

Abstract Submitted
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Protecting the electron spin coherence in a quantum dot with inhomogeneously polarized nuclear spins via dynamic nuclear polarization¹

WENXIAN ZHANG, JUN ZHUANG, Department of Optical Science and Engineering, Fudan University, Shanghai 200433, China, J.Q. YOU, Department of Physics, Fudan University, Shanghai 200433, China — An electron spin in a quantum dot is decohered by its surrounding nuclear spins via hyperfine coupling. During the dynamic nuclear polarization process, when the nuclear spins are polarized inhomogeneously by repeatedly injected polarized electron spins, a fully polarized nuclear spin core is formed. As a consequence, the polarized nuclear spin core can be harnessed to protect the electron spin coherence. In this way, we find that the electron spin coherence time can be extended tens times with the total nuclear polarization as low as 20%, in contrast to the usual requirement of 90% polarization, in a quantum dot with 256 nuclear spins. The total nuclear polarization goes even lower for larger quantum dots. The effect of the dipolar interaction between nuclear spins is also discussed.

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