# MEETING REPORTS

## SUMMARY OF THE COURSE AND WORKSHOP ON DIAGNOSTICS FOR FUSION REACTOR CONDITIONS, VARENNA (COMO), ITALY, SEPTEMBER 6-17, 1982

The primary objective of the next generation of fusion experiments, such as Joint European Torus (JET), Tokamak Fusion Test Reactor (TFTR), T-15, JT-60, Mirror Fusion Test Facility, is to obtain and study plasmas in conditions and with dimensions approaching those needed in a fusion reactor. Learning how to control the plasma heating, impurity flux, stability, and containment of the plasmas in these experiments sufficiently well to achieve the high temperatures and $n\tau$ values necessary for a close approach to ignition will require a measurement program at least as advanced and comprehensive as anything yet attempted in fusion research. This requires that traditional diagnostic methods need to be improved and extended to operate more reliably and in the increasingly hostile radiation environment that will be typical of the next generation of experiments. In addition, new diagnostic techniques need to be developed urgently both to replace traditional methods, which will be inapplicable in reactor conditions, and to measure more accurately or more reliably those plasma parameters that are badly diagnosed in existing experiments.

The course and workshop on "Diagnostics for Fusion Reactor Conditions" was addressed both to those already working in this field and to those about to enter it. The course lectures covered the main diagnostic techniques presently applied to fusion experiments with particular emphasis on methods that are most appropriate to the next generation of experiments and to fusion reactors. The following topics have been presented:

1. diagnostics for magnetic confinement experiments
   a. radiation emission and scattering (spectroscopy, x rays, electron cyclotron emission (ECE), bolometry, interferometry, and Thomson scattering)
   b. neutral particles diagnostics
   c. neutron diagnostics
   d. electrical diagnostics
   e. impurities, walls, and limiter
   f. hostile environments
   g. applications to large tokamaks (JET, TFTR)
   h. diagnostics for mirrors
   i. diagnostics for reversed-field pinches
2. diagnostics for inertial confinement experiments
   a. laser fusion
   b. ion beam fusion
   c. particle beam fusion
   d. relativistic electron beam
3. data acquisition systems.

The 46 course lectures have given a comprehensive introduction, a survey, and the most recent developments of the topics listed here. In addition, the major future needs in plasma diagnostics were presented and discussed in a general closing session, chaired by the three directors of the course: D. Akulina of the Lebedev Institute, Moscow, USSR; P. Stott, who is in charge of JET diagnostics, Abingdon, United Kingdom; and C. Wharton, of Cornell University, Ithaca, New York.

The workshop sessions have been arranged to provide a forum for discussing recent developments in new or traditional diagnostic methods and to provide an opportunity for experts in each field to exchange ideas. Seven of the workshop sessions have been devoted to topical discussions and presentations on the following subjects: collective scattering, ECE, neutrons, diagnostics for ignition experiments, x-ray crystal spectroscopy, optical spectroscopy, and impurities and wall effects. Two additional sessions were devoted to contributed papers on general subjects. The total number of contributed papers (oral only) was 30. The chairmen of the seven workshop sessions have also given introductory talks.

The course and workshop were attended by 90 scientists (including lecturers, participants, and invited speakers), coming from (numbers in parentheses indicate number of attendees): China (3); Denmark (1); France (7); Germany (9); India (1); Israel (1); Italy (23); Japan (2); Libya (4); the Netherlands (3); Poland (1); Republic of South Africa (1); Sweden (1); Switzerland (1); United Kingdom and JET (9); USSR (5); United States (17); and Commission of European Communities (headquarters in Brussels) (1). Affiliations represented included universities (17); industry (2); associations (Euratom and national laboratories) (44); and national laboratories, U.S. Department of Energy, Naval Research Laboratory, and the USSR Academy of Sciences (27).

The proceedings of the course (two volumes) and of the workshop (one volume) were published by the Commission of the European Communities with D. Akulina, G. Leotta, E. Sindoni, P. Stott, and C. Wharton as editors. Free copies are available at the following address: Dr. G. G. Leotta, CEC General Directorate XII, Fusion Program, 200 rue de la Loi, 1040 Brussels, Belgium.

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