Observation of Berry’s Phase in a Superconducting Qubit

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In quantum information science, the phase of a wavefunction plays an important role in encoding information. While most experiments in this field rely on dynamic effects to manipulate this information, an alternative approach is to use geometric phase, which has been argued to have potential fault tolerance [1]. Here we demonstrate the controlled accumulation of a geometric phase, Berry’s phase, in a superconducting qubit, manipulating the qubit geometrically using microwave radiation, and observing the accumulated phase in an interference experiment [2]. This is achieved utilising the excellent phase coherence and qubit control possible in Circuit QED [3]. We find excellent agreement with Berry’s predictions, and also observe a geometry dependent contribution to dephasing.