

practical situation the probe is much colder than the plasma. Recent experimental results obtained in an MHD generator duct yield results which broadly lie between the former (no cooling) and present (very substantial cooling) theories. (Canada)

R M Clements and P R Smy, *J Phys D: Appl Phys*, **14** (6), 1981, 1001-1008.

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5117. Continuous slowing-down approximation range of 50 keV-100 MeV electrons. (USA)

The Wilson theory has been modified for the calculation of the continuous slowing-down approximation (CSDA) range of 50 keV-100 MeV electrons in the absorbers of atomic numbers from 1 to 92 and in some detector materials, minerals, organic compounds and gaseous compounds. A correction factor which depends on energy as well as on atomic number is evaluated. Values of the CSDA range obtained by the present approach have shown an agreement with reported values within a discrepancy of 6-7%. An attempt has also been made to correlate the CSDA range with the available experimentally measured projected range. Calculated projected range and experimentally measured projected range are found to be in good agreement. (India)

Subodh Kumar et al, *J Appl Phys*, **52** (3), 1981, 1175-1178.

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5118. Flux-limited heat flow in a double plasma device. (GB)

Electron heat flow has been studied in a double plasma device. Electrons of mean energies 5.1 eV and 2.3 eV were separated by a grid which was then pulsed to create a thermal wave moving in a large temperature gradient. Changes in the electrons' velocity distribution, concentration and energy agreed qualitatively with a simple theory based on transport in neutral gases. Thermoelectric effects reduced the heat flow by a factor of 5. This factor combined with the theory suggests a flux-limiting parameter with an upper limit of 0.15 for laser fusion. This value lies within the range found in experiments on plasmas heated by lasers.

P A C Moore, *J Phys D: Appl Phys*, **14** (8), 1981, 1429-1443.

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5119. Numerical simulation of a system for ion temperature measurement by Thomson scattering in a tokamak. (USA)

A numerical simulation of tokamak ion temperature measurement by collective laser Thomson scattering was performed including a Monte-Carlo technique to model the statistical properties of power spectrum estimation. The accuracy to which the ion temperature T_i may be determined under the influence of a finite laser pulse length, a limited signal-to-noise ratio, unequal electron and ion temperatures, and the presence of heavy impurities was investigated. It is found that the effects of low-frequency plasma turbulence and heavy impurities on the scattered spectrum may be mitigated (and the required heterodyne receiver intermediate frequency bandwidth reduced) by considering only the high-frequency portion of the scattered spectrum. A ratio of total scattered power to total noise power of 1 to 2 is shown to be sufficient to determine T_i . A higher signal-to-noise ratio provides little enhancement in the accuracy of T_i determination. Improved values of T_i may be achieved by a longer laser pulse. A laser pulse at least 1 μ sec long is required to measure T_i to within 10%, with a signal-to-noise ratio of 2- and 2-GHz heterodyne receiver intermediate frequency bandwidth.

R L Watterson et al, *J Appl Phys*, **52** (5), 1981, 3249-3254.

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5120. Spectroscopic observations of impurities in Tokapole II discharges. (GB)

Tokapole II is a Tokamak with a four-node poloidal diverter. Impurity concentrations, line radiated power, and impurity behaviour have been studied in Tokapole II discharges with two VUV spectrometers, one of which uses a microchannel plate to acquire the VUV spectrum (400-1300 Å) during a single discharge. Oxygen (3-5% of the electron density) is the dominant impurity, and the measured total radiated power is 15-30% of the ohmic input power. Sheath potentials and arcs evidently play a dominant role in the generation of the observed metallic impurities, because the 15-20 eV plasma ions have essentially no sputtering yield. An impurity doping technique has been used to measure the impurity concentrations and the contributions of the various low-Z impurities to the total radiated power. From the time history of the oxygen ions, T_e is estimated to be about 100 eV. A model of impurity behaviour in a plasma with a magnetic limiter is presented.

R J Groebner and R N Dexter, *Plasma Phys*, **23** (8), 1981, 693-704.

