Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Dipole blockade between symmetric combinations of Rydberg Stark states TURKER TOPCU, Virginia Tech — Quantum information protocols relying on neutral atom based architectures rely on the Rydberg (Ry) blockade mechanism to mediate conditional logic. The leading order interaction, in this case, is the dipole-dipole interaction between Ry states of opposite parity. One problem in using the first-order dipole interactions between Ry states of definite parity, such as $|ns\rangle$ and $|np\rangle$, is that the interaction is anisotropic, introducing errors in two-qubit gate operations relying on Ry blockade. We will demonstrate that simple linear combinations of Ry Stark states can be employed to partially mitigate this issue. We consider linear combinations of Ry Stark states that are symmetric about the middle of the Ry Stark manifold, such as $|R\rangle \pm |B\rangle$ where $|R\rangle$ and $|B\rangle$ are the red-most and blue-most states in a Stark manifold. Such states have decompositions in terms of the l-basis states that only include either the even or the odd parity states. As states closer to the middle of the Stark manifold contain more l-states in their decomposition, one can in principle attain better isotropy in the dipole blockade while retaining its order of magnitude interaction strength and $1/R^3$ behavior.

Turker Topcu
Virginia Tech

Date submitted: 31 Jan 2020 Electronic form version 1.4