

# LECTURE NOTES

INTENSIVE COURSE - CLTPP-4

SOCRATES

Course on Low Temperature Plasma Physics  
and Applications

Eindhoven, The Netherlands  
June 30-July 6, 1999

Master Class on Hot Topics in Plasma  
Physics and Technology  
July 7-9, 1999

Support:



Socrates



Graduieretenkolleg HTPP, Philips Nat. Lab, Philips Licht,  
Arbeitsgemeinschaft Plasmaphysik (APP), NWO, FOM, STW

## Program of the course:

### Wednesday, June 30:

- 08.15 - 08.45 Student registration
- 08.45 - 09.15 Welcome and short introduction  
*W.M. de Jonge*
- 09.15 - 10.45 Introduction, gas discharge, plasmas, applications, plasma types, similarities (E/N, pd), stability  
*N. St.J. Braithwaite*
- 11.15 - 12.45 Fundamentals, Debye character, collisions with neutrals, coulomb collisions, inelastic collisions, ionisation, excitation mean free paths, time constants, magnetic field confinement, Hall parameters, cyclotron resonance.  
*D.C. Schram*
- 14.00 - 15.30 Plasma production, plasma sources: DC glow, RF plasma capacitive, inductive; surfatron, helicon, ECR, microwave plasmas  
*M. Schmidt*
- 16.00 - 17.30 Excitation and radiation in atomic plasma, collisional radiative models,  
*J.A.M. van der Mullen.*

### Thursday, July 1:

- 09.00 - 10.30 Electron kinetics, processes, electron energy distributions (incl. Maxwell...), transport properties  
*J. Loureiro*
- 11.00 - 12.30 RF discharges, electron distribution functions, D.C. potentials, ion energy distribution, charge exchange collisions.  
*W.J. Goedheer*
- 14.00 - 15.30 RF discharges, electron kinetics, particle in cell/ Monte Carlo models  
*S. Longo*
- 16.00 - 17.30 Hydrodynamic models, numerical problems.  
*G.M. Janssen*

### Friday, July 2:

- 09.00 - 10.30 Kinetics in molecular plasmas, dissociation, ro-vibrational excitation, influence on charge density and distribution functions  
*J. Loureiro*
- 11.00 - 12.30 Electron kinetics, processes in H<sub>2</sub>, N<sub>2</sub> (O<sub>2</sub>) plasmas  
*A. Ricard*
- 13.30 - 15.00 Thermal plasmas, fundamentals, characteristic lengths, distribution functions, equilibrium, radiation etc..  
*P. Fauchais*
- 15.30 - 17.00 Thermal plasmas, generation, arcs etc., RF discharges, inductive, capacitive torch design. Application, cutting, welding etc..  
*P. Fauchais*

**Saturday, July 3:**

- 09.00 - 10.30 Introduction to surface processes  
*J. Winter*
- 11.00 - 12.30 Surface processes during film growth.  
*A. van Keudell*

**Saturday afternoon** free for shopping etc..

**Sunday, July 4: Excursion/day off**

**Monday, July 5:**

- 09.00 - 10.30 Radiation and spectroscopy in thermal plasmas  
*V. Helbig*
- 11.00 - 12.30 Plasma diagnostics I  
Mass spectrometry, Residual gas analysis probes and other  
particle diagnostics.  
*Ch. Hollenstein*
- 14.00 - 15.30 Plasma diagnostics II  
Thomson scattering, Rayleigh scattering, CARS  
*J. Uhlenbusch*
- 16.00 - 17.30 Plasma diagnostics III  
TALIF, VUV spectroscopy  
*H.F. Döbele*

**Tuesday, July 6:**

- 09.00 - 10.30 Plasma diagnostics IV  
Emission, absorption, LIF measurements, cavity ringdown  
*N. Sadeghi*
- 11.00 - 12.30 Radical interactions, infrared spectroscopy  
*G.M.W. Kroesen*
- 14.00 - 16.00 Discussion session
- 16.00 - 16.30 Conclusion, summing up, closure.

## **Notes:**

- The examination of students, if relevant, will in general be performed by the home university. The students from The Netherlands are requested to contact either dr. Kroesen or prof. Schram/dr. Van der Mullen/Van de Sanden on this matter.
- The lecture notes are meant to give support to the students attending the course. Hence the distribution is restricted to the students attending the course and reproduction of the notes or parts of the notes is not permitted without permission of the authors.

## Program of the Master Class:

### Wednesday, July 7:

- 09.00 - 10.30 Negative hydrogen ion formation and the importance of  $H_2(r,v)$   
*B. Graham*
- 11.00 - 12.30 Study of volume and surface reactions in molecular gases with pulsed discharges  
*G. Cernogora*
- 14.00 - 15.30 Microwave plasmas in  $N_2/O_2$  plasmas  
*J. Marec*
- 16.00 - 17.30 RF plasmas and RF biasing of remote plasmas.  
*D. Vender*

### Thursday, July 8:

- 09.00 - 10.30 Non equilibrium high pressure plasmas, coronas, for treatment of gases  
*E. van Veldhuizen*
- 11.00 - 12.30 The physics of light emission of sulphur lamps.  
*A. Körber*
- 14.00 - 15.30 Nucleation, cluster formation and detection of dust particles in plasmas  
*E. Stoffels*
- 16.00 - 17.30 Nucleation in plasmas and deposition of nano Crystalline Si  
*P. Roca I Cabarrocas*

### Friday, July 9:

- 08.30 - 10.00 Modelling of plasma deposition of a-Si:H  
*W. Goedheer*
- 10.30 - 12.00 Mechanisms of a-Si:H deposition  
*M.C.M. van de Sanden*
- 12.00 - 12.45 Discussion, conclusions and closure
- 12.45 - 14.00 Lunch.