

## INFLUENCE OF INELASTIC RYDBERG ATOM-ATOM COLLISIONAL PROCESS ON KINETIC AND OPTICAL PROPERTIES OF LOW-TEMPERATURE LABORATORY AND ASTROPHYSICAL PLASMAS

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**Abstract.** Elementary processes in plasma phenomena traditionally attract physicist's attention.

The channel of charged-particle formation in Rydberg Atom-Atom thermal and sub-thermal collisions (the low temperature plasmas conditions) leads to creation of the molecular ions – associative ionization (AI), atomic ions – penning-like ionization (PI) and the pair of the negative and positive ions.

In our universe the chemical composition of the primordial gas consists mainly of Hydrogen and Helium ( $H$ ,  $H^-$ ,  $H^+$ ,  $H_2$ ,  $He$ ,  $He^+$ ), Hydrogen-like alkali-metal Lithium ( $Li$ ,  $Li^+$ ,  $Li^-$ ) and combinations ( $HeH^+$ ,  $LiH^-$ ,  $LiH^+$ ). There is a wide range of plasma parameters in which the Rydberg Atoms of the elements called above make the dominant contribution to ionization and that process may be regarded as a prototype of the elementary process of light excitation energy transformation into electric one.

The first series of quantitative measurements of the rate constants for Rydberg Atoms starts in 1978 (Devdariani, Klyucharev et al.). The method of AI and PI calculations, so-called “dipole resonant” mechanism proposed in 1971 (Smirnov, Mihaylov) was used in semiclassical (Mihailov and Janev 1981) and quantum mechanical theories (Duman, Shmatov, 1980). The latest stochastic version of chemi-ionisation (AI+PI) on Rydberg Atom – Atom collisions extends the treatment of the “dipole resonant” model by taking into account redistribution of population over a range of Rydberg states prior to ionization. This redistribution is modeled as diffusion in the frame of stochastic dynamic of the Rydberg electron in the Rydberg energy spectrum (Bezuglov, Borodin, Klyucharev et al. 1997).

Such approach makes it possible to operate on efficiently of inelastic collisional processes and sometimes to operate on time of Rydberg Atoms life. This may lead to anomalies of Rydberg Atoms spectra.

Another result obtained in recent time is understanding that experimental results on chemi-ionization relate to the group of mixed Rydberg Atom closed to the primary selected one. The Rydberg Atoms ionisation theory today makes a valuable contribution in the deterministic and stochastic approaches correlation in atomic physics.