Hidden Crossing Approach to the Description of Inelastic Processes in μCF

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There are several problems in physics of muon catalyzed fusion which need the cross section of different collision processes of mesic hydrogen isotope atoms in the excited states $n \leq 6$, particulary, charge exchange

$$(a\mu)_n + b \rightarrow (b\mu)_{n'} + a \tag{1}$$

and Coulomb de-excitation

$$(a\mu)_n + b \rightarrow (a\mu)_{n'} + b, \tag{2}$$

where $(a, b) = (p, d, t)$.

In adiabatic approach the inelastic transitions (1) and (2) are located in the vicinity of the quasi-crossings of the adiabatic potential curves. The quasi-crossings reflects exact crossings (branch points) at the complex value R_c of the internuclear distance R. The quasi-crossings are evident and visible on the graphs of the adiabatic potential curves if $\mathrm{Im}(R_c)$ is small enough. Usually these narrow quasi-crossings correspond to the resonant sub-barrier interaction of two adiabatic states in the asymptotic region $R >> 1$. However it is quite a rare case. Much more important type of quasi-crossings is the, so-called, hidden crossings discovered in 1981 [1]. They appear when the adiabatic energy level touch the top of effective potential. The corresponding branch points R_c are far away from real axes R and they can not be identified from the conventional plot of adiabatic energy curves at real internuclear separations.

To incorporate the isotopic effects which are very important in processes (1)-(2), the conventional adiabatic approach must be modified accordingly [2].

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[1] E.A. Solov'ev, Sov. Phys. JETP **54**, 893 (1981).
[2] E.A. Solov'ev, Sov. J. Nucl. Phys. **43**, 492 (1986).