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Improving Nano-MRI Spatial Resolution with Phase Multiplexing BRAD MOORES, ALEX EICHLER, CHRISTIAN DEGEN, ETH Zurich — Magnetic resonance force microscopy (MRFM) is a scanning probe technique that allows measuring nuclear spin densities with resolution better than 10nm. Detecting such small volumes of spins (less than $(10\text{nm})^3$ corresponds to approximately 20,000 spins) requires long averaging of signals from statistically polarized nuclei. For instance, previous work demonstrated that imaging a single isotope (^{1}H) of a Tobacco Mosaic Virus required averaging for 2 weeks, and therefore the chemical contrast abilities of MRFM had to be forfeited to enable higher spatial resolution. In order to reconcile the chemical selectivity of MRFM along with the proven high spatial resolution, we have developed a phase multiplexing technique capable of simultaneously acquiring spin signals from multiple isotopes and from up to six spatial locations. We have demonstrated this method using a nanowire test sample, and have achieved one-dimensional imaging resolution of less than 5 nm and subnanometer positional accuracy.

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