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Nanoscale Magnetic Resonance Imaging¹

DANIEL RUGAR, IBM Research Division

Magnetic resonance imaging (MRI), based on the sensitive detection of nuclear spins, enables three dimensional imaging without radiation damage. Conventional MRI techniques achieve spatial resolution that is at best a few micrometers due to sensitivity limitations of conventional inductive detection. The advent of ultrasensitive nanoscale magnetic sensing opens the possibility of extending MRI to the nanometer scale. If this can be pushed far enough, one can envision taking 3D images of individual biomolecules and, perhaps, even solving molecular structures of proteins. In this talk we will discuss issues related to nanoscale magnetic resonance imaging, especially its implementation using magnetic resonance force microscopy (MRFM). We will also consider the future possibility of using NV centers in diamond for detection of nanoMRI.

¹This work was performed in collaboration with John Mamin, Mark Sherwood, Christian Degen, Martino Poggio and Ginel Hill.