absence of this Great Man and Great Physicist.

In this memorial issue of the JOSC, we share with our readers a series of tributes collected from some of Vladimir Kresin's friends and collaborators which honor his life and work in science and the JOSC.

## 2 Tributes

### 2.1 Jochen Mannhart (Max Planck Institute for Solid State Research, Stuttgart, Germany)

More than 30 years have elapsed since I first met Vladimir. My first impression of him was that I better keep a safe distance from that grumpy ol' Soviet guy. How wrong I was!

As I got to know him better, I discovered to my great delight that Vladimir was an impressive scientist with a brilliant mind and a profound background. He was youthful and fresh in his thinking, always open to new ideas. His scientific curiosity was remarkable, and he pursued his own groundbreaking ideas very thoroughly.

Vladimir was incredibly generous with his time and always willing to offer valuable advice. “They should not burden you with such administrative work. This is like using a microscope to hammer a nail into the wall,” he once remarked to me. When I submitted a manuscript that questions the second law of thermodynamics to the Journal of Superconductivity and Novel Magnetism, of which he was the editor-in-chief, he published it immediately, remarking to me: “The second law is only based on experience; it may well be disproved.”

Unforgettable to me is a small meeting Vladimir organized in Berkeley in June 2000 entitled “Workshop on Induced Cooperative Phenomena” to which he had also invited Edward Teller and John Craven as special speakers. The former needs no introduction, the latter has been referred to as the “mastermind of America's cold-war submarine spying.” What a brilliant initiative of Vladimir! Hearing and meeting these two speakers made a profound impression on me. This workshop was the best one I have ever attended.

On a personal level, I knew Vladimir and his family to be exceptionally warm and sincere. He was always fun to discuss with and ever a source of fascinating anecdotes and wisdom.

Today, after having known him for more than three decades, I miss Vladimir as a scientist, a colleague, and, most of all, as a friend.

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## 2.2 V.P.S. Awana (National Physical Laboratory, New Delhi, India)

Though I never meet Vladimir face-to-face and mostly interacted with him during my tenure first as associate editor in JOSM and later as a co-editor, I was introduced to Vladimir by Israel Felner—long-term collaborator and mentor from the early 1990s. This is in addition to following up of some of Vladimir's voluminous high-quality research for the benefit of the superconductivity community. In particular, the pseudo gap phenomenon in high-temperature superconducting cuprates was fascinating to theoreticians and the experimental material community who were searching for high temperature superconducting phases.

I always felt at ease during my several online interactions with him in regard to the overall progress of the JOSM. Something I found very special about Vladimir was his way of communicating through e-mails, often appearing to me as if we were talking to each other. He always encouraged as the youngest co-editor on the board and inspired me to bring out new concepts and to contribute not only as co-editor but also as a pro-active author as well.

The scientific community has lost a great scientist and I have lost a great mentor who could always challenge me in new ways. May his memory be blessed forever.

## 2.3 Bernard Raveau (University of Caen, France)

I met Vladimir Kresin for the first time in San Francisco Bay, as he invited me to give a talk at the 1987 Conference on Novel Mechanisms of Superconductivity held at the Berkeley Marina. This was the first international conference held after the discovery of the high critical temperature ( $T_c$ ) in cuprates and, as a solid chemist non-specialist of superconductivity, I was both impressed and honored to be invited by this well-known theoretical physicist. Beyond the huge character of the conference (I could measure that by his judicious choice of invited speakers), Vladimir opened the route to numerous collaborations, bringing together physicists and chemists as well as theoreticians and experimentalists. During the following years, we had the opportunity to have together many scientific discussions, and we met many times either in conferences or in workshops on superconductors, and Vladimir's ideas and comments were always for me an important support for my investigations into new materials. We became very close friends, and I appreciated his great sense of humor. I remember with pleasure my first visit to LBNL, when Vladimir introduced me to Edward Teller, the father of the hydrogen bomb, who was very happy to give us his personal point of view about the role of Jahn–Teller effect in the superconductivity of cuprates. I also enjoyed his visit at the CRISMAT Laboratory in Caen and the trips that we had

together at Mont Saint Michel and on the landing beaches in Normandy. Beyond his great contributions to science, Vladimir had also exceptional human qualities, and I will miss his voice at the phone and his nice jokes but I will never forget our close friendship.

## 2.4 Israel Felner (The Hebrew University, Jerusalem, Israel)

I met Vladimir many years ago at various world-wide scientific conferences. At each conference, he was invited to lecture on his scientific theoretical achievements. As an experimentalist, I always enjoyed attending his lectures, since he did not present complicated formalism, and the lectures were clear and well explained, thus everyone could enjoy and understand them. In particular, I remember his milestone lecture, on the cuprates' pseudo-gap state, in which he predicted very high-temperature superconductors, a phenomenon which we face in nowadays (albeit at high pressures).

I was surprised and pleased to see Vladimir participating in my lectures, and after one of them, he asked me to join him for several hours together for talking and discussing. Then, he offered me to become an associate-editor of this journal, a benefit that I considered as great honor and respect. We became good friends and spent long hours together with our wives (Lilia and Rivka) at various events held at the conferences. In particular, I remember a lovely sunset near the fort in Ischia; at the end of which, we found a strict vegetarian restaurant to have dinner and have had all four of us, a wonderful time at the rest of the evening.

Later, Vladimir invited me to become a co-editor of this journal, a position I still hold today. As an editor, when I encountered problems that required additional thinking, Vladimir was always at my disposal with his sense of humor, wisdom, and experience.

