Barbara Terhal

Scientists have been able to make qubits since the 1990s. But how many qubits do you need to make a quantum computer? While you could make very simple programs with just a handful of qubits, more useful programs will need hundreds of qubits. However, qubits are super sensitive to their environment and susceptible to decoherence, which can mess up the qubit when information is stored, during computation, or when the final state is measured -- all leading to errors in the quantum computation. Normal computer bits can be duplicated to avoid errors, but qubits can't be copied—or else their quantum state is lost. Barbara Terhal is a pioneering theoretical physicist who studies special techniques called **quantum error correction** used to retain qubit information despite errors. These techniques entangle multiple error-prone qubits into one error-protected group. Because one qubit is entangled with multiple others in a web of quantum error correction connections, the answer to "how many qubits are needed to make a computer" will likely be millions!