Fundamental and Technological aspects of Laser Induced

Plasma (available from the 11 semester - February 2017)

Prof. Alessandro De Giacomo (the course includes specific lectures by invited scientists in the field of Laser Induced Plasma)

Max. 5 students

1. Plasma state (from gas to plasma, definitions, plasma parameters, plasma properties)

2. Energy distributions in plasma species (Maxell, Boltzmann and Planck distributions, partitionfunction)

3. Laser-matter interaction (scattering, treatment, ablation mechanisms, LaserSupported Detonation Wave,.fast ionization wave, Laser-Supported Blast Wave).

4. Elementary mechanisms in plasmas (elastic collision, inelastic collision, ionization, recombination, photoionization, direct and inverse

bremsstrahlung)

5. Thermodynamic aspects ofplasmas: a classification (Thermal Equilibrium, Local Thermal Equilibrium, partial Local Thermal Equilibrium, 2Tplasmas)

6. Kinetics in plasmas (non equilibrium effects, Cross sections, rate coefficient, State to state approach)

7. High density effects (ideal plasma and degenerate plasma, Sommerfeld parameter, Debye Huckel theory onplasmas, particle growth)

8. Instrumentation (laser sources, spectrometers, ICCD, Fast Camera, ablation chamber)

9. Diagnostic tools (emission spectroscopy, laser excitation techniques, scattering, shadowgraph, fast imaging)

10. Applications of Laser Induced Plasma (Laser Induced Breakdown Spectroscopy-LIBS, Pulsed Laser Deposition - PLD, Pulsed Laser Ablation In Liquidsfor Nanostructures generation - PLAL, Laser Ignition, Laser Propulsion)

Laboratory experiences

1. Determination of plasma parameters

2. Chemical analysis by LIBS

3. Production of materials by PLAL or PLD