On July 2016, I attended a scientific conference in San Francisco. Vladimir read the participant names and “forced” me to visit him at his home in Berkeley. He and Lilia knew my habits and ordered strictly kosher food as well as disposable dishes, fulfilling strictly the Jewish customs. I spent a great day at their house.

The scientific community had lost a great scientist and I have lost a good and loyal friend. May his memory be blessed forever.

## 2.5 Guy Deutscher (Tel Aviv University, Israel)

After he was finally allowed to escape from the Soviet Union, Vladimir could enjoy traveling around the world, meeting physicists from the West. Many became his friend, charmed by his Russian warmth and humor, and impressed by his deep knowledge. I was one of them.

Like all scientists who have worked or are still working on superconductivity, Vladimir Kresin had the dream to make it work at room temperature. His last published works are testimony that he never gave up on that dream. He is in good company. In his last published work, Pierre Gilles de Gennes, my beloved teacher and mentor, came up with a new pairing mechanism—30 years after declaring that there was nothing new to be discovered on superconductivity anymore. Another iconic physicist of that same generation, Phil Anderson, who had declared that superconductivity was limited to below 30 K or so, spent later much time working on a new mechanism involving the pseudo-gap phenomenon discovered in the high critical temperature ( $T_c$ ) cuprates, and these are only a few examples, Bill Little and David Pines being two other famous physicists who were obsessed with room temperature superconductivity.

One may then ask: what was the difference between Vladimir and these other famous High  $T_c$  fans? They all had a deep knowledge of condensed matter physics, including the most complex many body effects. Vladimir had learned them under the prestigious guidance of Lev Landau; there was no better school. The difference was, I think, that Vladimir was more open-minded. He did not necessarily think that his idea was the best one, he encouraged exchange between people having different ideas, on the only condition that they were based on sound physics—no nonsense. He also loved to interact with experimentalists.

In this spirit, Vladimir had organized in 1987, together with Stu Wolf, a conference on Novel Superconductivity near Berkeley. The program had been put together before the discovery of Bednorz and Muller. At the last minute, Vladimir and Stu decided to invite Alex Muller. This was a stroke of genius—it was the first international meeting where Alex presented his discovery. This change of program turned what was to be a modest meeting between experts into a world event. Vivid exchanges took place—the ideas put forward by Alex on the glassy aspects of high  $T_c$  due he thought to twin boundaries were not well received. He sensed this and was unhappy. I had met him during a visit at Tel Aviv a few years earlier and knew him well enough to explain to him frankly what I thought was the problem. After congratulating him on his discovery, I explained to him that internal boundaries such as grain boundaries and twins do not play much of a role in conventional superconductors, because they have a long coherence length. But in the cuprates, the coherence length is on the nanometer scale—a fundamental difference. When this was understood, everything became clear as we pointed out in a joint paper. This little story is one example of how new ideas can be generated by allowing people to present their ideas and results in an open way and by encouraging discussions that can be uncompromising. Vladimir did it in a splendid way.

Going back to the fundamentals was a principle that Vladimir always applied. We had long discussions on the origin and the consequences of the short coherence length. Many subtle effects must be taken into account, involving the renormalization of important quantities such as the electron effective mass and the Fermi velocity. Based on these fundamental considerations, we showed that the importance of the electron–phonon interaction in the cuprates could not be ruled out. This does not mean that it is the high  $T_c$  mechanism, but it cannot be ruled out. What I learned from Vladimir is that, from a theoretical standpoint, strong electron–phonon coupling does allow high  $T_c$ . This is one of his well-known works.

There followed the days where the symmetry of the order parameter became the central issue. You had to be either in the *s*-wave or in the *d*-wave camp. Vladimir was inclined to *s*-wave. He gave a hard and worthwhile fight, analyzing in detail experimental results that did not in fact allow definite conclusions. In the end, it had to be recognized that *d*-wave was certainly dominant, although some strong experiments pointed out to a minority *s*-wave component.

It had been hoped that once the symmetry question would have been resolved, the high  $T_c$  mechanism would also become clear. Vladimir very much doubted that this would be the case. For instance, a mechanism based on spin fluctuations, as proposed by Pines, would naturally give a *d*-wave symmetry. But the experimental observation of *d*-wave symmetry does not in any way prove that spin fluctuations are at the origin of high  $T_c$ . And in fact, we know today that this is not the case. Vladimir was right. To this day, the mechanism of superconductivity in the cuprates still eludes us.

Our interests overlapped in other fields, such as granular superconductivity. Vladimir was fond of small grains, more exactly clusters. He showed that their shell structure could in principle lead to superconductivity at high temperature, basically because of peaks in the electronic density of states. In the seventies and early eighties, I had studied granular aluminum films whose  $T_c$  can reach several times that of pure aluminum. Could this be the result of a shell effect? We still do not know, the smallest grains we can make contain several hundred atoms; they may be too large to display shell effects—we just do not know enough about their exact structure. This is the conclusion we reached. Vladimir would always be very careful about connecting his theory with experiment.

Now, a personal note: I have had through the years many occasions to benefit from the unique combination of wisdom, deep knowledge in condensed matter physics, and kindness that altogether characterized Vladimir. We met in all kinds of places, in California of course, but also at conferences around the world, always with great pleasure. Once I was sitting at a cafe in Paris with my wife Aline and some friends, just across the Jardin

du Luxembourg, suddenly, Vladimir and Lilia appeared; I had no idea they were in Paris. They sat down with us; we had a wonderful time together. Jokingly, I told Vladimir that I was having problems with some of his former Russian colleagues. With his marvelous smile, he simply advised me to avoid Moscow for some time.

Vladimir brought with him this special kind of warmth, of strength, and of humor.

This is the way he should be remembered.

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