THE COLLISIONAL ATOMIC PROCESSES IN GEO-COSMICAL PLASMAS: DATA NEEDED FOR SPECTROSCOPY

V. A. Srećković[1], Lj. M. Ignjatović[1], M. S. Dimitrijević[2]

[1] *Institute of Physics Belgrade, Pregrevica 118, 11080, Belgrade, Serbia* vlada@ipb.ac.rs

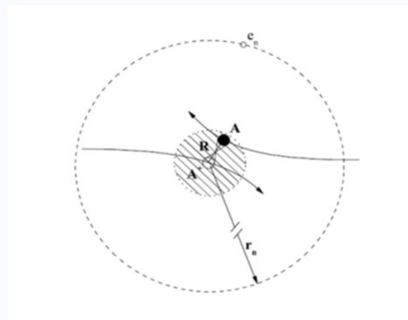
[2] *Astronomical Observatory, Volgina 7, Belgrade, Serbia;* mdimitrijevic@aob.rs

The processes: here, we investigate the chemi-ionization (CI) processes in atom-Rydberg atom collisions. The rate coefficients for CI processes in K*(n) + K and H*(n) + K collisions are presented for a wide region of temperatures and principal quantum numbers. The data for the rate coefficients are very useful for the improvement of modelling and analysis of different layers of weakly ionized plasmas in atmospheres of various stars where these and other CI processes could be important and could change the optical characteristics (Mihajlov et al 2011; Sreckovic et al. 2014). Also, the results are of interest in spectroscopy of low temperature laboratory plasma.

$$A^*(n) + X \Rightarrow \mathrm{e} + \begin{cases} AX^+, \\ A + X^+, \end{cases}$$

and symmetric processes

$$A^*(n) + A \Rightarrow \mathrm{e} + \begin{cases} A_2^+, \\ A + A^+, \end{cases}$$



Data: to get needed theoretical information of the molecular spectra and pressure broadened atomic line profiles, the accurate molecular potential curves and transition dipole moments are needs, as well as a accurate theoretical simulation method.

Modeling: the rate coefficient for the presented plasma parameters could be of important for the models of solar photosphere. Moreover, the calculated rate coefficient for the presented plasma parameters could be of interest in modeling geo-cosmical plasmas and also for the models of Io's atmosphere. Also for analysis of the data of the future space mission for the investigations of chemical composition and thermal structures of exoplanets ARIEL. In accordance with the CI theory the partial rate coefficients K(a)(n, T) and the total ones K(ab)(n, T) can be presented with relations

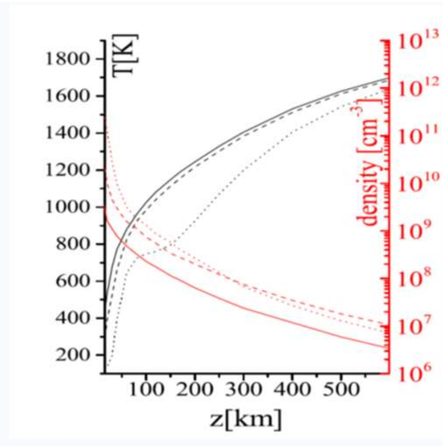


Figure2: Temperature and density altitude profiles for low-density (solid line), moderate-density (dashed) and high-density (dotted line) models of Io's atmosphere

In accordance with the CI theory the partial rate coefficients K(a)(n, T) and the total ones K(ab)(n, T) can be presented with relations. Work in progress…

$$K^{(a)}(n,T) = \int_0^{E_m^{(a)}(n)} v\sigma^{(a)}(n,E)f(v;T)dv, \quad K^{(ab)}(n,T) = \int_0^{\infty} v\sigma^{(ab)}(n,E)f(v;T)dv,$$

References:

Mihajlov, A. A., Ignjatovic, L. M., Sreckovic, V. A., Dimitrijevic, M. S.: 2011, ApJS, 2, 193.

Sreckovic, V. A., Mihajlov, A. A., Ignjatovic, L. M., Dimitrijevic, M. S.: 2014, Adv Space Res., 54, 1264. 93