XIV. MAGNETIC RESONANCE[*]

Academic and Research Staff

Prof. J. S. Waugh
Dr. M. W. Mehring
Dr. W-K. Rhim

Graduate Students

J. D. Ellet, Jr.   S. V. Pausak   J. D. Ramshaw
M. G. Gibby   A. Pines   J. De V. Read
W. E. Good, Jr.   H-N. Yeung

RESEARCH OBJECTIVES

This group is carrying on the following main activities.

1. <u>Coherent Averaging Effects</u>. A nuclear spin system subjected to a periodic disturbance (in our case usually a train of RF magnetic field pulses) can be made to behave as though its spin Hamiltonian had been modified. By suitable choice of excitation one can, for example, remove the static dipolar interactions from a solid, change the heat capacity of the spin system, and so forth. A theory of these averaging effects has been developed and a number of preliminary experiments carried out. We are now constructing a very much more powerful spectrometer, controlled by a computer and capable of operation up to 250 MHz.

2. <u>Random Molecular Rotation in Liquids and Solids</u>. Two nuclear relaxation studies are under way to study the nature, as opposed to the rate, of thermally excited molecular rotations. The experiments are designed to answer such questions as, "Is the rotation of a molecule describable as a random walk in angle, and if so, what is the mean angular step size?"

3. <u>Nuclear Relaxation and Intermolecular Forces</u>. Measurements of the temperature and density dependence of nuclear relaxation times in dilute gases give information about the anisotropic part of the intermolecular potential energy. We have set up a computer-controlled pulsed NMR spectrometer that makes possible unusually precise measurements of this kind. Measurements have recently been completed on matrices of Hcl and Ar.

4. <u>The Kerr Effect in Fluids and Molecular Interaction</u>. We have developed a theory of dielectric polarization and alignment which relates experimental quantities (in particular, the Kerr electro-optic effect) to well-defined local-order parameters in the case of a liquid or to intermolecular forces in the case of a slightly nonideal gas. An experimental program is under way to exploit this information in characterizing the anisotropic part of intermolecular potentials.

J. S. Waugh