Contribution ID: **44** Type: **not specified**

State-to-state self-consistent kinetic modelling of hydrogen plasmas

Tuesday, 30 March 2021 13:15 (30 minutes)

The kinetic scheme, build in the past for the investigation of the vibrational kinetics of the ground electronic state in low-pressure negative ion sources and in the radiative-coupled simulation of entry conditions in the Jupiter atmosphere, has been improved including the H_3^+, H^- ion kinetics, and the detailed dynamics of the electron-impact excitation of singlet states of H_2 molecule $(B, B' \ ^1\Sigma_u^+, C, D \ ^1\Pi_u)$ [1] resolved on both initial and final vibrational manifolds, together with the de-excitation channels, i.e. the radiative decay and the collisional quenching, and also accounting for the VT and VV collisional processes responsible for the redistribution of energy between vibrational and translational degrees of freedom.

The state-to-state kinetic simulation has been carried out with the GPKin code that couples self-consistently a set of master equations describing the time evolution of the chemical species (atomic and molecular) densities and their internal (electronic and vibrational) distributions and the Boltzmann equation for the electron energy distribution function, eedf, taking into account the external electric field.

The state-to-state self-consistent approach, implementing the detailed kinetic scheme, has been exploited for the simulation of non-equilibrium conditions in nanosecond repetitively pulsed discharges in pure hydrogen [2], in H_2/N_2 plasma [3], of interest for the investigation on nitrogen seeding experiments in tokamak divertor and in H_2/He plasma [4], of interest for the interpretation of shock tube experiments for atmospheric entry of gaseous giant planets. The chemical model for H_2/Li plasma is under construction, including the electron impact induced processes in LiH [5], for the interest in liquid metal divertors.

[1] Celiberto, R., et al (2001) Atomic Data and Nuclear Data Tables, 77(2), 161-213.

[2] Colonna, G., et al. (2017) European Physical Journal D, 71(11), 1-8

[3] Colonna, G., Laricchiuta, A., Pietanza, L. D. (2019) Plasma Phys Controlled Fusion, 62(1), 014003.

[4] Colonna, G., Pietanza, L. D., Laricchiuta, A. (2020) Int J Heat and Mass Transfer, 156, 119916.

[5] Celiberto, R., Janev, R. K., Laricchiuta, A. (2020). Plasma Sources Science and Technology, 29(3), 035008

Primary authors: Dr LARICCHIUTA, Annarita (CNR ISTP Bari); Prof. CELIBERTO, Roberto (DICATECh - Polytechnic of Bari, Bari, Italy); Dr PIETANZA, Lucia Daniela (CNR ISTP Bari); Prof. CAPITELLI, Mario (CNR ISTP Bari); Dr COLONNA, Gianpiero (CNR ISTP Bari)

Presenter: Dr LARICCHIUTA, Annarita (CNR ISTP Bari)

Session Classification: CR