

Abstract Submitted  
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**Many-body singlets of nuclear spins**<sup>1</sup> WANG YAO, The University of Hong Kong — We show that dynamic spin polarization by collective raising and lowering operators can drive a spin ensemble from arbitrary initial state to many-body singlets, the zero-collective-spin states with large scale entanglement. For an ensemble of  $N$  arbitrary spins, both the variance of the collective spin and the number of unentangled spins can be reduced to  $O(1)$  (versus the typical value of  $O(N)$ ), and many-body singlets can be occupied with a population of  $\sim 20\%$  independent of the ensemble size. We implement this approach in a mesoscopic ensemble of nuclear spins through dynamic nuclear spin polarization by an electron. The result is of two-fold significance for spin quantum technology: (1) a resource of entanglement for nuclear spin based quantum information processing; (2) a cleaner surrounding and less quantum noise for the electron spin as the environmental spin moments are effectively annihilated.

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