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Understanding Entanglement as a Resource for Quantum Information Processing[1] SCOTT M. COHEN, Department of Physics, Duquesne University — Ever since Erwin Schrodinger shocked the physics world by killing (and not killing) his cat, entanglement has played a critical role in attempts to understand quantum mechanics. More recently, entanglement has been shown to be a valuable resource, of central importance for quantum computation and the processing of quantum information. In this talk, I will describe a new diagrammatic approach to understanding why entanglement is so valuable, the key idea being that entanglement between two systems "creates" multiple images of the state of a third. By way of example, I will show how to "visualize" teleportation of unknown quantum states, and how to use entanglement to determine the (unknown) state of a spatially distributed, multipartite quantum system. Illustrative examples of this entanglement-assisted local state discrimination are sets of orthogonal product states exhibiting what is known as "non-locality without entanglement", including unextendible product bases. These ideas have also proven useful in using entanglement to implement a unitary interaction between spatially separated (and therefore non-interacting!) systems.

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