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PLASMA PHYSICS AND CONTROLLED FUSION

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EPS Plasma Physics Division

12th European Conference on Controlled Fusion and Plasma Physics, Budapest, 2-6 September 1985

The 12th conference of the Division, held on 2-6 September 1985 in Budapest, was a great success. The Local Organising Committee provided excellent arrangements and facilities. Many new and interesting experimental and theoretical results were reported, and there was much interesting and stimulating discussion. The contributed papers are available as Volume 9F in the Europhysics Conference Abstracts series. The invited papers will be published as a special issue of Plasma Physics and Controlled Fusion, probably with the December 1985 or January 1986 issue.

During the conference there was a meeting of the International Programme Committee for the 1986 conference (see next but one item). There were also two meetings of the Divisional Board which was pleased to accept a formal offer from our Spanish colleagues to host the 1987 conference.

New Vice-Chairman

During one of the Divisional Board meetings Dr K Appert, presently with the CRPP in Lausanne, accepted a unanimous nomination to become Vice-Chairman of the Board from 1 January 1986. Dr Appert expressed himself willing, if elected, to take on the job of Chairman after the 1987 conference, when the present Chairman's term of office will end.
(A Gibson/received 18 September)

13th European Conference on Controlled Fusion and Plasma Heating, Schliersee, 14-18 April 1986

IPP are organising the 13th European Conference on Controlled Fusion and Plasma Heating to be held at the Kurzentrum, Schliersee, near Munich, on 14-18 April 1986. The conference will be especially devoted to problems of plasma heating and confinement. The scope will comprise 20 invited papers, 24 supplementary oral presentations on confinement problems relating to special heating methods, and possibly up to 300 contributed poster presentations.

The DEADLINE for submission of ONE-PAGE ABSTRACTS, which will be used for paper selection and, at the conference, as a guide for delegates, is 25 JANUARY 1986. For publication in the proceedings, four-page abstracts should be submitted during the conference. FURTHER DETAILS are available from: Mrs C Stahlberg, Max-Planck-Institut für Plasmaphysik, D-8046 Garching, West Germany.
(I Milch/received 19 September)

Associate Euratom-FOM

Thomson scattering on the TORTUR tokamak

The observation of relatively small distortions on the maxwellian velocity distribution of the electrons due to the presence of collective oscillatory motions or beam-like distributions at higher energies by Thomson scattering requires an optical assembly of special design. At a spectral resolution considerably higher than for the usual

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where LH waves also couple to the ions, the confinement is degraded. Sawteeth have been completely suppressed by means of lower hybrid current drive. The current profile in this case flattens in the central plasma region and q(0) increases above 1. Sawteeth have also been stabilised during neutral beam injection by additional LHCD.
(I Milch/received 23 September)

Association Euratom-CEA

ECRH on TFR
The Euratom-FOM/Euratom-CEA joint project of ECRH on TFR started experiments at the end of March 1985 with one 60 GHz gyrotron (135 kW, 35 ms pulses). The results were presented at the EPS meeting in Budapest in September.

The complete system is now operational and performing well: it consists of three 60 GHz gyrotrons each delivering up to 220 kW for 100 ms. The three lines inject O-mode from the low-field side of the torus. Two waveguide antennas are oriented perpendicular to the magnetic field. A grated twist reflector, mounted at the inboard side of the torus, converts the non-absorbed power fraction into the E-mode and reflects it with a 20° angle. The third antenna is mounted with a 16° angle and can be used at central densities above cut-off because reflection into the waveguide is avoided. Using 660 kW, 100 ms pulses, the central electronic temperature (averaged over sawteeth) has been raised from 1 keV to 3keV (measured by Thomson scattering). The target plasma had the following characteristics: B_T = 21.4 kG, R = 98 cm, a = 18 cm, $n_e(0) = 2\times10^{13}$ cm^{-3}, I_p = 110 kA, gas - hydrogen. The future programme, in addition to heating, will address MHD control (on which spectacular results have already been obtained) and suprathermal electron generation.

The success of this experiment would not have been possible without the enthusiasm of R Cano, the initiator of the project, and the efficient collaboration of M T Van Donselaar, both of whom died during in the summer of this year - they will be sadly missed.
(J Tachon/received 20 September)

ISPC-7

The large attendance (587) at the 7th International Symposium on Plasma Chemistry held on 1-5 July in Eindhoven, The Netherlands reflected the increasing interest in this growing field of application of low-temperature plasma physics. In this symposium, sponsored by IUPAC and EPS, new applications of plasma science were discussed. Programme items included plasma synthesis, plasma diagnostics, plasma etching, plasma deposition and polymerisation, plasma-surface interaction, modelling, plasma spraying and extractive metallurgy. The symposium comprised 4 plenary invited lectures, 11 topical invited lectures, 90 oral presentations and 150 poster presentations. The industrial side of the technology was emphasised in a one-day workshop, and an exhibition of 38 stands showed the recent advances made in plasma industrial applications. A three-day plasma course organised in conjunction with the symposium attracted more than 80 attendees.

