Landau-Zener theory: slow and fast noise in nanoscale systems

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This work research investigates the effect of transition probability of noise in Landau-Zener theory using the perturbation expansion method compare to Kayanuma's investigation. We use perturbation expansion method to study the off-diagonal noise in x-directions that we called X-noise model and another general case is the existence of off-diagonal noise in both x and y direction with so-called XY-noise model. We use this perturbation expansion to find a general formula of transition probability for the case of slow noise (slow fluctuation) and fast noise (fast fluctuation). We have shown that the results based on the perturbation expansion method for the slow noise (transition probability versus LZ parameter) for the case of XY-model are in full agreement with Kayanuma's perturbative treatment for X-noise model. We demonstrated that the perturbation expansion method can be easily generalized that for the investigation of XYnoise model, but also for the case of fast fluctuation.

Keywords: Landau-Zener transition probability, noises and perturbation.