Preface

Three years after the first book "Progress in Nonequilibrium Green's Functions" (World Scientific Publ. 2000, ISBN 981-02-4218-2) – here comes volume II. Again it includes refereed review papers, which are based on talks and posters presented at an interdisciplinary workshop.

The book combines discussion of fundamental problems of quantum transport theory with modern applications in various fields, ranging from semiconductors to plasmas and nuclear matter. Continuing the historical overview given in the first volume by Paul Martin, Gordon Baym and Don DuBois, this time the remarkable developments in the Soviet Union in the 1950ies/60ies are recalled by two of the experts: Alex Abrikosov and Leonid Keldysh. Their exciting recollections complement the previous ones, showing that, under the conditions of the "iron curtain" most of the developments proceeded independently.

Among the main topics of this book, a central role this time play quantum kinetic theory of transport and optics in semiconductors. Other problems discussed include high-temperature superconductivity, Coulomb explosion of clusters, Bose condensation in nuclear matter, parton dynamics, Also, the scope of theoretical and computational concepts has been broadened. Included were not only Nonequilibrium Green's Functions (NGF), but also other many-body approaches such as time-dependent density functional theory, Bohm trajectories, quantum Monte Carlo and quantum dynamics and their comparison and possible combination with NGF.

As the first time, the papers have been thorougly refereed. Some of them had to be substantially modified to meet the high scientific standards as well as specific demands of an interdisciplinary readership.

This workshop was held under quite unique circumstances. 5 days before the opening, Dresden was hit by the worst flooding in its history, affecting parts of the historic Altstadt including the famous art gallery, the Zwinger and the original conference venue. Yet the conference did take place in Dresden, symbolizing the great love of physicists for their field. We are grateful to all participants for their personal courage which made this memorable scientific event – and with it the present book – possible.

Many thanks to Renate Nareyka for her invaluable assistence before, during and after the workshop, to Manfred Bonitz for his support in flooded Dresden, and to Wolf–Dietrich Kraeft and Thomas Bornath for proof reading of large parts of the present book. Further, our thanks go to the main

sponsor of the workshop and the book – the Wilhelm und Else Heraeus–Stiftung (Hanau, Germany) and to the Deutsche Forschungsgemeinschaft (DFG) for supporting the participants from Eastern Europe and this book (via the Sonderforschungsbereich 198). Facing the flood situation, both organizations were immediately ready to provide additional funds which made the workshop under these unusual conditions possible. Finally, we gratefully acknowledge a grant from the Office of Naval Research (USA) and support from Rostock University.

Michael Bonitz and Dirk Semkat Rostock, January 2003

In memoriam Yuri Klimontovich (1924–2002)

On 27 November 2002 Yuri Lvovich Klimontovich died from cancer. He was one of the most outstanding many-body theorists of the 2nd half of the 20th century and had a profound influence on the development of Statistical Physics, kinetic theory, plasma physics and even Nonequilibrium Green's functions [1].

Yuri Lvovich Klimontovich was born on 28 September 1924 in Moscow. He graduated from Moscow State University in 1948 with a work on the theory of radiation damping [3]. He received his PhD in 1951 with a work on kinetic theory of plasmas (his advisor was N.N. Bogolyubov). In 1964 he received the degree of a Doctor of Science (Dr. habil.) for the development of a nonequilibrium statistical theory of plasmas [4]. After 4 years as senior lecturer at Moscow Aviation Technology Institute he became an associate (1955) and full professor (1965) at Moscow State University where he remained active until his last days. Among many honors, he was awarded the State Prize of Russia (1991), the A. von Humboldt Prize (1994) and the degree of a Dr. honoris causa of Rostock University (1990).

His scientific life was remarkably productive and we can give only a few examples: he derived the response of the electron gas [5] 2 years before Lindhard and proposed time and energy dependent distribution functions [6]. His most brilliant idea was the concept of second quantiza-

tion in phase space by introducing the microscopic phase space density $N(x,t) = \sum_{i=1}^{N} \delta(x - x_i(t))$ where $x_i = \mathbf{r}_i, \mathbf{p}_i$ are the particle trajectories [7]. This method (which in many points is very similar to Nonequilibrium Green's functions) turned out extremely successful and productive for many-particle physics. On its basis Klimontovich developed the kinetic theory of nonideal plasmas, nonideal gases and electromagnetic field-matter interaction, laser theory, Brownian motion and the theory of fluctuations. He derived non-Markovian and total energy conserving kinetic equations, developed the concept of retardation (gradient) expansion, derived a relativistically covariant kinetic theory, hydrodynamic and gasdynamic equations for correlated systems. These results and much more are the basis of 250 scientific papers and 11 brilliant monographs and text books [8].

He was a teacher for generations of physicists in many countries, a remarkable person and friend. His exceptional books, papers and ideas remain with us. His thoughts were original and often unconventional and surprising. He did not hesitate to question established theories and to provoke controversial discussions, some of which have significantly advanced Statistical Physics. Many others remain with us as open puzzles and will stimulate further developments in the field of many-body physics.

Michael Bonitz

[1] Leonid Keldysh in his talk at this conference (see pp. 4–17) noted the stimulating influence he received from the review paper on nonequilibrium processes in plasmas by Klimontovich and Silin [2].

[2] Yu.L. Klimontovich and V.P. Silin, *Uspekhi Fiz. Nauk* **70**, 247 (1960); [English translation: *Soviet Phys. Uspekhi* **3**, 84 (1960)].

[3] Yu.L. Klimontovich and V.S. Fursov, *ZhETF* **19**, 819 (1949).

[4] *Statistical Theory of Nonequilibrium Processes in Plasmas*, Izdat. MGU, Moscow 1964 (russ.) and Pergamon Press, Oxford 1967.

[5] Yu.L. Klimontovich and V.P. Silin, *Dokl. Akad. Nauk* **82**, 361 (1952) [*Sov. Phys. Doklady*]; *ZhETF* **23**, 151 (1952) [*Sov. Phys. JETP*].

[6] Yu.L. Klimontovich, *Dokl. Akad. Nauk* **108**, 1033 (1956).

[7] Yu.L. Klimontovich, *ZhETF* **33**, 982 (1957) [*Sov. Phys. JETP* **6**, 753 (1958)].

[8] *Kinetic Theory of Nonideal Gases and Plasmas*, Moscow, Nauka 1975 (russ.); and Pergamon Press, Oxford 1982; *Kinetic Theory of Electromagnetic Processes*, Moscow, Nauka 1980 (russ.) and Springer 1983; *Statistical Physics*, Moscow, Nauka 1982 (russ.) and Harwood Academic Publishers, New York 1986.