ABSTRACT

INVESTIGATION OF QUANTUM ENTANGLEMENT IN FOUR QUBIT J1-J2 ISING SPIN SYSTEM IN THE PRESEMCE OF A HOMOGENEOUS MAGNETIC FİELD AND DZIALOSHINSKII-MORIA (DM) INTERACTION

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Quantum computation and quantum information theory is a field in which information processing can be realized by using the quantum mechanical systems. The most striking part of this field is the study of entanglement. Entanglement is a fully quantum mechanical resource that plays a fundamental role in many of the most interesting applications of quantum computation and quantum information. The study of entanglement of quantum spin chains in solid state systems is provides a bridge between quantum information processing and condensed matter physics and constitute a rich area of study. Therefore, in this thesis, investigation of entanglement in four qubit Ising system including nearest neighbouring interaction, next-nearest neighbouring interaction, DM interaction, and magnetic field is studied. First, ground state calculations are carried out. Frorm these results, it is understood that magnetic field has influence on both of the nearest neighbouring and the next-nearest neighbouring qubits while DM interaction and frustration become effective on the nearest neighbouring and the next-neighbouring qubits, respectively. Second, thermal entanglement is investigated. As the result of investigations, it is seen that DM interaction and magnetic field exhibit positive effects generally on thermal entanglement of the system. Consequently, we show that effective control of entanglement can be yield by employing the competiting effects of the magnetic field, DM interaction, and frustration in this general Ising model.

Key Words: DM interaction, entanglement, J1-J2 Ising model, qubit.