Entanglement in the Tavis-Cummings model with Izing interaction

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Hamiltonian

$$H = (1/2)\hbar\Xi(r_{K_1}^z + r_{K_2}^z) + \hbar g \sum_{m=K_1}^{K_2} (r_m^+\eta + \eta^+ r_m^-) + \hbar Z r_{K_1}^z r_{K_2}^z$$

Separable initial atomic states

$$|\psi_{A_1A_2}\rangle = |+,-\rangle$$

Entangled initial atomic states

$$|\psi_{A_1A_2}\rangle = \cos\vartheta\,|+,-\rangle + \sin\vartheta\,|-,+\rangle$$

Initial thermal cavity field state

$$P_{EF}(0) = \sum_k h_k\,|k\rangle\langle k|,$$

$$h_k = \langle k\rangle^k (1+\langle k\rangle)^k,$$

Transposed reduced two-atom matrix

$$P_{K_1K_2}^{T_1}(t) = \begin{pmatrix} w_{11}(t) & 0 & 0 & w_{14}(t) \\ 0 & w_{22}(t) & 0 & 0 \\ 0 & 0 & w_{33}(t) & 0 \\ w_{14}(t)^* & 0 & 0 & w_{44}(t) \end{pmatrix}$$

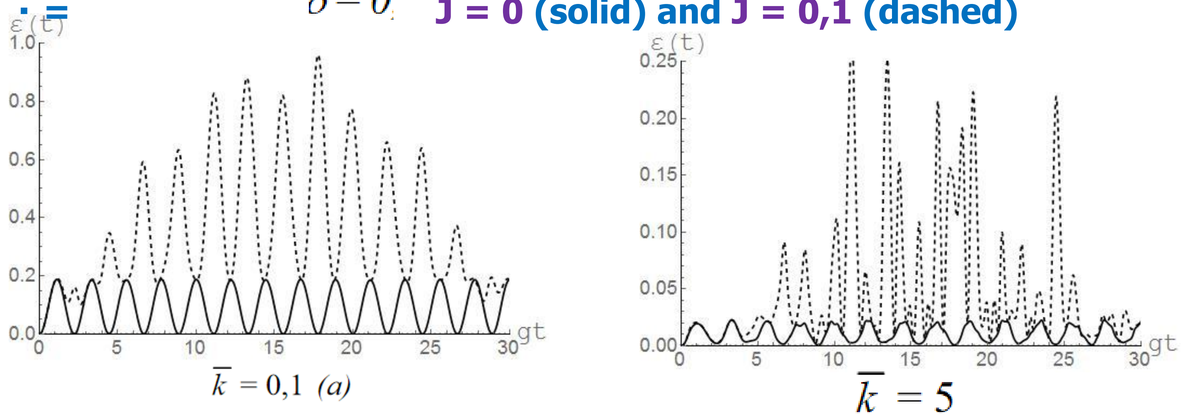
Negativity

$$\varepsilon = -2\sum \mu_i^-$$

$$\varepsilon(t) = \sqrt{(w_{11}(t) - w_{44}(t))^2 + 4\,|\,w_{14}(t)\,|^2} - w_{11}(t) - w_{44}(t)$$

Negativity calculations: Separavle initial atomic state

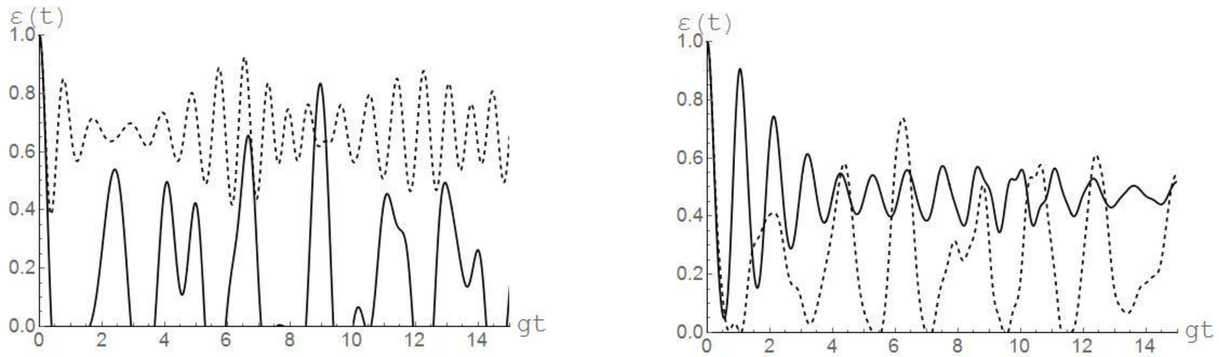
· = $\delta = 0$ J = 0 (solid) and J = 0,1 (dashed)



Mean value of cavity mode

Negativity calculations: Entangled initial atomic state $\theta = \pi/4$.

· = $J = 0$ (solid) and $J = 3$ (dashed)



Mean value of cavity mode $\overline{k} = 1$

САМАРСКИЙ УНИВЕРСИТЕТ