Abstract Submitted
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Microwave pulse driven quantum algorithms with ultracold polar molecules in an electric field[1] PHILIPPE PELLEGRINI, LAËTITIA BOMBLE, MICHÈLE DESOUTER-LECOMTE, Université de Paris Sud, Orsay (France) — We theoretically investigated the possibility of running complex microwave pulse driven logical operations on a register of quantum bits (qubits) encoded in rovibrational levels of ultracold polar molecules in an electric field. Using optimal control theory, microwave pulses are designed to perform specific universal logic gates such as the controlled NOT or Toffoli gates. Simulations with highly polar molecules like NaCs or LiCs show that logic gates involving 2 or 3 qubits can be run in a time scale of a few tens of microseconds and with a fidelity as high as 99%. The use of both the vibration and the rotation of the dimers facilitates the manipulation of the qubits and opens new possibilities for the realization of a scalable quantum computer.

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