A few copies of the contributed papers proceedings are still available at Hfl 250 from C J Timmermans, Eindhoven University of Technology, PO Box 513, NL-5600 MB Eindhoven, The Netherlands.
(D C Schram/received 17 September)

WLAP 2

Second Workshop on Laser Acceleration of Particles, Malibu, 7-17 January 1985
New applications of plasma physics were discussed at the Second Workshop on Laser Acceleration of Particles held on 7-17 January 1985 in Malibu, California. The workshop, organised by C Joshi and T Katsouleas of UCLA, attracted about 120 attendees.

Burton Richter presented a challenge to accelerator designers: a 5 TeV on 5 TeV linear electron-positron collider with a luminosity of 10^{34} cm^{-2} s^{-1}, produced, for instance, by bunches of 2.5×10^{9} particles 0.3 mm long by 10^{-5} mm radius, repped at 5 kHz. To create the highest accelerating fields, use of laser radiation is indicated. Methods fall into three classes: (1) near-field, (2) far-field and (3) plasma accelerators.

The prime candidate in (1) is the droplet accelerator, in which a miniature linac structure is formed by one or two rows of conducting spheres, 5 μm apart, formed by inkjet printer technology. A laser beam ionises the droplets and excites the linac field. Spreading of the plasma limits the acceleration gradient to ≃ 1 GeV m^{-1}. A type (2) device could be an inverse free-electron laser, in which a laser beam pushes particles with a transverse velocity component imparted by a wiggler magnetic field. The limit here is ≃ 0.2 GeV m^{-1}.

Fields of order 100 GeV m^{-1} can, in principle, be produced by exciting large-amplitude electron plasma waves, the available gradient scaling as $0.1n^{1/2}$ eV m^{-1}, where n is the density in m^{-3}. These waves can be driven by electron bunches, as in the wake-field accelerator, or by laser beams, as in the beat-wave accelerator. The latter seems to be the most advanced and most promising scheme at this point. Here the plasma wave is excited by the ponderomotive potential of two laser waves beating at the plasma frequency. The sharp density resonance has already been seen. In experiments at UCLA, 9.6 and 10.6 μm beams from a 15 J, 2 ns CO_2 laser are propagated collinearly into an $n \simeq 10^{23}$ m^{-3} plasma, and the plasma waves are detected both by ruby Thomson scattering and by forward scattering of the CO_2 light itself. Fields of order 1 GeV m^{-1} were measured. In addition, many competing processes, such as stimulated Raman and Brillouin scattering and interactions of the product waves and their harmonics have been sorted out. The phase velocity of the plasma waves had a relativistic γ of 10. In an experiment planned at RAL, waves with $\gamma \simeq 100$ would be excited by glass laser beams of 1.06 and 1.05 μm wavelengths. At ILE, Osaka, experiments are proceeding on the creation of a 'plasma fibre' with an inverted density profile useful for trapping light waves in any beat-wave scheme. The nonlinear physics issues raised by the possibility of laser accelerators provide many opportunities for the exploration of new ideas and relativistic plasma behaviour in the coming years.

Proceedings are available from the American Institute of Physics as AIP Conference Proceedings No. 130.
(F F Chen/received 23 September)

ICPIG XVII

The XVIIth International Conference on Pheonomena in Ionized Gases (ICPIG XVII) was held on 8-12 July 1985 in Budapest, Hungary. ICPIG deals with all aspects of plasma and gas discharge physics except fusion-oriented research. A total of 393 contributed papers were accepted (44 from the USSR, 25 from Japan, 18 from the USA, and the remainder from Europe). One of the highlights of the conference was the invited lecture on cosmogony given by H Alfvén who appealed to the conference to put much emphasis on the new science of plasma astrophysics.

From discussions at the posters sessions and during coffee breaks it became clear that there is a worldwide trend towards application-oriented basic research in gas discharge and plasma physics, and many governments are now willing to provide money for this type of non-fusion work.
(W Bötticher/received 13 September)

Culham Laboratory

Tokamak and stellarator operation on CLEO with ECRH
28 and 60 GHz gyrotrons have been used on CLEO to study the limiting value of β in tokamaks and stellarators. In tokamaks the limiting β value is in agreement with theory. Modification of tokamak equilibria at high q by the addition of highly sheared rotational transform with $l = 3$ helical windings improved the confinement time and β; nevertheless, due to problems associated with a rise in plasma density at high power the tokamak ballooning mode β limit was not exceeded except at the lowest plasma currents.

Raising the total power input to a tokamak discharge by ECRH allows the density limit to be increased