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ELECTRON-MOLECULE COLLISIONS IN FUSION PLASMAS: a long-standing collaboration with Professor Ratko Janev

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Abstract. It is well known that the temperature reached in thermonuclear fusion reactors (tokamak) is extremely high, and that the hydrogen gas, completely ionized, can be confined by a properly shaped magnetic fields. If this is true in the core of the tokamak, however in the peripheral regions the temperature can get strongly reduced, so that atomic and molecular species can condensate. This is the case of the divertor chamber, where the plasma cools down by delivering the excess of thermal energy, along with fusion ash and impurities. Also close to the container walls, where the hydrogen particles, getting outside the closed field lines, give rise to chemical reactions yielding to molecular compounds. In these regions, electron-molecule collisions play a role of utmost importance, by inducing a plethora of interconnected molecular processes (ionization, dissociation, excitations…), which strongly affect the plasma evolution. Modeling and simulations of these *low-temperature* plasmas, as well as experimental determinations, require large sets of electron-molecule scattering data. Cross sections, rate constants, Einstein's coefficients etc. are the basic input quantities in plasma modeling and they can be obtained by resorting to theoretical calculations. In this seminar, we will present the production of plasma information achieved in decades of collaboration of our group with Professor Janev, starting from the first work aimed to collect vibrationally-resolved cross section data for excitations induced by electron impact in H_2 and H_2^+ molecules and their isotopes (Celiberto et al, 2001), going through the study of resonant processes (Celiberto et al, 2008), till the recent IAEA project on "*Atomic Data for Vapour Shielding in Fusion Devices*" (Heinola, 2019).

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