THE LYAPUNOV ANALYSIS OF THE HIGHLY EXCITED BEND MOTION OF ACETYLENE

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The Lyapunov exponents are calculated for the trajectories in the quantum phase space of the eigenstates of the highly excited C-H bend motion of acetylene via an algebraic Hamiltonian constructed on the two coupled SU(2)/U(1) coset spaces.[a] The calculation shows that for a given action on the C-H bend motion, those top lying levels are always of regular motion, while those low lying levels can be mixture of regular and irregular motions. Levels in between are more irregular. Irregularity increases from the lower levels up to the higher levels then decreases as the top levels are approached. As the action on the C-H bend increases, irregularity increases, in general. Quite often, the Lyapunov exponents for a level span a wide spectrum. This means that the motion can not be ergodic. Stable and unstable periodic trajectories and the transition between the regions in the quantum phase space with various degrees of irregularity are also identified, showing that the dynamical structure is quite complex.

[a] G. Wu, Chem. Phys. 252, 315(2000)