Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Phosphorus-31 MRI of bones using quadratic echo line-narrowing
MERIDETH FREY, SEAN BARRETT, Yale University Physics Dept., KARL INSOGNA, JOSHUA VANHOUTEN, Yale University, School of Medicine Dept. of Internal Medicine — There is a great need to probe the internal composition of bone on the sub-0.1 mm length scale, both to study normal features and to look for signs of disease. Despite the obvious importance of the mineral fraction to the biomechanical properties of skeletal tissue, few non-destructive techniques are available to evaluate changes in its chemical structure and functional microarchitecture on the interior of bones. MRI would be an excellent candidate, but bone is a particularly challenging tissue to study given the relatively low water density and wider linewidths of its solid components. 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 NMR spectrum of solids. This offers a new route to do high spatial resolution, 3D ^{31}P MRI of bone that complements conventional MRI and x-ray based techniques to study bone physiology and structure. We have used our pulse sequence to do 3D ^{31}P MRI of *ex vivo* bones with a spatial resolution of (sub-450 μm)^3, limited only by the specifications of a conventional 4 Tesla liquid-state MRI system. We will describe our plans to push this technique towards the factor of 1000 increase in spatial resolution imposed by fundamental limits.

Merideth Frey
Yale University Physics Dept.

Date submitted: 11 Nov 2011 Electronic form version 1.4