

RECENT DEVELOPMENTS IN CONDENSED MATTER PHYSICS

Volume 1 • Invited Papers

Edited by

J. T. DEVREESE

Chairman of the Conference
University of Antwerpen (RUCA and UIA)

Associate Editors

L. F. LEMMENS

University of Antwerpen (RUCA)

V. E. VAN DOREN

University of Antwerpen (RUCA)

J. VAN ROYEN

University of Antwerpen (UIA)

PLENUM PRESS • NEW YORK AND LONDON

CONFERENCE CHAIRMAN

J. T. DEVREESE, RUCA & UIA, Antwerpen

LOCAL COMMITTEE

L. F. LEMMENS, RUCA, Antwerpen
V. E. VAN DOREN, RUCA, Antwerpen
J. VAN ROYEN, UIA, Antwerpen

INTERNATIONAL ADVISORY COMMITTEE

M. BALKANSKI, Paris, France	W. J. HUISKAMP, Leiden, The Netherlands
A. ABRKOSOV, Moscow, USSR	G. M. KALVIUS, Munich, FRG
V. M. AGRANOVITCH, Moscow, USSR	A. R. MACKINTOSH, Copenhagen, Denmark
P. AVERBUCH, Grenoble, France	N. H. MARCH, Oxford, UK
G. BENEDEK, Milan, Italy	E. MOOSER, Lausanne, Switzerland
H. B. CASIMIR, Heeze, The Netherlands	N. F. MOTT, Cambridge, UK
B. R. COLES, London, UK	K. A. MULLER, Zürich, Switzerland
S. R. DE GROOT, Amsterdam, The Netherlands	S. NIKITINE, Strasbourg, France
A. J. FORTY, Warwick, UK	C. J. TODD, Ipswich, UK
D. FROHLICH, Dortmund, FRG	M. VOOS, Paris, France
A. FROVA, Rome, Italy	E. P. WOHLFARTH, London, UK
H. GRIMMEISS, Lund, Sweden	E. WOLF, Stuttgart, FRG
H. HAKEN, Stuttgart, FRG	P. WYDER, Nijmegen, The Netherlands
C. HILSUM, Malvern, UK	H. R. ZELLER, Baden, Switzerland

INTERNATIONAL PROGRAM COMMITTEE

N. N. BOGOLUBOV, Moscow, USSR	E. MITCHELL, Oxford, UK
J. BOK, Paris, France	F. MUELLER, Nijmegen, The Netherlands
M. CARDONA, Stuttgart, FRG	R. PEIERLS, Oxford, UK
E. COURTENS, Rüschlikon, Switzerland	H. J. QUEISSER, Stuttgart, FRG
S. F. EDWARDS, Cambridge, UK	D. SETTE, Rome, Italy
R. ELLIOTT, Oxford, UK	H. THOMAS, Basel, Switzerland
J. FRIEDEL, Orsay, France	M. TOSI, Trieste, Italy
H. FROHLICH, Liverpool, UK	F. VAN DER MAESEN, Eindhoven, The Netherlands
F. GARCIA MOLINER, Madrid, Spain	J. ZAK, Haifa, Israel
G. HARBEKE, Zürich, Switzerland	A. ZAWADOWSKI, Budapest, Hungary
H. R. KIRCHMAYR, Vienna, Austria	W. ZAWADZKI, Warsaw, Poland
S. LUNDQVIST, Göteborg, Sweden	W. ZINN, Jülich, FRG
S. METHFESSEL, Bochum, FRG	A. ZYLBERSZTEJN, Orsay, France

NATIONAL ADVISORY COMMITTEE

S. AMELINCKX, SCK/CEN, Mol	K. H. MICHEL, UIA, Antwerpen
F. CARDON, RUG, Gent	J. NIHOUL, SCK/CEN, Mol
R. EVRARD, ULg, Liège	J. PIRENNE, ULg, Liège
R. GEVERS, RUCA, Antwerpen	D. SCHOEMAKER, UIA, Antwerpen
J. P. ISSI, UCL, Louvain-la-Neuve	L. STALS, LUC, Diepenbeek
L. LAUDE, UEM, Mons	R. VAN GREEN, VUB, Brussels
A. LUCAS, FUN, Namur	L. VAN GERVEN, KUL, Leuven

INTRODUCTION

These volumes contain the invited and contributed talks of the first general Conference of the Condensed Matter Division of the European Physical Society, which took place at the campus of the University of Antwerpen (Universitaire Instelling Antwerpen) from April 9 till 11, 1980.

The invited talks give a broad perspective of the current state in Europe of research in condensed matter physics. New developments and advances in experiments as well as theory are reported for 28 topics. Some of these developments, such as the recent stabilization of mono-atomic hydrogen, with the challenging prospect of Bose condensation, can be considered as major breakthroughs in condensed matter physics.

Of the 65 invited lecturers, 54 have submitted a manuscript. The remaining talks are published as abstracts.

