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# Influence of decoherence on electromagnetically induced transparency in superconducting quantum circuit

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We study the absorption and dispersion properties of the three levels  $\Lambda$ -type superconducting quantum circuit driven by a pump field and a relatively weak probe field being applied to the different transitions. We find that the decoherence time between levels is critical to the observation of electromagnetically induced transparency (EIT) in superconducting quantum circuit. When the total decoherence time is fixed, it is necessary to ensure better coherence between levels  $|3\rangle \leftrightarrow |2\rangle$  than  $|3\rangle \leftrightarrow |1\rangle$  so as to exhibit obvious EIT. Furthermore, under given probe field, the bigger the Rabi frequency of probe field is, the wider the window of EIT, the easier to observe the transparency window. At this moment, however, slow light is inconspicuous and not conducive to optical information memory.

**Keywords:** Electromagnetically induced transparency, Superconducting quantum circuits,

Decoherence, absorption and dispersion

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