Preface

The idea to write this book appeared after a series of workshops devoted to superconductivity of low-dimensional objects, which we organized last decade. In 2004 director of Walther-Meißner-Institut Professor Rudolf Gross and I organized an NATO Advanced Research Workshop "Nanoscale Devices, Fundamentals and Applications" and published the book with the same title, collecting the best of reports, presented on that workshop. As we realized a bit later, the book was in demand by colleagues, who deal with applications of superconductivity. For example, the group of researchers is engaged in development and fabrication of a very sensitive superconducting sensor for infrared radiation, superconducting thin-film bolometer, would like to achieve the highest possible sensitivity. They develop different technological processes for improvement of the quality of the superconducting film, trying to obtain thin films with the narrowest width of superconducting transition. In case, when a member of such group has knowledge in superconducting fluctuations (which are rather noticeable for low-dimensional objects) that there exists a limitation of the smallest possible width of the superconducting transition, ΔT_c, given by the Ginsburg criteria, $\Delta T_c = GiT_c$, then such group of researchers can save a lot of time and instead of many experimental attempts to improve the quality of the films, just select the most suitable material with the smallest value of the parameter Gi. This is a simple example how the knowledge of the intrinsic phenomena in superconductivity at nanoscale can help the experimentalists to save their resources and time to achieve the desirable result.

Recently, some very interesting effects were first predicted theoretically and then detected experimentally in layered and low-dimensional superconductors – triplet superconductivity, crossed Andreev reflection, and pi-shift. How one can use them for novel devices? What kind of nanostructures should be prepared for detection and application of those effects? In order to highlight some of the rosen questions, well-known experts were invited to write chapters for this book.

We believe that the book can attract attention of researchers, engineers, Ph.D. students and others, who would like to gain knowledge about some intrinsic effects of Superconductivity at nanoscale.

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