

## Superconductivity Research in Bulgaria

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***Abstract* - History and present status of Bulgarian research in superconductivity are outlined. Present problems and societal issues affecting Bulgarian science in general are briefly discussed, and an approach to improving the situation proposed. This short review intends to emphasize the importance of fruitful participation of Bulgarian research teams in joint European scientific programs within the 7<sup>th</sup> Framework Program of the European Commission.**

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### I. History

The beginning of superconductivity research in Bulgaria goes back to 1950s and 1960s when the Bulgarian physics was closely cooperating with others within the “Soviet block” of “socialist” countries (Soviet Union, Poland, Czechoslovakia, Eastern Germany, *etc.*). A number of students graduated in physics at distinguished foreign universities, mostly in Russia and Ukraine, but also in Poland, Eastern Germany, and Czechoslovakia, where physics was (and still is) much more developed. Other young physicists made post-graduate stints in the same countries, while many of the elder scientists passed through specialization courses or some work visits there (one, two and more years). Some of these physicists, theorist and experimentalists, took part in the development of Bulgarian research in fundamental and applied superconductivity and related topics. They maintained close contact and received ideas, and also technical aid, from their scientific advisers abroad through the relatively well established paths of scientific communications (annual short- and long-term visits, correspondence, conferences, common research projects, *etc.*). Here I must mention the exceptionally intensive cooperation with the Joint Institute of Nuclear Research in Dubna, Russia, the International Laboratory for High Magnetic Fields and Low Temperatures and the Institute for Structural Research and Low Temperature in Wroclaw, Poland, the quite intensive cooperation with Moscow State University, The Physical Institute of RAS (FIAN, Moscow), P. Kapitza Institute (Moscow), L. D. Landau Institute (Moscow), Ioffe Institute (St. Petersburg), and other. Very often, the international cooperation in superconductivity was connected with other topics of condensed matter physics such as, for example, superfluidity problems, low-temperature techniques, magnetism.

Nearly to the end of 1980s, the modest success of our superconductivity science was ensured mainly by the supply of research ideas and experimental facilities from abroad. The equipment for research in low temperatures and high magnetic fields in Bulgaria was rather poor; also by now it is

insufficient for modern experimental studies. Nevertheless, from 1980s on, some Bulgarian experts accumulated considerable experience and became capable to perform independent research. As in other scientific fields, including physics, few (most privileged) members of our superconductivity community have had the opportunity to travel to Western countries and gained experience there. Others, also quite few, including me for example, are a product of Bulgarian education and self-education. However, I should emphasize that the Russian school in superconductivity and low-temperature physics was very strong and from the pure scientific point of view, the cooperation within the “Soviet Block” was very useful and advantageous for Bulgarian physics. Unfortunately, other features of the “real socialist system” caused unavoidable and serious defects in the development of our science, including the superconductivity research. The societal disadvantages in the development of science in ex-socialistic countries, including Bulgaria are now under debate, and I give below a few examples.

## **II. Social Aspects and Conditions of Research**

Among the societal disadvantages for the development of science was lack of atmosphere stimulating independent thinking and intellectual freedom. In contrast to, for example, Russian or Polish physics, we had no world-famous scientists whose independent thinking created a local atmosphere of intellectual freedom in spite of inconvenient social conditions. Policy restrictions were severely disturbing the research (often, but not always, checking of airmails of scientific communications with Western colleagues, restrictions and choice of often unsuitable people for participation in collaborative research or in conferences abroad, biased choice of the research staff (the mediocre but faithful to the regime were chosen over truly talented people). Besides, the financial support of Bulgarian science was very insufficient and resulting in quite difficult work conditions. The situation now is similar in many respects, although the reasons are somewhat different. At present, the hope for future improvement is related to the membership of Bulgaria in the European Union and the expected extension of international cooperation resulting from this membership.

To meet the requirements for collaboration within the common European research framework, currently the FP7 (7<sup>th</sup> Framework Programme of the European Commission), the organization of our science should be improved and the prevailing mentality altered. Despite official statements from the Bulgarian side, in the last two decades there has been no substantial development towards a modern and effective science management in both, higher education and research. The Government just puts the small amount of money earmarked for science into the hands of high-standing scientists holding leading administrative positions (Rectors of Universities and administrative leadership of the Academy of Sciences). It does not control the spending, while the recipients of the funds block any real development and the implementation of objective, international science evaluation criteria. Of course,

talented and productive researchers try to work in any conditions. The most capable and motivated usually succeed, at least in part. However, the existing conditions do not stimulate research of high quality, and increasingly contribute to exodus (emigration) of the best young talent.

At this juncture, several variants of financial and organizational reform of our science may be proposed. I suppose, funding should be given preferentially those small islands of excellence (small research groups and single scientists), which still exists in the “sea” of corruption and indolence, and demonstrate research and personal performance conforming to international standards. After several years, these “islands” will organically grow to cover a more substantial part of our science. Therefore, a psychological mechanism will be gradually activated to entice a change of mentality in the “sea”, leading to improved performance, and higher scientific standards (and even better quality of local industrial products). This might lead to real results at a reasonable price. Several years of sustainable development in real partnership with other European countries should improve the situation. This is the most rational, sure and inexpensive way to restore Bulgarian science. The respective “islands of excellence” should be identified by applying internationally accepted criteria and with the help of our European colleagues (via monitoring by the EC). However, if the evaluation will be left in the hands of the present science leadership, one can expect very disappointing results.

### **III. Present Status of Superconductivity Research.**

Our research in superconductivity and related topics is concentrated mainly at the two most distinguished Bulgarian scientific institutions: the Center of Physics of Bulgarian Academy of Sciences (The Institute of Solid State Physics and the Institute of Electronics, Sofia) and at St. Kliment Ohridski University of Sofia. The currently active research groups are listed as “Bulgarian Activities” in the Guide to European Superconductivity, and the scope of their scientific interest is indicated there. During the last one to two decades, in conditions of heavy crisis of our science (lack of funding and organizational problems) our experts still have been able to perform research of relatively good quality, and to publish a number of interesting results in recognized international journals [1,2]. A number of visits abroad funded by our foreign partners ensured the survival of our most active and skillful experts and the success of a number of investigations. In particular, the thematic European network SCENET was very useful here. My initiative in May-July of 2000 resulted in the inclusion of Bulgaria into SCENET before a number of other countries and, owing to the support and funding by SCENET, several of our young scientists received real access to long-term specialization in leading European laboratories, as well as to winter and summer schools of high quality. Several scientific collaborations were also funded by SCENET.

In order to enhance the research in Bulgaria and to improve our scientific potential we need a continuing and more intensive European support via an effectively monitoring and adequately funded program. The FP7 can be effectively used, provided our scientists prepare successful project proposals. To this aim, we need a friendly and supportive response from our European colleagues when we attempt to join the respective research networks. Certainly, contacts with our European colleagues should be intensified in order to improve the style of performance and the funding of science in Bulgaria.

### References

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