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Accelerating the magnetic resonance imaging of hard and soft solids ZACHARY SETHNA, MERIDETH FREY, SEAN BARRETT, Yale University Physics Dept. — Recent fundamental research in quantum computing gave rise to a new NMR pulse sequence - the quadratic echo - that can be used to narrow the broad MR spectrum of solids by orders of magnitude. This advance enables high spatial resolution, 3D MRI of hard and soft solids (e.g., the ^{31}P MRI of bone and soft tissues, which has recently been demonstrated in our group). While this is great progress, the next challenge to address is the slow imaging time in solids. The T_1 time of solids can be orders of magnitude larger than that of a liquid (e.g., for some of our samples the T_1 time can be >100 s). Since imaging sequences wait a repetition time (of order T_1) between scans, a three-dimensional image (requiring many scans) can take >24 hours. Here we discuss approaches under study that aim to decrease the total imaging time of our MRI of solids technique. One method is to implement a variant on the driven equilibrium approach. Another method is to take less data, namely, sparse MRI (i.e., under-sampling of **k**-space). This leads to artifacts in standard FFT image construction; more advanced alternatives, such as a difference map algorithm, may be used to produce an image closer to the ideal, which is a promising approach to reduce total imaging time.

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