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Phase gate and readout with an atom/molecule hybrid platform ELENA KUZNETSOVA, University of Connecticut, ITAMP Harvard-Smithsonian Center for Astrophysics, MARKO GACESA, University of Connecticut, SUSANNE YELIN, University of Connecticut, ITAMP Harvard-Smithsonian Center for Astrophysics, ROBIN COTE, University of Connecticut — We suggest a combined atom/molecule platform for quantum computation, where two atoms of different species (e.g., in an optical lattice site) could be used for qubit encoding, initialization and readout, with one atom carrying the qubit and the other enabling a gate. In particular, we descuss the implementation of a two-qubit phase gate, in which a pair of atoms is transferred into the ground rovibrational state of a polar molecule with a large dipole moment, thus allowing molecules in adjacent sites to interact via their dipole-dipole interaction. We also discuss how the reverse process of coherently transferring a molecule into a pair of atoms could be used as a readout tool.

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