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Dynamical Decoupling Using Trapped Ions MICHAEL BIERCUK, HERMANN UYS, AARON VANDEVENDER, NOBUYASU SHIGA, WAYNE ITANO, JOHN BOLLINGER, NIST Time and Frequency Div. — We present a detailed experimental study of the Uhrig Dynamical Decoupling (UDD) sequence in a variety of noise environments. Our qubit system consists of a crystalline array of $^9Be^+$ ions confined in a Penning trap. We use an electron-spin-flip transition as our qubit manifold and drive qubit rotations using a quasi-optical 124 GHz microwave system. We study the effect of the UDD sequence in mitigating phase errors and compare against the well-known CPMG-style spin echo as a function of pulse number, rotation axis, noise spectrum, and noise strength. Our results show good agreement with theoretical predictions for qubit decoherence in the presence of classical phase noise, accounting for the effect of finite-duration π pulses. Finally, we demonstrate that the Uhrig sequence is more robust against systematic over/underrotation and detuning errors than is multipulse spin echo, despite the precise prescription for pulse-timing in UDD.

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