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Angular momentum changing transitions in proton-Rydberg hydrogen atom collisions D. VRINCEANU, Texas Southern University, R. ONOFRIO, Universita di Padova, Italy, H.R. SADEGHPOUR, Institute for Theoretical Atomic, Molecular and Optical Physics — Collisions between electrically charged particles and neutral atoms are central for understanding the dynamics of neutral gases and plasmas in a variety of physical situation. Specifically, redistribution of angular momentum states within the degenerate shell of highly excited Rydberg atoms occurs efficiently in distant collisions with ions. This process is crucial in establishing the validity of the local thermal equilibrium assumption and may also play a role in determining a precise ionization fraction in primordial recombination. We provide an accurate, non-perturbative rate coefficient for collisions between protons and H($n\ell$) ending in a final state H($n\ell'$), represented by the formula

$$q_{n\ell\to n\ell'}(T) = \frac{3.922\times 10^{-4}}{\sqrt{T[K]}}\ \frac{n^2\left[n^2(\ell+\ell') - \ell_<^2(\ell+\ell'+2|\Delta\ell|)\right]}{(\ell+1/2)|\Delta\ell|^3}\ \mathrm{cm}^3/\mathrm{s},$$

where $\ell_<$ is the smallest between ℓ and ℓ', and $\Delta\ell = \ell - \ell'$. The validity of this formula is confirmed by results of classical trajectory Monte Carlo simulations.

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