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Emulation of spin dynamics using a superconducting phase qudit MATTHEW NEELEY, M. ANSMANN, R. BIALCZAK, M. HOFHEINZ, E. LUCERO, A. O'CONNELL, D. SANK, H. WANG, J. WENNER, JOHN MARTINIS, ANDREW CLELAND, UC Santa Barbara — In superconducting quantum circuits, the nonlinearity of the Josephson junction allows energy-level transitions to be addressed individually by their unique frequencies. Typically this is used to operate the system as an effective two-level system, a qubit. In a recent experiment, we extended our coherent control of a phase qubit to the first five energy levels, allowing us to operate the device as a qu*d*it with $d = 3$, 4, or 5. We use this system to emulate the dynamics of single spins with spin quantum number $s = 1/2$, 1 and $3/2$. We show that the phase acquired by a spin under rotation around a closed path follows the theoretical prediction. In particular, we confirm the even (odd) parity of integer (half-integer) spins under 2π rotation.

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