Protective Measurement

It might be surprising to learn that it is believed possible to measure a system and determine a quantum wave function precisely so long as the wave function is an eigenstate of the system Hamiltonian. Aharonov et al. [672, pp. 214-216] showed that this can be accomplished using weak adiabatic measurement assuming the measurement-system unitary coupling formalism considered by von Neumann [13, pp. 441-445].This means for example that an entire atomic wave function that represents a given energy orbital can be determined without disturbing the state of the atom. Moreover, the measurement is claimed to protect the system from changing state compared to the non-adiabatic case of strong interaction, so long as the initial state of the system is an eigenstate of the system Hamiltonian.

When the system is initially in a superposition of eigenstates, an entangled superposition of measurement devices is predicted under unitary evolution [672, p. 218] which is claimed will collapse to one of the two readouts that is associated with an eigenstate of the system Hamiltonian.

Protective measurement is a rather remarkable finding. Protective measurement has been recently implemented in [675].