Title:	Reinforcement Learning for Hamiltonian Engineering of Dipolar Coupled Spin Systems
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Abstract:	In systems of electronic and nuclear spins, spin-spin interactions and onsite disorder can lead to a decay of spin coherence. However, by applying a sequence of resonant pulses to the system, the effective Hamiltonian for the system can be engineered to suppress these effects and extend the coherence times of the spins. Low-order expansions of Average Hamiltonian Theory and Floquet theory have provided a framework to generate pulse se- quences, both analytically and using numerical methods. The performance of these se- quences varies depending on the relative strengths of local magnetic field variations (due to chemical shift or disorder) and the strength of the dipolar coupling. We show that the reinforcement learning-assisted sequence design can be tuned to the specific range of local field variations and interactions present in the experimental system of interest while also allowing us to compensate for a broad range of experimental errors. We validate the perfor- mance of these sequences using numerical simulations and experimental tests on a 2.5 GHz microwave-controlled electron paramagnetic resonance spectrometer.
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