Light-induced nonadiabatic phenomena in diatomics with strongly coupled electronic states

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Nonadiabatic effects play a very important role in chemical processes and their dynamical control. These effects arise due to avoided crossings or conical intersections which are present either naturally in field-free space or are induced by a classical electric laser field in a molecular system. Recently, it was demonstrated that nonadiabatic effects can also be created in an optical cavity by forming avoided curve crossings in diatomics[1]. Due to the coupling of the quantized radiation field of the cavity to the electronic degrees of freedom of the molecule, a strong mixing between the nuclear and electronic degrees of freedom appears. We show here the equivalence of using the cavity's quantized radiation field and the classical

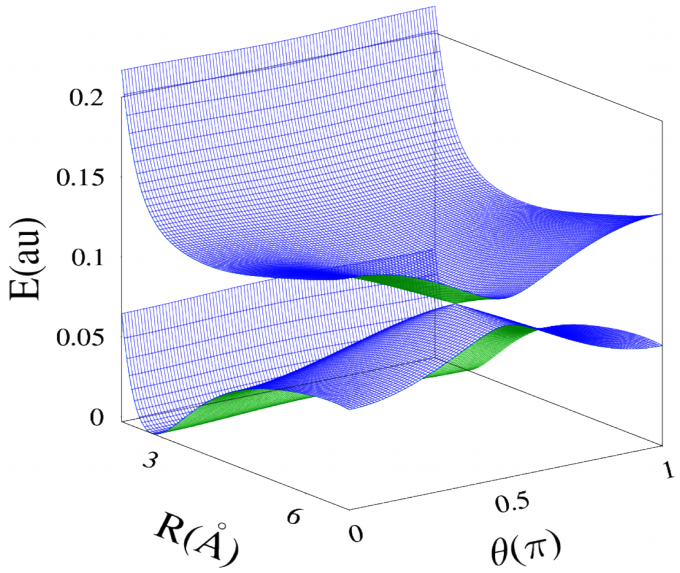

Figure 1. Light-induced potential energy surfaces as a function of the interatomic distance R and the angle θ between the molecular axis and the laser polarization direction. The applied energies and intensity of the laser pulse are $\hbar\omega_L$=0.815eV and I=10^{13} W/cm^2, respectively.

laser field as usually done for molecules. This is demonstrated for the specific molecule NaI which exhibits a pronounced natural (intrinsic) avoided crossing which competes with the avoided crossing induced by the field. Furthermore, as it is known by now that rotating molecules exhibit light-induced conical intersections in classical laser light[2,3], we also investigate the impact of these intersections. For NaI we undoubtedly demonstrate a significant difference between the impact of the laser-induced avoided crossing and that of the laser-induced conical intersection on the dynamics of the molecule[4].

References:

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