



Figure 1.2: Quantum two-level systems can manifest themselves in a wide variety of physical systems. The canonical spin- $1/2$  particle in a magnetic field serves as the theoretical ideal but is not reflective of typical qubits. Most systems of interest actually have more than two quantum states but can be mapped to the spin- $1/2$  particle system if they are constrained to a two-level manifold. Examples of such systems are single atoms (using electronic or nuclear energy levels) and quantized electrical circuits (both semiconducting and superconducting in nature).