

سمینار هفتگی گروه اطلاعات کوانتومی
سه‌شنبه ۱۳۹۴/۹/۱۰، ساعت ۱۵:۰۰، اتاق شورای دانشکده‌ی فیزیک

Scaling of macroscopicity close to a quantum phase transition

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Abstract

Consideration of superpositions of two macroscopically distinguishable quantum states are frequently referred to the Schrodinger's cat states, the state which presents a cat that may be simultaneously both alive and dead. In a macroscopic quantum phenomenon the quantum state do exhibit long-range quantum correlations. The general validity of quantum mechanics on macroscopic scales can be appeared in the system with the occurrence of a quantum phase transition. When the system is not at the critical point the correlations are exponentially damped for large enough separation. At the critical point there are appreciable correlations between a single site and every other site, indeed, the critical point corresponds to the situation where the spin chain is critically correlated, and we observe the quantum mechanics on a macroscopic scale. Whether one can reveal the quantum phase transition using the measure of macroscopicity is certainly significant for a deeper understanding of quantum phase transitions. We demonstrate that macroscopicity shows scaling behavior in the vicinity of the transition point.