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Power Interruption (PI) experiments have proven to be a powerful tool for the investigation of plasmas in steady state. The principle of these kinds of measurements is to look to the response of radiation to the PI. Normally the temporal behaviour of the intensities of different lines in the spectrum is measured. If the electron temperature is significantly higher than the gas temperature the electrons will cool down after removal of the power. Since the population of excited states is ruled by electron induced collisions, this means that the line intensities change rapidly (in the order of a few ms). This "jump" in intensity can either be downwards or upwards depending on the deviations from equilibrium at steady state.
The fast response is normally followed by a slower response (time scale around 10 to 100 ms), which corresponds to the decrease of free electrons due to recombination and diffusion. In order to ensure re-ignition of the plasma the power is switched off for only 60 ms. Two different atmospheric argon plasmas are investigated: one created by a surfatron [1] and one by the TIA (Torche a Injection Axiale) [2]. In case of the surfatron the jumps and slower decays of the argon, nitrogen and oxygen lines are studied as function of the amount of air which is introduced. After switching on there turns out to be a delay in the rise of the light intensity. By measuring this delay as function of the axial position the propagation velocity of the so-called ionisation front is deduced.

The plasmas created by the TIA expand in the open air. By construction a vessel around the plasma, the composition of the surrounding atmosphere is controlled [3]. This allows us to investigate the response of the plasma to molecules diffusing inward from the surroundings and to molecules which are deliberated introduced.

References

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