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Measuring non-linear Interactions in a Binary Bose-Einstein Condensate using Imbalanced Dynamical Decoupling HAGAI EDRI, BOAZ RAZ, ROEE OZERI, NIR DAVIDSON, Weizmann Institute of Science — We measure inter-state interactions in a two state mixture of a ^{87}Rb Bose-Einstein Condensate (BEC) using microwave spectroscopy. Due to population imbalance, these interactions have a non-linear σ_z component, leading to a shearing effect on the Bloch sphere. We use a population imbalanced dynamic decoupling scheme that accumulates inter-state interactions while canceling intra-state density shifts and external noise sources. We repeat measurements on both magnetic sensitive and insensitive transitions with similar uncertainties, showing that we successfully decoupled our system from strong magnetic noises. Our scheme can be extended to other systems, such as quantum memories that are inherently imbalanced populations, and used close to a Feshbach resonance, where interactions diverge, and strong magnetic noises are ever present. Our results also allow for a better understanding of inter atomic potentials.

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