guess, and a highly resonant Moon is the first idea that springs to mind. It is not the only possible explanation, however. Perhaps the impact triggered off numerous fractions which acted as an earthquake sequence. Explosions occasionally trigger earthquakes, but the only large scale triggering on Earth has been after megaton tests in Nevada (*Nature*, **223**, 773; 1969). By analogy the Moon should not be expected to quake after such a minor impact, but who knows ? Exciting as the result is, a certain amount of unwilling suspension of judgment is necessary.

Whatever the conclusions reached from the smash-down records, it does seem at first sight as if the signals recorded by Apollo 12's seismometer before it went off the air were of entirely local origin. Many had thought they were probably landslides or venting from the lunar launchpad. This view is now strengthened by the knowledge that even fairly modest lunar events generate so substantial a seismic record. So perhaps there are no moonquakes worth mentioning. If so, exploration of the lunar interior will need artificial sources. It is a pleasant relief that nothing enormous will be needed. The idea of a nuclear explosion on the Moon "to see what happens" has already been semi-seriously canvassed. At least there will be no demand from lunar seismologists for such fearfully large and politically nonsensical experiments.

IONOSPHERE

Petrel on Target

from our Astronomy Correspondent

By all accounts, the success of an investigation into the auroral ionosphere earlier this year has been a good advertisement for the British Petrel rocket built by Bristol Aerojet Ltd. Eight Petrels were launched during February and March in a campaign organized by the Science Research Council which took place at the European Space Research Organization (ESRO) range at Kiruna in Sweden. Preliminary scientific results from the campaign were discussed last week at a meeting in the Department of Physics at the University of Sheffield. For the first time in the history of the range, all the rockets in a campaign fell within the designated area. In the past, rockets such as Skylark and Arcas have been launched from Kiruna, and firings have been known to land not only outside the range but sometimes outside Sweden. Rockets have fallen in Finland, which meets Norway and Sweden not far from Kiruna. Despite reaching a greater height than normal—150 km instead of 125 km—because of a combination of meteorological factors and the altitude of the range, all the Petrels remained substantially on course, and it seems that their performance might earn them a place in the ESRO armoury.

Although only 7·5 inches in diameter and small enough to be launched from a tube, Petrel can carry enough instrumentation to make most ionospheric scientists happy. And with one rocket per experiment they have made their contribution to a pleasant life on the range by ending the awkward problems of integrating experiments from different groups.

It is now becoming easier to measure electric fields in the ionosphere, and several groups were preoccupied with the techniques. What seems to be the most promising method so far was described by the group from the University of Birmingham (J. W. G. Wilson, J. H. Wager and C. P. van Zyl) and is based on measurements of the voltage difference between two spherical probes. Unfortunately, however, in the firing which they described the probes seem to have caused the rocket to precess more than normal, and the results are therefore not as good as they might have been. Another way to evaluate the field is to observe the drift of an artificial cloud of ions relative to a neutral cloud, and a joint team from the Universities of Sussex and Southampton (J. Hunter, G. Martelli, K. Martin and P. Rothwell) has been extending this method to lower altitudes than normal. Clouds released in the E-region often do not separate into neutral and ionized components, yet nevertheless it seems possible to estimate the electric field from the way the cloud deforms.

The Sheffield group (P. Beckingham, W. Gibbons and T. R. Kaiser) is concerned with direct measurements of the fine structure of electron density in auroras which has been inferred from radar work. To do this the group has developed a Langmuir probe which in theory has a spatial resolution of a few tens of centimetres, but which in practice, because of telemetry limitations, has a height resolution of about 1·5 m. The group is looking for the role in auroras of irregularities about a metre across and perhaps tens of metres long aligned along the magnetic field.

There is also the question of the mechanism that accelerates electrons to energies of tens of keV and leads to very bright aurorae. Another group at Southampton (P. Rothwell *et al.*) and a group from the Radio and Space Research Station (D. A. Bryant, G. M. Courtier and G. Bennet) have been looking at electrons of these energies at times when acceleration is believed to be taking place.

Oddly enough, informal discussions of the results of a campaign before anything is published is the exception rather than the rule and people are hoping that the Sheffield meeting will set a trend.

APOLLO

New Broom on the Moon

from a Correspondent

Now that the main task of Dr George Mueller, the National Aeronautics and Space Administration's Associate Administrator for Manned Space Flight, of getting an American safely on to the Moon by 1970 is accomplished, there is every justification for his retirement. This was announced on November 10, four days before the departure of Apollo 12.

NASA has praised his achievement handsomely in an announcement that reads a little like an epitaph. "It is due to Dr Mueller's creative leadership of the magnificent manned space flight organization that the flight of Apollo 11 in July 1969 achieved the national goal set in May 1961: the landing of men on the Moon and their safe return to Earth by the end of the decade." Dr Mueller, it is claimed, was responsible for the largest research, development and operational programme ever undertaken by man. At its peak the Apollo programme employed 400,000 people. Among his principal achievements were devising methods for cutting down the interval between launchings. For