PREFACE

EIGHTH CAROLUS MAGNUS SUMMER SCHOOL ON PLASMA AND FUSION ENERGY PHYSICS

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Fusion research has entered a new phase. After the agreement obtained in 2005 to build ITER (abbreviation for International Thermonuclear Experimental Reactor but also the Latin word for "the way," the route to fusion) in Cadarache in the south of France, the seven member parties (the European Union represented by EURATOM, Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation, and the United States of America) formally established the ITER organization. After completion of a design review and with the first procurement arrangements for the superconductors of the toroidal field coils, we are all looking forward now to large-scale procurement activities and the beginning of the construction. ITER will demonstrate for the first time that significantly more power can be produced by the fusion of a D-T plasma than is necessary to maintain the plasma.

Now, we are facing a decade of construction work. Clearly, for the successful exploitation of the device in the future, it is of utmost importance today to train young scientists and engineers in plasma and fusion energy physics and technology. For the eighth time the Carolus Magnus Summer School on Plasma and Fusion Energy Physics has given its share to this mission. The school is jointly organized by the three institutes collaborating in the Trilateral Euregio Cluster (TEC): Institut für Energieforschung - Plasmaphysik, Forschungszentrum Jülich GmbH, Association EURATOM - Forschungszentrum Jülich, Jülich, Germany; FOM-Institute for Plasma Physics Rijnhuizen, Association EURATOM-FOM, Nieuwegein, The Netherlands; and Laboratory for Plasma Physics, Ecole Royale Militaire-Koninklijke Militaire School, Association EURATOM-Belgian State, Brussels, Belgium.

The Eighth Carolus Magnus Summer School on Plasma and Fusion Energy Physics has been held in Bad Honnef, Germany, at the Physikzentrum Bad Honnef, a beautiful location with superb lecturing facilities. The Physikzentrum is run by the German Physical Society and supported by the University of Bonn and the state North Rhine-Westphalia. The stately mansion housing the Physikzentrum is surrounded by a park at the foot of the Siebengebirge ("the Seven Hills") on the right bank of the Rhine River.

This year the organizers of the school welcomed a record number of 67 participants from 26 countries, the large majority of whom came not from the organizing institutes but from all over the rest of the world, including Argentina, Brazil, Morocco, South Korea, and China.

As the reader will see, the topics of the school cover a wide spectrum of plasma and fusion physics, ranging from basic theory of confinement and transport, heating and current drive, fusion plasma diagnostics with special emphasis on the needs of ITER, and plasma-wall interaction to the extrapolation to future devices such as ITER and the physics basis for power plants like DEMO. This broad coverage has been kept from the previous schools; nevertheless, the field of plasma-wall interaction and materials got an increased emphasis, reflecting the increasing importance in the international tokamak fusion research program of plasma-wall interactions and materials issues as exemplified by projects like the ITER-like wall for JET and Magnum PSI.

Traditionally, the lectures are given by specialists in their fields. As in the years before, lecturers from the three organizing institutes of the TEC were supplemented by a number of lecturers from nearby universities and other European laboratories. Much time was given

to discussion between lecturers and participants. We gratefully acknowledge the efforts of all lecturers, and we especially mention the non-TEC specialists: Drs. G. Van Oost (Ghent University), D. Bartlett (European Commission, Brussels), D. Hartmann (Max-Planck-Institut für Plasmaphysik, Greifswald), H. Wilson (University of York), B. Weyssow (Université Libre de Bruxelles, Brussels), R. Keppens (Katholieke Universiteit Leuven), X. Garbet (CEA, Cadarache), M. Rubel (Royal Institute of Technology, Stockholm), J. Linke (Forschungszentrum Jülich), R. Wolf (Max-Planck-Institut für Plasmaphysik, Greifswald), and L. Horton (Max-Planck-Institut für Plasmaphysik, Garching). In another tradition, the scope of the school is further broadened by the two special evening lectures. This year these lectures covered the topics of climate change (Prof. Dr. A. Wahner, Forschungszentrum Jülich) and exotic plasmas (Prof. G. Kroesen, TU Eindhoven).

In addition to attending the lectures, the participants used the opportunity of the school to present their own research work in several poster sessions. And, equally important, the school provided a forum for them to get to know each other and to exchange views about the prospects of fusion—and the rest of the world. Soccer matches and hiking tours provided the necessary recreation; musical performances by some of the participants showed the wide range of talents gathered at this year's summer school.

We are also glad to continue the collaboration with *Fusion Science and Technology* (*FS&T*). *FS&T* has published the lectures of the Carolus Magnus Summer School from the very first school onward. These issues have proven to be a valuable reference source for both the participants and for courses on plasma and fusion energy physics in universities. It is hoped that the present edition will continue in this tradition.

We cordially want to thank our sponsors: EURATOM and the three organizing institutes of the TEC: Institut für Energieforschung - Plasmaphysik, Forschungszentrum Jülich GmbH, Association EURATOM - Forschungszentrum Jülich, Jülich, Germany; FOM-Institute for Plasma Physics Rijnhuizen, Association EURATOM-FOM, Nieuwegein, The Netherlands; and Laboratory for Plasma Physics, Ecole Royale Militaire-Koninklijke Militaire School, Association EURATOM-Belgian State, Brussels, Belgium. The other sponsors were Forschungszentrum Jülich GmbH, Jülich, Germany; Belgatom, Belgium; and the European Physical Society, East West Task Force.

Last but not least I personally want to thank my colleagues on the organizing committee, Dirk, Michael, and Roger, for their continuous and hard work during two years to make the Eighth Carolus Summer School again a big success.