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Allowed Quantum States for Two Coupled Quantum Dots via Vacuum VIJAY KASISOMAYAJULA, ONOFRIO RUSSO, New Jersey Institute of Technology — We consider a system containing two similar isolated nano-structures such as quantum dots in a vacuum. The Planck radiation law which contains the $1/2$ $\hbar\omega$ term, which is the energy density per photon per mode for the zero point energy, creates concern when it is realized that the total energy in the vacuum summing all field modes leads to an infinite energy. Even when a high frequency cutoff is introduced, the calculated energy in the vacuum is dramatically larger than that observed. When the Hamiltonian H is defined for the structure-vacuum system, it is separated into the unperturbed Hamiltonian H_u and the perturbation term of the form

$$\int g_a(\omega)\hbar\omega \left(a(\omega)^\dagger a(\omega)\right) d\omega + \mathrm{i}\left(s^\dagger + s\right) \int g_b(\omega)k(\omega) \left(a(\omega) - a(\omega)^\dagger\right) d\omega$$

respective bosonic creation and annihilation operators satisfying $[a(\omega),\ a(\omega\prime)^\dagger] = \delta(\omega - \omega\prime)$, s and $s^\dagger$ the system operators that couple the structures to the vacuum, $k(\omega)$ the frequency dependent coupling constant, and the $g_a(\omega)$ and $g_b(\omega)$, functions necessary to insure a finite energy density. The state of the system can then be realized when the condition meets the requirement that the medium which is the vacuum be considered to be at the flat white noise limit.

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