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Long-range quantum gates using dipolar crystals HENDRIK WEIMER, Harvard University, ITAMP, NORMAN YAO, Harvard University, CHRIS LAUMANN, Harvard University, ITAMP, MIKHAIL LUKIN, Harvard University — We propose to use the magnetic dipole interaction in high density arrays of nitrogen-vacancy centers to enable long-range quantum logic between distant spin qubits. In our approach, an effective interaction between remote qubits is achieved by adiabatically following the ground state of the dipolar chain across a quantum phase transition [1]. We demonstrate that the proposed quantum gate is particularly robust against disorder and enables coherent coupling between qubits on distances that are compatible with sub-wavelength addressing techniques.

[1] H. Weimer et al., arXiv:1009.1003 (2011).

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