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Distribution of oscillator strength in Gaussian quantum dots

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The energy spectra and oscillator strengths of two, three and four electrons confined by a quasi-two-dimensional attractive Gaussian-type potential have been calculated for different strength of confinement ω and potential depth D by using the quantum chemical configuration interaction (CI) method employing a Cartesian anisotropic Gaussian basis set. A substantial red shift has been observed for the transitions corresponding to the excitation into the center-of-mass mode (CM). The oscillator strengths, concentrated exclusively in the center-of-mass excitation in the harmonic limit, are distributed among the near-lying transitions as a result of the breakdown of the generalized Kohn theorem. The distribution of the oscillator strengths is limited to the transitions located in the lower-energy region when ω is large but it extends towards the higher-energy region when ω becomes small. The analysis of the CI wavefunctions shows that all states in the energy range covered by the present study can be classified according the $polyad\ quantum\ number\ v_p$. It is shown that the distribution of the oscillator strengths for large ω occurs among transitions involving excited states with the same value of v_p as the center-of-mass excited state, $v_{p,cm}$, while it occurs among transitions involving the excited states with $v_p = v_{p,cm}$ and $v_p = v_{p,cm} + 2$ for small ω.