The contents of this first volume consists of 9 plenary papers. Among the topics treated in these papers are:

- electronic structure computations of iron
- the density functional theory
- hydrogen in amorphous Si
- topologically disordered materials
- nuclear antiferromagnetism
- stabilization of mono-atomic hydrogen gas
- covalent and metallic glasses
- nonlinear excitations in ferroelectrics.

The other 56 papers of the first volume are divided among 17 symposia and 12 sessions. The different topics treated are:

- localization and disorder
- metals and alloys
- fluids
- excitons and electron-hole droplets
- surface physics
- dielectric properties of metals
- experimental techniques

- electronic properties of semiconductors
- low-dimensional systems
- defects and impurities
- spin waves and magnetism
- phase changes
- superionic conductors
- dielectric properties
- polarons
- molecular crystals
- superconductivity
- spin glasses
- photo-emission
- polaritons and electron-phonon interaction

A review of these invited talks is given in the Closing Address.

Volumes 2, 3 and 4 contain the contributed papers of the participants to this Conference. All the 170 contributions deal with a wide range of topics including the same subjects reviewed in the invited papers.

The conference itself was organized in collaboration and with the financial support of the University of Antwerpen (Rijksuniversitair Centrum Antwerpen and Universitaire Instelling Antwerpen), the Belgian National Science Foundation and Control Data Corporation, Belgium. Co-sponsors were: Agfa-Gevaert N.V., Bell Telephone Mfg. Co., Coherent, Esso Belgium, I.B.M., Interlaboratoire N.V., I. Komkommer, Labofina, Metallurgie Hoboken-Overpelt, Spectra Physics.

Previous meetings of the Condensed Matter Division of the European Physical Society emphasized topical conferences treating "Metals and Phase Transitions" (Firenze, 1971), "Dielectrics and Phonons" (Budapest, 1974), "Molecular Solids and Electronic Transport" (Leeds, 1977). The promising start of 1971, however, did not evolve into a continuous success, and only 80 participants attended the 1977 meeting.

When the Board of the Condensed Matter Division invited me to act as Chairman for this Conference, several reasons could have been invoked for feeling reluctant about accepting this invitation. It was nevertheless decided to undertake this task, because we were convinced that there exists a genuine need in the European Physical Community for an international forum similar to the successful "March Meeting" of the American Physical Society. This March Meeting is not organized as a meeting for the physical societies of the different states but for all physicists and laboratories individually.

At the early stages of the organization of this Conference, about 800 solid state physicists were members of the Condensed Matter Division. However, as a result of an analysis which was made in Antwerpen, it soon became clear that in Europe not less than 8000 solid state physicists are active in several fields of research.

Therefore as a first step announcements were sent to all these physicists individually. The large response to these announcements, as reflected in the presence of about 600 solid state physicists at this Conference, proves that the need for such a forum indeed is present in the European physics community and that the time is ripe for the organization of an annual conference.

Subsequently, the International Advisory and Program Committees of this Conference were formed with great care. A large number of distinguished physicists were invited to serve as members of these committees. They represented not only the different fields and sections of condensed matter physics but also the different member states of the European Physical Society.

It was also the task of both the International Advisory and Program Committees to guide in establishing the conference program. As a result of a first consultation a large number of topics and speakers were suggested to be incorporated in the program. In order to make a fair and balanced choice, a ballot with all the suggestions was sent out to the Committee members. The result led to a first selection of speakers and topics. This number was gradually supplemented with names and topics resulting from private consultations to a total of 28 topics and 65 invited speakers. The final program consisted of 9 plenary sessions, 11 symposia each with 3 or 4 invited speakers and a maximum of 8 parallel sessions, in which 320 contributed papers were presented. Among the invited and contributed papers, there were several contributions from the U.S.A. Also scientists from Japan and China gave invited and contributed talks.

I should like to thank the invited speakers for their collaboration in preparing the manuscripts of their talks. This volume together with the volumes of the proceedings of the contributed papers will give the scientific community a review of the state of affairs of condensed matter physics in Europe together with several new developments from the U.S.A., Japan and China. It gives a report on the most recent advances in theory as well as experiment. Publication of these proceedings will serve as a guide in the years to come not only to the participants of this conference but to the scientific community at large.

It gives me great pleasure to thank the President of the Universitaire Instelling Antwerpen, Dr. jur. P. Van Remoortere and the Rector, Prof. Dr. R. Clara, for their continuous interest and

support for this Conference and for making available so promptly and effectively the whole infrastructure of the university conference center.

Finally, I wish to thank Miss R.M. Vandekerkhove, the administrative secretary of the Conference. My thanks are also due to Miss H. Evans and Mr. M. De Moor for their administrative and technical assistance in the organization, and to all those who helped to ensure a smooth operation of the Conference.

J.T. Devreese
Professor of Theoretical Physics
Chairman of the Conference