SPATIAL LOCALIZATION IN HIGH RESOLUTION NMR

Ray Freeman

Department of Physical Chemistry*

Oxford University

Oxford, England

It is possible to use the non-uniformity of the radiofrequency field B_1 to define the spatial coordinates of the "sensitive volume" of the sample, so as to record a high resolution spectrum (usually phosphorus-31) of an animal organ in vivo. The most promising schemes use "prepulses" which modify the Z-component of magnetization according to some predetermined spatial profile, exploiting the B_1 gradients created by a surface coil. Spin-spin and spin-lattice relaxation effects must be taken into account since the pulse sequence may have an appreciable duration and the repetition rate must be relatively high. The aim is to achieve a reasonable penetration into the sample while rejecting signals from regions close to the surface. This inevitably implies that resonance offset effects be compensated by the use of composite radiofrequency pulses. Improvement in the shape of the sensitive volume can be achieved by introducing a second coil on the far side of the sample and driven in the opposite phase, the so-called "straddle-coil" configuration. Fast switching circuitry allows different radiofrequency pulses to be applied consecutively to the two coils, and the NMR signal may be acquird with the two coils reconnected in the same sense.

*Present Address: Department of Chemistry, Cambridge University, Cambridge, England