NEWS AND VIEWS

Why Physics is Fun

PHYSICS at its best is nothing if not elegant. The memorable experiments are somehow distinguished by their simplicity and even by their cheekiness. With the benefit of hindsight, for example, it is plain that Rutherford and his associates in the 1900s were asking altogether too much of the simple apparatus with which they sought to understand the processes of radioactivity. This means that their success seems even more remarkable. But the same is also true of the way in which J. J. Thomson first measured the ratio of charge and mass for an electron and—for that matter—of the way in which Joule established the quantitative relationships between different kinds of energy. Simple apparatus and clever design can do more than merely establish a proposition: by their simplicity they carry extra conviction. And to make the process even more absorbing, the very best of the experiments in physics contain an element of paradox. Something that might be expected to happen fails to happen.

But is there not a danger that these qualities will be lost by the coming of the new style of working in physics? This is a reasonable question to ask. It is, however, pleasing that the way in which it is now necessary for large groups of people to work closely together on the design and the conduct of a single experiment has not meant a sacrifice of elegance but, if anything, the opposite. A great many of the experiments carried out in connexion with the large particle accelerators, for example, have benefited from the close and detailed study of a group of men under pressure to make the best possible use of expensive equipment and restricted access to it. The result is that experiments like those on neutrinos and muons designed at CERN and Brookhaven in the past few years are in the best traditions of elegance in physics. It is true, of course, that string and sealing wax have no place in circumstances like these, but these were never essential ingredients of Rutherford's experiments either. What matters is the directness of the design.

But elegant experiments are to be found elsewhere than in attendance on the big machines. An intriguing illustration of this has now appeared in *Physical Review Letters* (**19**, 1049; 1967). Drs F. C. Witteborn and W. M. Fairbank there describe an experiment to measure the free fall of electrons in a vacuum enclosed by a copper tube. The immediate object is to test the predictions of Professor L. I. Schiff and M. V. Barnhill a year ago that in circumstances like these the gravitational force on an electron is exactly cancelled out by electrical forces. These, in turn, are supposed to arise because of the way in which the balance between positive and negative electrical charges within the metal is distorted by the presence of a gravitational field. In the experiment which Drs Witteborn and Fairbank have designed, electrons from the cathode are tracked upwards through a metre long copper tube by a moderate electric field. To make sure that they travel along the axis of the tube, the whole apparatus is placed within a superconducting solenoid which provides a magnetic field of 7,000 Gauss or more. The technique is to measure the time taken by the slowest electrons to travel the length of the drift tube and to calculate from this the upper limit to the effect of gravitational force on these same electrons. The first result of this experiment is that the effective force is less than nine per cent of that appropriate to the inertial mass of an electron. The next step will be to repeat the experiment with positrons, for there it is expected that the effective force on the electrified particle will not be cancelled out but, rather, doubled. At this stage there is no way of knowing whether the equipment will provide a means of testing the suggestion that particles such as electrons and anti-particles such as positrons may be found to repel each other, but this is at least an intriguing possibility.

It is true, of course, that this experiment is only possible because of the way in which large superconducting magnets can now be designed. It is also true that the phenomenon which is being studied has been drawn to public attention in the most indirect way. But the way in which the experiment has been designed and carried out is a proof that the traditions of elegance in physics continue. That is something to be grateful for.

Gould's Belt Defined

EARLIER calculations of the relationship between the local cluster of stars and the rest of the galaxy have been confirmed and refined by an article by Dr F. V. M. Clube of the Royal Greenwich Observatory (*Mon. Not. Roy. Astron. Soc.*, **137**, 189; 1967). Dr Clube has made use of several recent measurements of the velocity and position of the stars in the local cluster as well as information about the distribution of neutral hydrogen in the nearby parts of the galaxy obtained by radio astronomers in recent years. His general conclusion is that the local cluster, as defined by the presence of *B* type stars, occupies a strip 200 parsecs wide and 500 parsecs long with the Sun at the leading edge of the strip and roughly 75 parsecs from the central axis.

In his analysis, Dr Clube has used a total of 113 *B* stars with accurate radial velocities and with proper motions which have been measured accurately Following earlier investigators, he has sought to represent the motions of these stars by a model in