Matter-Field entanglement within the Dicke Model

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Symmetry adapted SU(2) coherent states are used as variational states to describe the ground and first excited states of the Dicke Model. A comparison with the numerical exact solution is done for the energy, and for the fluctuations of: population of the two levels, the total number of excitations, and the number of photons. We also calculate the compression coefficients and the fidelity. Finally, it is shown that the entanglement between the atoms with the one mode radiation field takes singular values at the phase transition of the model. The linear entropy and the von Neumann entropy are calculated as measures of the entanglement.