State selective charge-transfer collisions of slow C\textsuperscript{6+} -H\textsubscript{2}: A molecular-
state Close-coupling study

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Synopsis The molecular orbital close-coupling approach, based on the expansion of the molecular-states and
augmented with the plane-wave translation factor, is applied to evaluate state-selective charge transfer cross sections
of C\textsuperscript{6+} -H\textsubscript{2} at low energies.

Charge transfer becomes an important mechanism in establishing the ionization structure of a plasma containing multiply
charged ionic systems present in many astronomical objects [1]. These processes may be highly state selective leading to product ions
in excited states and the resulting emissions become a very useful diagnostic probe of plasma environment. Collisions of multiply charged
ions with molecules are very common in astrophysical plasmas. As compared to the ion-atom collision, the ion-molecule calculations are
rather more complicated. Among the molecules, H\textsubscript{2} is the simplest of all; the charge exchange with H\textsubscript{2} provides a recombination mechanism
for multiply charged ions in X-ray ionized astronomical environments. Detailed information on the collision cross sections is
essential to understand such behavior. The charge transfer of C\textsuperscript{6+} with molecular hydrogen at low energies is studied using a semi classical,
impact-parameter, close-coupling approach based on the molecular-state expansion
augmented with the plane-wave translation factor. Freezing the molecular feature of the
target, the colliding system is approximated by a pseudo-one-electron system. During the course
of the collision a transient quasimolecule comprising the entrance and various exit
channels of the charge-transfer reaction is considered. Pseudo potential technique is
applied to account for the binding of the electron in the transient diatomic quasimolecule. Both the
partial and total cross sections show very good agreement with other theoretical and
experimental results. The emission characteristics of the spectrum resulting from
charge transfer are also presented.

[1] Bidhan C. Saha, “Collisions of fully and partially stripped ions with H\textsubscript{2} at low energies”,
in Atomic Structure and Collision processes

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