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**High-selectivity detection of single nuclear spins using rotary echo on a nitrogen-vacancy center in diamond** VAGHARSH MKHITARYAN, VIATCHESLAV DOBROVITSKI, Ames Laboratory, Iowa State University, Ames, Iowa 50011 — The properties of the nitrogen-vacancy (NV) centers in diamond make them an excellent tool for nanoscale spin detection and sensing, capable of detecting individual nuclear spins located 0.5-1 nm away [1]. However, the selectivity of the current methods is limited. We show that the rotating-frame control of the NV center's electron spin can improve the sensing selectivity 10-1000 times in comparison with the existing methods. We employ periodically changing Rabi driving (multiple rotary echo [2]) with a precisely chosen period, corresponding to the precession of the given nuclear spin. The rotary echo decouples the NV center from most nuclear spins, efficiently protecting coherence. At the same time, the given nuclear spin, whose precession fits a stringent resonance condition, does not decouple, and can be detected by its decohering impact on the NV spin. We evaluate the resolution and sensitivity of this detection scheme analytically, and verify the results by numerical simulations.

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[2] I. Solomon, Phys. Rev. Lett. 2, 301 (1959).

Vagharsh Mkhitaryan
Ames Laboratory, Iowa State University, Ames, Iowa 50011

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