As the workhorse for modern atomic, molecular, and optical (AMO) physics for the past 30 years, ultracold gases have proven to be extremely robust systems for studying a broad range of physics such as plasmas, cold chemical reactions, and condensed matter systems. In this talk, I will focus on utilizing these systems for two important applications: compact sensors and quantum computation. First, I will discuss research guiding atoms in blue-detuned, hollow optical modes of a hollow fiber. Hollow-core optical fibers are particularly attractive platforms as they are capable of supporting light as well as atoms or molecules. The higher order optical modes supported by the fiber allow for large optical depths, low photon scattering rates, and efficient use of guide laser power. I will also discuss experiments demonstrating spatially and temporally resolved magnetometry using Faraday spectroscopy of a confined atomic sample. The second portion of my talk will focus on applications of AMO systems to quantum computation. In particular, I will discuss progress towards realizing a quantum computer. This work was performed in the Optical Sciences Division at the Naval Research Laboratory in Washington, DC and at the Joint Quantum Institute, NIST, and the University of Maryland in College Park, MD.