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Investigating Quantum Metrology in Noisy Channels

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Quantum entanglement lies at the heart of quantum information and quantum metrology. In quantum metrology, with a colossal amount of quantum Fisher information (QFI), entangled systems can be ameliorated to be a better resource scheme. However, noisy channels eject the QFI substantially. This research work seeks to investigate how QFI of N-qubit GHZ state is ejected when subjected to de-coherence channels: bit-phase ip and generalize amplitude damping (GAD), which can be induced experimentally. We determine the evolution under these channels, deduce the eigen values, and then derive the QFI. We found that when there is no interaction with the environment, the Heisenberg limit can be achieved via rotations along z direction. It has been shown that the maximal mean QFI of the N-qubit GHZ state (Fmax) dwindles as de-coherence (d) increases due to low of information from the system to the environment, until d = 0:5, then revives to form a symmetric around d = 0:5. This revival is as a consequence of memory eject of the environment which leads to back-ow of the information from the environment to the system. Thus, d > 0:5 leads to a situation where more noise yields more efficiency. It has been shown that at nite temperature, QFIs decay more rapidly than at nite temperature. Our results also reveal that QFI can be enhanced by adjusting the temperature of the environment.