5121. High power heating in the ion cyclotron range of frequencies in the Wisconsin Tokapole II. (GB)

Fast wave heating at the second, third and fourth harmonics of the ion cyclotron resonance, and slow wave heating at the fundamental in a single ion species hydrogen plasma, are found to be in good agreement with warm plasma theory at rf power levels ≤ 130 kW. Ion heating is negligible off an eigenmode. Ion body temperatures are more than doubled to 75 eV from the 35 eV ohmically heated case with tails comprising 8% of the plasma at 320 eV. No deleterious effects except a non-disruptive 10% shortening of the discharge length caused by impurity influx are noted. A passive mode tracking technique allows $\approx 40\%$ increase in power deposition in a passing eigenmode over that of a fixed frequency rf source. Ion temperatures are limited by charge exchange due to the < 50 eV central temperature and the small 13 cm radius current channel. (USA)

A P Biddle and J C Sprott, *Plasma Phys*, **23** (8), 1981, 679-691.

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5122. An alpha particle range spectrometer using solid state nuclear track detectors. (GB)

A simple range spectrometer is described for the measurement of the range of alpha-particles in air using cellulose nitrates CA80-15 and LR-115 solid state nuclear detectors. The disc-type alpha particle sources ^{252}Cf , ^{241}Am and ^{239}Pu have been used for these measurements. Theoretical formulae are proposed. The range values obtained thus are slightly less than those obtained using conventional radiation detectors. (Pakistan)

Ata Ullah Bajwa and Parvez Chaudhry, *J Phys E: Sci Instrum*, **14** (8), 1981, 968-970.

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5123. Spectrum and energy levels of four-times-ionized niobium. (USA)

The $4p^6nl$ spectrum of Nb^{4+} was measured and analysed. The spectrum was excited in a vacuum sliding spark source with a peak current of 800 A and a pulse width of 70 μ s. The analysis of the spectrum has extended the 12 known lines to 84 and the 10 known levels to 30. The ionization energy was calculated to be 407897 ± 40 cm $^{-1}$. There is strong evidence that the $4p^34d^2$ configuration interacts strongly with the $4p^6nf$ configuration. In addition, the hyperfine splitting of the $4p^66s$ level has been observed and measured to be 1.1 cm $^{-1}$.

David T Kagan et al, *J Opt Soc Am*, **71** (10), 1981, 1193-1196.

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5124. Diagnostics of high-pressure arc plasmas from laser-induced fluorescence. (GB)

Laser-induced fluorescence has been studied in high-pressure mercury, mercury-metal halide and sodium-mercury arcs, using a rhodamine 6G cw dye laser for the excitation. The fluorescence was observed at 90° with respect to the laser beam. The fluorescence is interpreted assuming thermal equilibrium in the excited region of the arc. Quantitative evaluation of the fluorescence from the mercury arc indicates the validity of this approach. Laser-induced fluorescence can be used to determine local density ratios of arc plasma components and local emission profiles (line shapes and line shifts). As an application the electron density and the Na-Hg density ratio at the arc axis of a sodium-mercury discharge are determined from Stark shifts in the fluorescence of several transitions in the sodium atom and from fluorescence intensities. (Netherlands)

W J van den Hoek and J A Visser, *J Phys D: Appl Phys*, **14** (8), 1981, 1613-1628.

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5125. A hollow-cathode discharge as a cold uniform plasma source. (GB)

It is observed that in addition to the macroscopic hollow-cathode effect between two parallel mesh electrodes, microscopic hollow cathodes are formed in the holes of the wire mesh. With a mesh hollow cathode as a plasma source, a cylindrical plasma with a charge density of the order of 10^8 cm $^{-3}$ is obtained. (Japan)

M Sugawara et al, *J Phys D: Appl Phys*, **14** (8), 1981, L137-L140.

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5126. Hollow cathode startup using a microplasma discharge. (USA)

The use of microplasma discharge to initiate a hollow cathode discharge is described. Operating characteristics of a hollow cathode designed and built around this starting concept are presented. Possible applications for this hollow cathode are discussed.

Graeme Aston, *Rev Sci Instrum*, **52** (8), 1981, 1259-1260.

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5127. O_3^+ ions in a low pressure glow discharge of oxygen. (GB)

O_3^+ ions have been detected and measured in a positive column of glow discharge in oxygen between 0.04 and 0.17 torr. A suitable ion-molecule