Invited lecture

ELECTRON, ION AND ATOM COLLISIONS LEADING TO ANOMALOUS DOPPLER BROADENING IN HYDROGEN AND HYDROGEN RARE GAS MIXTURES

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The first interpretations of unusually high Doppler broadening of hydrogen lines in non-equilibrium plasmas were based on possible dissociative processes, recombination and excitation (Capelli et al. 1985). The experiments, especially the experiments performed in Dc fields revealed a large asymmetric component with energies often exceeding the energy available from the repulsive potentials of the dissociating molecules (Barbeau and Jolly 1990; Konjević and Kuraica 1992). The explanation of such results was sought and found on the basis of high E/N swarm experiments (Petrović et al. 1992; Petrović and Phelps 1991) which show a large degree of excitation by fast neutrals formed in charge transfer collisions with fast ions. At high E/N, which can be only achieved under breakdown conditions to the left of the Paschen minimum, the mean free paths are sufficiently high to allow large energy gain by ions. In addition it is possible to have reflection and neutralization of ions with reflection as fast neutrals, which leads to different components in blue and red wings of the Doppler profile (Petrović et al. 1992).

Some alternative explanations of anomalous Doppler profiles were offered in the literature (Mills et al. 2002), but all reliable measurements performed so far (Jovićević et al. 2004; Tatarova et al. 2007) do not require more than a combination of dissociative excitation (with a perhaps possible recombination as well playing some role) and acceleration in high fields leading to heavy particle (predominantly fast neutral) excitation.

On the other hand, high E/N swarm DC experiment (Townsend regime discharge) may be modeled directly and exactly as it does not require self consistent calculation of the electric field and is thus open to a simple Monte Carlo simulation that may include complexity at the level of representation of collisional events. In this paper we show revised results of modeling of Doppler profiles by using a well tested Monte Carlo procedure and revised models of heavy particle collisions. In particular we study the importance of fast H_2 and fast H particles, the effect of different models of angular distribution of particles scattered of the surface and of the molecules and we study the role of the energy losses due to vibrational excitation.

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Invited lecture

RECENT WORK ON LINE SHAPES FOR THE SPECTRA OF COOL STARS

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Accurate pressure broadened profiles of alkali resonance doublets perturbed by helium are needed for modelling of the atmospheres of late M, L and T type brown dwarfs and for generating their synthetic spectra in the region 600 - 900 nm. Previous fully quantum-mechanical calculations of the line widths and shifts are extended to consider the line-wing profiles where impact theory is no longer valid. Results will be presented at the Conference.

Invited lecture

MODELLING THE SPECTRUM OF THE STELLAR POPULATION IN STAR FORMING AND ACTIVE GALAXIES

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Emission lines in active nuclei or star forming gaalaxies are overimposed to the absorption line spectrum of the underlying stellar population. Modelling this stellar population allows to make a proper subtraction of this component in order to analyse the emission lines, but it also give a handle on the age, metallicity and possibly history of the stellar population.

I will review the possible approach to this question and discuss the recent progress in modelling a stellar population.