patients with obstructive jaundice.

Finally, the conference had a timely reminder from Dr Mary Dyson (London) of the possible risks of ultrasonic scanning. She described experiments in which chick embryos were irradiated at the head process stage. Certain dose parameters produced a significant increase in abnormalities, particularly of the central nervous system. At diagnostic levels no harmful results have been reported, but the field is not yet fully explored.

CHEMISTRY

Asymmetry of C-F

from a Correspondent

RECENT work on the fluorine n.m.r. spectra of silver trifluoracetate, $Ag^+CF_3CO_2^-$, by Waugh and his colleagues at MIT (*J. Chem. Phys.*, **57**, 2147 ; 1972) has revealed a remarkable lack of axial symmetry in the chemical shift tensor for the C-F bonds.

A typical C-F bond has avial symmetry, that is all directions perpendicular to the bond are equivalent. More specifically, vector properties such as a bond dipole moment contribution will lie parallel to the bond: likewise a second rank tensor associated with a property such as the optical polarizability is expected to have one of its principal directions parallel to the bond and the other two to be associated with equal principal values and consequently referring to all directions perpendicular to the bond. Such axial symmetry is a necessary property of a model of a bond in isolation, and would be expected to be realistic for real bonds in molecules, at least in the absence of π electron or aromatic effects.

To understand the findings it must be remembered that an n.m.r. chemical shift, the quantity σ in the energy expression, $-\hbar\gamma\mathbf{I}\cdot(1-\sigma)\cdot\mathbf{B}$, relates to the departure of the n.m.r. frequency for the substance being studied from that of the bare nucleus or other reference state. For fluorine, σ may reach several hundred p.p.m. and is well known for many liquids. But for liquids the quantity observed is the mean value of σ, that is one-third of the trace (Spur or diagonal sum) of the tensor quantity. With very few exceptions these mean values are the only quantities that have been available. The fuller information could not be obtained from solid state spectra because it is normally obscured by the dipole–dipole coupling between nuclei; this is a much bigger effect than the chemical shift and leads to line widths of the order of 10 kHz.

Waugh and his colleagues used a special sequence of radiofrequency pulses to excite the resonance and to remove the effect of the dipole–dipole coupling. The line widths were 0.5 kHz or less, thus enabling the details of the chemical shift to be made plain. In a single crystal of $Ag^+CF_3CO_2^-$, at least at 40 K where the $-CF_3$ rotational motion has been frozen, each distinct C-F bond in the unit cell may make a different angle with the magnetic flux density and consequently have a different effective chemical shift for the fluorine resonance. Six lines were resolved and measurements at several crystal orientations with respect to the magnetic field allowed the complete chemical shift tensor to be derived for each of the C-F bonds of the $-CF_3$ group. There are small, yet real, differences between the bonds, but essentially the results indicate, for each C-F bond, that the principal values and principal axis directions of the σ tensor are $+73$ p.p.m. along the bond, -75 p.p.m. in the CCF plane and $+2$ p.p.m. in the circumferential direction around the $-CF_3$ group.

Such a tensor is clearly not of the expected axial type, which would require principal values in the ratios $+74$: -37: -37. This is surprising, for the electrons in the immediate vicinity of the nucleus normally dominate its chemical shift. Theoretical chemists will have to get to work to explain the lack of axial symmetry and the differences between the three bonds, and to find the reason why the principal direction is actually at an angle of 10° to the C-F bond direction rather than strictly parallel to it.

NUCLEAR PHYSICS

Exchange Effects

EVIDENCE for the occurrence of substantial exchange effects in the elastic scattering of oxygen-16 nuclei from oxygen-18 nuclei is given in a recent issue of *Physical Review Letters* (**29**, 1683; 1972) by Gelbke and his colleagues of the Max-Planck-Institut für Kernphysik at Heidelberg.

It has long been known that, when a light nucleus (typically of mass less than 40 a.m.u.) is scattered from a target composed of similar light nuclei, the observed distribution in angle of the bombarding particles cannot be explained solely by an interaction in which the incident particle is affected by a combination of the Coulomb repulsion between the particles and a nuclear interaction simulated by a potential well with a real and imaginary part (an optical model potential). What the extra mechanism is or what quirk of the mechanism makes the observed angular distribution of elastically scattered heavy particle deviate from that predicted by the optical model has been the subject of considerable speculation. The work of Gelbke *et al.*, however, eliminates some of the suggested possibilities and comes out in favour of an exchange contribution.

The telltale feature of anomalies of this kind in elastic scattering is their variation with the energy of the incident particle. The Heidelberg team studied the reaction of ^{16}O on ^{18}O at 24 MeV,

Oncornaviruses and Breast Cancer

Two of the chief obstacles in the way of further investigations of the virus-like particles which have been detected in samples of human milks and may be human counterparts of mouse mammary tumour viruses are the lack of cultivated cells which can be productively infected or transformed by these milk particles, and the lack of cultures of human breast cells that produce the particles. At present these cells can be obtained only from human milk and there is no assay for their biological activity. The experiments reported in next Wednesday's *Nature New Biology* (January 10) by Keydar *et al.*, however, may show the way to a method of obtaining reproducible cultures of human cells that support the replication of the human "milk virus".

Keydar and his colleagues co-cultivated primary human embryo cells and human breast cancer cells, and exposed other cultures of human embryonic cells to milk, from breast cancer patients, which had reverse transcriptase activity and presumably contained the milk particles. In nine out of a total of fifteen such cultures Keydar *et al.* detected the production of particles which contain 60–70S RNA and reverse transcriptase activity and have a buoyant density of 1.18 g ml. These are, of course, diagnostic properties of RNA tumour viruses. Furthermore, some of these cultures have been producing these particles for nine months whereas control cultures of human embryonic cells not exposed to milk or co-cultivated with cancerous breast tissue have not produced any detectable particles with the characteristics of RNA tumour viruses.

As Keydar *et al.* point out, the particles which are being produced in their cultures may have arisen from the cancer cells and may be involved in the aetiology of breast cancer. On the other hand, they may be contaminants or they may have arisen in the embryonic cells. These second alternatives, however, are less likely and attempts are under way to characterize the particles produced in the cultures and establish their relationship, if any, with virus-like particles in human milks.