

Non-equilibrium mechanisms in (sub)atmospheric plasmas and in its expansion

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Non-Equilibrium Mechanisms in (Sub)Atmospheric Plasmas and in its Expansion, D.C. SCHRAM, J.A.M. VAN DER MULLEN, M.C.M. VAN DER SANDEN, EUT -

Stationary or flowing (sub)atmospheric plasmas can be characterised by two non-equilibrium parameters: the groundstate deviation from Saha δb_1 and the heavy particle to electron temperature ratio T_h/T_e . The state is then defined by p , n_e , δb_1 and T_h/T_e , with T_e as a dependent parameter. This description allows for a simplification of the plasma transport equations in e.g. a 2 D-code and easier comparison with measurable quantities (as n_e) as illustrated from recent work on ion current from a flowing cascade arc plasma source. The expansion of such a plasma in a low $-p$ vessel leads to a flowing high density recombining plasma with underpopulated excited states as manifest from a.o. absorption spectroscopy. Additional reactions as asymmetric charge exchange and dissociative recombination of molecular ions with injected molecules as H_2 , N_2 , C_nH_m and SiH_4 (for surface modification and plasma deposition) are summarised. The importance of recirculation flows and ro-vibrational excitation is indicated.