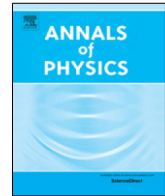




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Editorial

Foreword to Special Annals of Physics issue, Eliashberg festschrift



With this special issue, we celebrate the 60th anniversary of the Eliashberg theory of superconductivity as well as the upcoming 90th birthday of its author – Dr. Gerasim Matveevich Eliashberg. Dr. Eliashberg is a brilliant and legendary theoretical physicist, a member of the Russian Academy of Sciences, one on the most senior members of Landau Institute for Theoretical Physics, a good friend and beloved teacher to some of us.

Gerasim Eliashberg was born in 1930 in St. Petersburg. As a teenager, he survived the siege of Leningrad during the second World War. He graduated from Leningrad State University in 1952, and owing to peculiarities of that time, joined a factory first. Only in 1959, he could fully devote himself to his favourite subject of theoretical physics and enrolled in a Ph.D. programme.

In March and November of 1960, Gerasim Eliashberg published two seminal articles that propelled him to the forefront of physics at the time. In these papers, he put together a set of groundbreaking methods and ideas that latter became known as the Eliashberg theory of superconductivity. The theory appeared only three years after the development of the first microscopic Nobel-prize winning theory of superconductivity by Bardeen, Cooper, and Schrieffer (BCS). Eliashberg's work has provided a foundation and justification of the BCS theory. Eliashberg has formulated, using the Green function techniques, the concept of a boson-mediated attraction between electrons, in line with the ideas of high-energy physics at the time, and reduced the theory to a set of straightforward and practical formulae that account for all subtleties of electron–phonon interaction. Various applications of the Eliashberg theory and extensions of his method to other

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boson-mediated interactions have been used ever since and they still constitute an active field of condensed matter research. This is clearly witnessed by this issue.

After obtaining a Ph.D. degree in 1963, Gerasim Eliashberg moved to the Moscow region, where he became a member of the newly formed Institute for Theoretical Physics in 1965. He has remained a member of the Institute ever since.

The theory of non-equilibrium superconductivity was a particular challenge at the time, and Gerasim Eliashberg spent many years working on the subject, utilizing a complex and elegant method of analytical continuation from imaginary energies to real ones. This work has created a whole new field of microscopic kinetic theory of electronic systems. A particularly important discovery of Dr. Eliashberg was a counter-intuitive prediction of superconductivity enhancement by microwaves. This Eliashberg's work has received a lot of experimental attention and confirmation. Experimental and theoretical investigations based on the Eliashberg theory of stimulated superconductivity continue to this day. Of particular interest is the use of Eliashberg's ideas in the ongoing research on superconducting devices, whose goal is practical realization of quantum computing algorithms.

In scientific discussions, Gerasim Eliashberg often comes up with clear and instructive ideas and statements, even if the right way to approach a problem is by no means obvious. His extraordinary intuition and deep insights have enabled him to help colleagues to make progress on challenging projects that otherwise seemed hopeless. In various collaborations, he has made many pioneering contributions to the fields that still flourish long time after. In collaboration with Lev Gorkov, he has led research on the electronic properties of small metallic particles. This work has had broad impact on a large and diverse community that studies random, disordered and chaotic systems. In collaboration with Yuri Bychkov, he studied strongly-interacting two-dimensional electrons in magnetic fields, and obtained one of only a few exact results in this active field. With his students, Dr. Eliashberg had explored charge and spin transport in materials without inversion symmetry, some twenty years before the subject became a "hot" topic of research.

Already for many years, condensed matter physics has remained a highly competitive area of research, where personal assertiveness, publish-or-perish culture, fashion-driven research are common traits (de facto survival skills) of both young and mature scientists alike. On this background, Gerasim Eliashberg strikes with modesty, generosity, and kindness. He is gentle and equally patient in conversations with anybody: from a Nobel prize winner to a beginning master student. While being aware and appreciative of modern research trends and fashion, Dr. Eliashberg promotes the notion of Science as a never-ending dialogue between a researcher and Nature, a deep process that can be painstakingly difficult, but can also bring joy beyond earthy limits, a joy that is different from winning a competition. Some of us have had the privilege to have Gerasim Matveevich Eliashberg as a mentor, and this experience is unforgettable.

Eliashberg's mentoring sometimes went far beyond research. On one occasion, a Ph.D. student brought to an appointment with his supervisor no scientific points, but rather a tangle of serious personal problems: derailed personal relationships, no money to live on, and no place to live. Gerasim Eliashberg listened carefully and with empathy, and said: "Perhaps in these circumstances you can try to work more, work harder, and achieve at least a little bit of progress towards your PhD goals. I do not want to patronize though. It is just many times, I have felt desperate and powerless facing various life challenges and circumstances. And I did what I just suggested. It has helped". This conversation occurred many years ago, but the advice is timeless and may be helpful during the present world-wide crisis, as well as for future crises yet to come.

Dear Gerasim Matveevich, it is a pleasure and honour to congratulate you and wish you a very happy birthday. Best wishes and thank you!

Mikhail Feigel'man
Victor Galitski
Boris Ivlev
Leonid Levitov
Yuli Nazarov