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Some theoretical aspects of damping effect for an atomic system in a nanoscale cavity

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In this work the nature of the decay of atomic and field states is investigated in the retrospect of the Weisskopf-Wigner approximation. The approximation is analyzed and described in the terms of the limit behavior of the state amplitudes for quite long time intervals. Applied to the many-body system of identical two-level atoms, coupled with a quantized electromagnetic field in a cavity, the theory allows to answer the question about the causes of a state decay process. It was shown that with decreasing the system volume, the maximum value of probability to find an atom in its excited state increases. The atomic excited state probabilities were calculated for several system space configurations in micro- and nano-scale cavities.