Cowsik and Pal then calculate that Compton scattering from these electrons will generate an excess of X-rays in the galactic plane from the infrared background, which corresponds to the measurements made at Leicester. In other words, the OSO-3 gamma-rays and the Leicester X-rays are both manifestations of the interaction of cosmic ray electrons and the infrared excess.

Unfortunately, however, there is still doubt about the NRL–Cornell observations, chiefly because of indirect evidence from interstellar optical absorption lines. The lines do not have the strength expected if there is an infrared excess on top of the 3 K background radiation to generate excited states. In practice this means that upper limits corresponding to the 3 K background are placed on the infrared flux at certain wavelengths in the interval 0·4–1·3 mm, so that the infrared excess cannot be in a continuum on this evidence. This is why it is important to find ways of checking the NRL–Cornell measurements, and Cowsik and Pal say that one way would be to see if the galactic X-rays of Cooke *et al.* extend to higher energies than the 18 keV of the Leicester experiment.

ELECTRON BEAMS

Electrons for Carrying Light

by our Solid State Physics Correspondent

An intriguing puzzle has emerged from a new type of electron diffraction experiment involving a laser beam. H. Schwarz and H. Hora (*App. Phys. Lett.*, **15**, 11; 1969) have found that if a beam of electrons is diffracted by a thin crystal film of silicon or aluminium oxide through which a laser beam is shone at right angles to the electron beam, the resulting diffraction pattern, when viewed on a non-fluorescent screen of alumina, contains spots of the same colour as the light in the laser beam.

This result is certainly quite startling. It implies, as Schwarz and Hora point out, that the electrons pick up the oscillations of the light and then, instead of losing them at the boundary of the film, proceed to carry them across to the alumina screen. This not only seems to defy the sort of simple explanation that has proved satisfactory for the Kapitza–Dirac effect, in which an electron beam is diffracted by a standing light wave, but indicates that some mysterious process is occurring in which the light oscillations are converted by the electrons and then released in the alumina screen.

Schwarz and Hora carried out first a simple diffraction experiment, observing the pattern from non-illuminated films of the oxides on a normal fluorescent screen. They then substituted a non-fluorescent alumina screen, when the patterns naturally disappeared. But on directing a beam of parallel light from an argon laser lengthwise through the specimens, in a direction perpendicular to the electron beam and with the electric vector of the light polarized parallel to the electron beam, the spots reappeared at the same positions as on the fluorescent screen and at approximately the same wavelength as the blue laser beam.

The significance of the direction of polarization was examined by rotating the laser beam, and the spots were found to disappear. Moreover, Schwarz and Hora noticed that the brightness of the spots decreased rapidly as the plane of polarization was rotated. They also showed that by slowing down the electrons and increasing their number correspondingly, a substantial drop occurred in the intensity of the spots, whereas little effect was registered when the same changes were monitored on the fluorescent screen.

What is the explanation of this strange phenomenon? Could the blue light perhaps have been created in the alumina screen and the similarity in frequency with the laser beam be coincidental? There seems no doubt that the spots were indeed caused by the electrons, because Schwarz and Hora were able to move the spots by applying a magnetic field to the beam, so what mechanism could exist to modulate the electron wave by the light wave?

Schwarz and Hora have no easy explanation for their results. A classical description in terms of point electrons is clearly inadequate, as the electrons would "shake off" any light oscillations when they left the film. They suggest, however, that some bunching of the electrons with the light frequency may occur, and that on hitting the target the electrons may somehow transmit their pulsating energy by collective effects. Although they fight shy of the question of varying the frequency of the laser light, they indicate that the experiments ought to be repeated with different materials and different geometrical and electrical configurations. More data are clearly needed to establish whether this experiment is really as mystifying as it appears to be.

SOLAR WIND

More Data from Apollo 11

by our Astronomy Correspondent

While something like 150 principal investigators work against the clock to prepare reports for the first scientific bonanza of 1970, the Houston conference on the Apollo 11 Moon rocks, a preliminary account of the solar wind experiment which was set up by Edwin Aldrin on the lunar surface has appeared in *Science* (**166**, 1502; 1969). This is the roller blind arrangement of aluminium foil designed to trap particles from the solar wind for analysis on Earth by F. Bühler *et al.* of the University of Berne and P. Singer of the Institute of Crystallography and Petrography, Zurich. The advantage of aluminium is that its ability to trap particles from the solar wind depends only weakly on the particle energy. Bühler and his associates aim to determine the noble gas content of the solar wind, and their first report describes the flux of ^{4}He which turns out to be $6·3 \pm 1·2 \times 10^6$ atoms cm^{-2} s^{-1} at the Moon. The foil also trapped detectable amounts of ^{3}He, but no details are given.

The chief problem for the Swiss group seems to have been the possible contamination of the foil by the noble gases which are abundant in grains of Moon dust. The foil was boxed in a lunar sample container for the return journey and this made matters worse, but Bühler and his colleagues say that most of the foil could be cleaned except for heavy contamination of the foil which was nearest the lunar surface. To test the cleaning procedure—detergent followed by ultrasonic cleaning—parts of the foil which were shielded from the solar wind by the reel were analysed and found to be free of excess ^{4}He.