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Information entropic measures of a quantum harmonic oscillator in symmetric and asymmetric confinement within an impenetrable box

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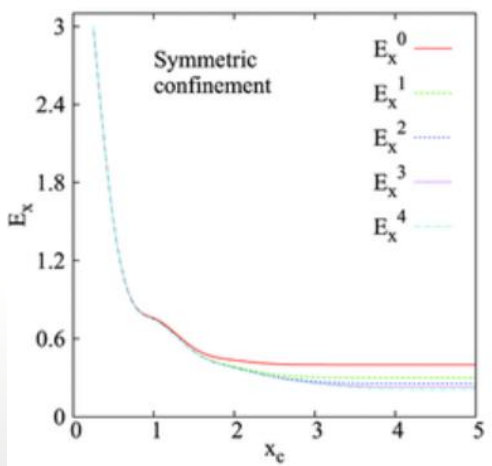

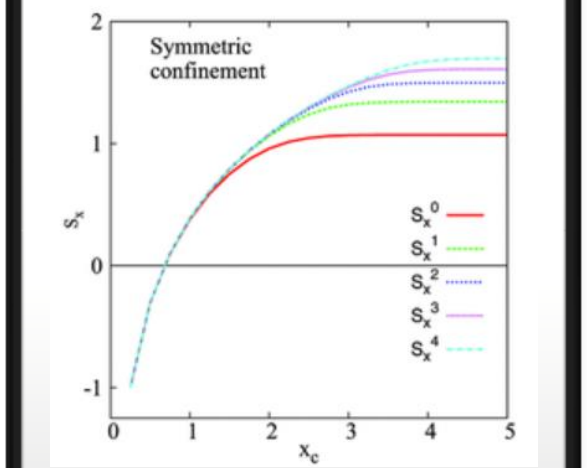

Information-based uncertainty measures like Shannon entropy, Onicescu energy and Fisher information (in position and momentum space) are employed to understand the effect of *symmetric and asymmetric* confinement in a quantum harmonic oscillator. Also, the transformation of the Hamiltonian into a dimensionless form gives an idea of the composite effect of force constant and confinement length (x_c). In the symmetric case, a wide range of x_c has been taken up, whereas asymmetric confinement is dealt with by shifting the minimum of the potential from the origin keeping box length and boundary fixed. Eigenvalues and eigenvectors for these systems are obtained quite accurately via an imaginary-time propagation scheme. For asymmetric confinement, a variation-induced exact diagonalization procedure is also introduced, which produces very high quality results. One finds that, in symmetric confinement, after a certain characteristic x_c, all these properties converge to respective values of a free harmonic oscillator. In the asymmetric situation, excited-state energies always pass through a maximum. For this potential, the classical turning point decreases, whereas well depth increases with the strength of asymmetry. A study of these uncertainty measures reveals that localization increases with an increase of the asymmetry parameter.