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Linewidth narrowing for ^{31}Phosphorus MRI of cell membranes
SEAN BARRETT, MERIDETH FREY, Yale University Physics Dept., JOSEPH MADRI, MICHAEL MICHAUD, Yale Medical School — Most ^{31}P Magnetic Resonance Spectroscopy studies of tissues try to avoid contamination by a relatively large, but broad, spectral feature attributed to cell membrane phospholipids[1]. MRI using this broad ^{31}P membrane spectrum is not even attempted, since the spatial resolution and signal-to-noise would be poor, relative to conventional MRI using the narrow ^{1}H water spectrum. This long-standing barrier has been overcome by a novel pulse sequence, recently discovered in fundamental quantum computation research[2], which narrows the broad ^{31}P spectrum by $\sim$1000$\times$. Applying time-dependent gradients in synch with a repeating pulse block enables a new route to high spatial resolution, 3D ^{31}P MRI of the soft solid components of cells and tissues. So far, intact and sectioned samples of *ex vivo* fixed mouse organs have been imaged, with (sub-mm)^3 voxels. Extending the reach of MRI to broad spectra in natural and artificial tissues opens a new window into cells, enabling progress in biomedical research.

[1]W.J. Thoma et al., J. MR **61**, 141 (1985); E.J. Murphy et al., MR Med **12**, 282 (1989); R. McNamara et al., NMR Biomed **7**, 237 (1994).
[2]Y. Dong et al. Phys. Rev. Lett. **100**, 247601 (2008); D. Li et al. Phys. Rev. B **77**, 214306 (2008).

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