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THE STABILITY INVESTIGATION OF DIATOMIC MOLECULES BY INSPIRING FROM LASER STABILITY THEORY

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The stability theory has usually been exploited for evaluating the pumping ranges for which the below- and above-threshold states of lasers are differentiated. The laser stability theory is here implemented to determine the stability ranges of an oscillating diatomic molecule. As a result, the stable oscillation of a diatomic molecule is investigated in the all quantised energy levels of Morse potential until it tends to infinity at the last stable energy level. It then turned out that the last stable energy level is the same dissociation level of a diatomic molecule predicted by the different theoretical and experimental literatures. The next priority is to derive vibrational motion equations of both homo- and hetero-nuclei diatomic molecules. The temporal variations of relative position and linear momentum of two oscillating atoms are calculated by solving Heisenberg's equations of motion. The results indicate that the oscillatory behaviour of diatomic molecules is described by the wave packets which consisted of two different frequencies. It peculiarly turned out that the diatomic molecules are exactly dissociated at the energy level in which their equations of motion become unstable and the both oscillating frequencies become negative, simultaneously. We also determine the minimum oscillation frequency (cut-off frequency) of a diatomic molecule at the dissociation level of Morse potential. In summary, it is demonstrated that the stability features of an optical oscillator (such as a laser) are common with those of a quantum mechanical oscillator (such as a diatomic oscillator).

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