The possibility that this valuable character is under genetic control is being explored. Gene L_1, which bestows, among other things, large fruit, seems to be involved here. Last year saw an advance in the exploitation of L_1; previous fruits from plants carrying this gene had been of a rather coarse appearance, but four selections made in 1969 were a great improvement.

Any improvements in yield must, of course, be combined with hardiness, particularly in the winter when canes do not always survive. The Canadian variety 'Carnival' has turned out to be outstandingly hardy, possibly because of the low water content of its canes. 'Carnival' also had some resistance to grey mould, caused by the fungus *Botrytis cinerea*. Resistance to another enemy of the raspberry, the beetle *Byturus tomentosus*, has been found in seedlings of the species *Rubus phoenicolasius*. The suggestion that this resistance was due to an acidic component of the cuticular wax now seems to have been ruled out.

Strawberries too have disease problems; they tend to succumb during transportation. In a test devised to assess the capacity of different varieties to withstand transportation, strawberries were shaken together and examined forty-eight hours later when fungi had been able to develop. Results indicated that firmness of flesh was not the only factor involved in carrying quality; toughness of skin and resistance to *Botrytis* may also be important.

A more exotic line of research at the institute is the breeding programme for lilies. Most of the Asiatic hybrids derived from crosses made in 1967 have now flowered, and some look very promising, especially those with yellow flowers. Some of these are to be planted in a trial with standard commercial varieties next year, and the best should eventually be released as new cultivars. The European lily, *Lilium pyrenaicum*, which can be grown easily in Britain, has recently been crossed with various other European and Caucasian species. So far only one hybrid has flowered, a cross with *L. pomponium*, which has a growth habit intermediate between the two parents and scarlet flowers similar to those of *L. pomponium*.

ELECTRONICS

Multiplying in Real Time

A MEANS of convolving and correlating signals inside a ferroelectric crystal has been proposed which could have important applications in radar systems. The convolution takes place in real time and C. F. Quate and R. B. Thompson (*Appl. Phys. Lett.*, **16**, 494; 1970) maintain that the strength of the interaction between signals at 1,350 MHz is adequate to be used for signal processing devices.

Correlation systems are used in radar for extracting a signal from a noisy background. Communications from the Moon, for example, are received on correlators. But present designs rely either on digital methods to break down the pulses or, when real time methods are available, on complicated systems involving, say, twenty parallel paths with different delays to map out the convolution. The chance of having a single device to correlate in real time is the prize offered by the ferroelectric system proposed.

Quate and Thompson point out that the operations of delay, multiplication and integration which comprise correlation can be achieved by the non-linear interaction of two sound waves as they pass through a crystal at different phase velocities. Broadly, the difference in phase creates the translation of the functions, and the polarization induced inside the ferroelectric crystal —being proportional to the product of the two amplitude modulated functions—provides the multiplication. The device can then be made to integrate by letting the polarization drive a microwave cavity mode, the output from which gives the convolution of the two original waves.

The low velocity of the sound waves made it possible for Quate and Thompson to carry out these operations in a crystal of convenient size for signals several microseconds long. Although they avoid the question of an exact mechanism to explain the interaction of the waves —in other words, whether the dipoles are created by a direct interaction between strain waves or through indirect electrical effects of the waves—they stress that the important thing is to have parametric coupling in which phase matching and frequency conservation are met simultaneously. For this they propose coupling schemes which satisfy the conditions for waves travelling both parallel and antiparallel.

The experiments at 1,350 MHz provided a good illustration of the device. Quite well defined convolutions were obtained at 2,700 MHz generated by sound waves travelling in opposite directions, and Quate and Thompson have the idea of extending the time-bandwidth of the system by increasing the length of the crystal and by enlarging the bandwidth. They also draw attention to some recent experiments of surface waves which indicate that the same technique could be used with Rayleigh wave configurations.

DENSE STARS

Magnetic Flux of White Dwarfs

from our Cosmology Correspondent

THE most important requirement of the currently favoured pulsar models is a large magnetic field ($\gtrsim 10^{12}$ gauss) associated with a neutron star. Most theorists postulate that such a field might be produced by the conservation of the flux arising from a field of some 10^2 associated with the parent main sequence star which has collapsed to form the pulsar core. If such a process is viable, however, then we would expect white dwarf stars, which have also formed from the collapse of main sequence stars, to possess fields of at least 10^6 gauss, which would just be detectable by modern spectroscopic techniques. Two articles describing observational tests for fields of this magnitude have been published in *Astrophysical Journal*, both (unfortunately for the theoreticians) reporting negative results.

G. W. Preston has searched for evidence of displacements due to the quadrature Zeeman effect in the spectra of DA stars (*Astrophys. J.*, **160**, L143; 1970); in spite of the difficulty of detecting such an effect in the rather broad Balmer lines which are characteristic of these stars, he feels that the evidence suggests an upper limit for their mean surface magnetic fields of $\sim 5 \times 10^5$ gauss, already rather lower than the theorists would like. A more accurate limit is obtained by J. R. P. Angel and J. D. Landstreet, who have measured the sharpness of the cores of the Balmer lines (*Astrophys. J.*, **160**, L147; 1970). Provided that the field is below 10^6 gauss (which is known to be true from Preston's work) the normal Zeeman effect will produce