

# Non-Markovian Master Equation for a Rydberg-EIT Medium

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The combination of Rydberg gases and the quantum coherent process of electromagnetically induced transparency (EIT) has recently attracted considerable theoretical and experimental interest, as it holds promise for realizing extremely large nonlinearities by exploiting the exaggerated interactions between Rydberg atoms. Main interest of this work is obtaining new and efficient method to study coherences in Rydberg-EIT medium. We observe that fluctuations of the inter-particle interaction, caused by random jumps of the surrounding atoms to the Rydberg state, affect the calculated coherences. Long-time behavior of autocorrelation function shows that these fluctuations need a non-Markovian treatment. We present a non-Markovian master equation approach to study source and effects of this fluctuations. A specific case which considers the fluctuations as an additional dephasing mechanism for the system is also presented.