on "deep" inelastic electron scattering and rough values of the longitudinal cross-section were available from SLAC. These did not support the specific vector dominance model proposed by Sakurai (Chicago) for this process. The usual wide range of conceptually very different explanations continued to exist for these data, although experimental differentiation between the various possibilities still seems remote.

MOON

Cratering under Low *g*

from our Astronomy Correspondent

A TWIN-PROP C-131B aircraft, a KC-135A jet and a 1·8 m^3 vacuum chamber have been used in a bizarre experiment to see how gravity and atmospheric pressure affect the formation of craters in sand (Johnson *et al.*, *J. Geophys. Res.*, **74**, 4838; 1969). The aim was to produce information which would be useful if civil engineering works are ever undertaken on the Moon, and to provide a baseline for the analysis of craters in the lunar soil. The technique was to detonate small quantities of explosives in boxes of dry sand with particle sizes between 0·4 and 0·85 mm. To simulate low and high gravity, the time-honoured method of flying the aircraft in a vertical parabola was used, and the experimenters from the Air Force Institute of Technology report results at 0·17g (lunar gravity), 0·38g and 2·5g.

The investigation was not without its formidable difficulties, however, and it seems to have been impossible to combine the variable gravity tests with the effects of atmospheric pressure. Thus the influence of pressure was tested separately in a vacuum chamber on the ground. Because the crater shape in the dry sand was destroyed as the aircraft pulled out of the parabola, the experimenters had to rely on ciné films of what happened. And they had to satisfy themselves that the finite size of the box and reflected shock waves from the sides and bottom could be ignored. (This was only true if the depth of sand in the box was at least 35 cm.)

The conclusion is that the ratio of crater diameters formed under different gravities is inversely proportional to the ratio of gravities to the power n, where n increases with the depth of the explosive, but is always less than 0·16. In the pressure range from 300 to 1,000 mm of mercury, the ratio of diameters is inversely proportional to the ratio of pressures to the power 0·044. Below 300 mm of mercury and down to 5×10^{-4} mm of mercury the exponent is smaller, but hard to define from the data. But, on average, craters formed below 1 mm of mercury had diameters roughly 1·1 times those of craters formed at terrestrial atmospheric pressure.

LATTICE DYNAMICS

Gregarious Phonons

from our Solid State Physics Correspondent

THE importance of the interference between one phonon and multi-phonon scattering processes in a crystal may well have been badly underestimated, judging by the uncompromising results of an experiment by R. A. Cowley, E. C. Svensson and W. J. L. Buyers on the scattering of neutrons by ionic crystals (*Phys. Rev. Lett.*, **23**, 525; 1969). This may not be entirely surprising, as the tacit acceptance of the division into single-phonon and multi-phonon processes for an anharmonic crystal has always been somewhat anomalous, although largely motivated by the lack of any sound theory to couple the products of the harmonic model. Cowley *et al.* have now worked out the scattering cross-section for X-rays and neutrons in an anharmonic crystal in terms of the anharmonic self-energy of the crystal, and they deduce some marked effects on the line shape and intensity for groups of scattered particles. They have tested the predictions on NaCl and KBr, and obtain remarkably good agreement with experiment.

The interference between one-phonon and two-phonon processes, which is the important interference contribution, gives rise to two "adjustments" to the cross-section. Cowley *et al.* have sought to explain the intensity modulation in the X-ray diffuse scattering from NaCl—hitherto something of a riddle—in terms of this interference contribution, and they have obtained a very reasonable fit to the measurements. They deduce that most of the intensity variation is attributable to interference terms, although some contribution from changes in the form factor due to the ionic motion is possible.

They have carried out a separate experiment on KBr which gives further backing to the theory. They selected the branch of the dispersion curves expected to give the largest interference contribution, the LO branch, and have measured the variation with temperature of the intensity of neutron groups scattered by the crystal. The results are impressive. Anharmonic effects are notoriously difficult to pin down accurately, but these turn out to give agreement between the predicted and measured variations to better than a standard deviation. Even allowing for pessimism about the ability to subtract off the background accurately at the three temperatures employed, 94 K, 298 K and 450 K, the agreement is encouraging.

A noticeable gap in the dispersion curve data on alkali halides has been filled by J. R. D. Copley, R. W. Macpherson and T. Timusk (*Phys. Rev.*, **182**, 965; 1969), who have measured the phonon frequencies in potassium chloride at 115 K with slow neutrons. The abundance of models vying for attention to fit the alkali halide frequencies, however, indicates that there is still some way to go before the multiparameter empirical model can be regarded as an early relic in the same way that Born von Karman models for metals are now treated.

METALLURGY

Ordered Alloys

from our Materials Science Correspondent

A GROWING interest in ordered alloys was evident at the conference devoted to this topic and held at Bolton Landing, New York State, by the American Institute of Mining, Metallurgical and Petroleum Engineers from September 7–10. There are several reasons for this growth of interest during the past ten years. The electron microscope, for one thing, has revealed a great deal about the structural aspects of order, such as antiphase domains and superdislocation morphology