MOON

The Great Lunar Conference

from a Special Correspondent

Houston, January 7

PROFESSOR FRED HOYLE said at an evening dinner here that he would gladly accept one cent for every word spoken at this conference, and in doing so he may have been alluding to the element of repetitiousness in some of the first discussions. So far the partisans both of a hot Moon and a cold Moon are equally unable to account for all the facts that have emerged.

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It is also clear that a great many of those attending the conference—over a thousand investigators from nine countries—have been unable in the time available to complete the work on which they were embarked—many of those from Britain who have gone to Houston were at the bench until the last minute before their departure. It will therefore be something of a relief to them and their successors that the National Aeronautics and Space Administration has announced a somewhat gentler programme of Moon landing in the years ahead. For the next two years, until the end of 1971, there will be flights at the rate of two a year. In 1972, there will be a moratorium on lunar exploration. It is also being arranged that a geologist would take part in one of the impending flights, chiefly in the hope of clearing up some of the uncertainty about the rocks which have been recovered from the Moon. It is, of course, entirely possible that NASA itself will welcome a respite from Moon landings, given the continuing pressure on its budget and the need to get on with other kinds of jobs.

So far, two points of importance seem to have emerged from the conference. First, there is doubt about the age to be assigned to some of the samples collected in the flight of Apollo 11. Using the ubidium–strontium method of dating, three groups of investigators put the age of the solid samples at 3,500 million years. By contrast, the groups which have been investigating the age of the dust tend to quote ages 1,000 million years greater. The disagreement between these two estimates raises obvious and important questions about the origin of the Moon—did the dust arise by a different process from the rest of the material and, if so, what was the mechanism ? The trouble, unfortunately, is that it will undoubtedly be some time before it can be shown beyond doubt that the discrepancy is not an artefact. The second puzzle seems to have been provided by a piece of lunar rock returned by the flight of Apollo 12 which apparently differs from all previous samples in chemical composition. The sample is said to be a species of quartz containing large amounts of potassium, and its presence on the Moon is a hint of substantial geochemical differentiation.

GAMMA RAYS

Another Survey draws a Blank

by our Astronomy Correspondent

GAMMA RAY astronomists have been having some success recently. First there was the galactic background of high energy gamma rays reported in 1968 by Clark and his colleagues, followed last year by good evidence for a point source of high energy gamma rays in Sagittarius. Happily people can now talk about real fluxes instead of the upper limits which have dominated the subject since early days. There is still a long way to go, however, before gamma ray observations have the influence on astronomy that X-rays have had, for example. Just how far is shown by the latest publication from the group at Case Western Reserve which participated in the discovery of the Sagittarius source (G. M. Frye and Chia Ping Wang, *Astrophys. J.*, **158**, 925; 1969). This group has analysed scans of large areas of the northern sky obtained with essentially the same spark chamber that picked up the point source in a balloon flight from New South Wales a year ago, without repeating its luck. They report four flights from sites in Texas and at Panama City in which the balloon floated at a pressure level corresponding to about 25,000 m. Although the flights more or less confirm the galactic background of Clark *et al.*, something which the later flight from New South Wales did not do, there was no sign of gamma rays from such likely sources as the Crab Nebula, the unusual galaxy M87 and the quasar 3C 273. Clearly, bigger detectors are needed even than the Case spark chamber which is as sensitive as anything flown so far.

The spark chamber works by making visible the tracks of the electron–positron pair which incident gamma rays generate in the plates, and the tracks are recorded on 16 mm film. Gamma rays from 50 MeV up to 2 GeV can be detected, and the precise energy is available from the separation of the electron–positron tracks, although this assumes that the energy is equally divided between the two. The angular resolution at 50 MeV is 2·6°, getting better at higher energies.

The objective of the search is of course that gamma rays ought to be generated in the high energy objects which radio astronomy has revealed, and even upper limits on the gamma ray flux are valuable because they can place limitations on the mechanisms which are at work. The fact that none of the eight quasars which were scanned registered above the background means that matter–antimatter processes are not the energy source, for example.

Clearly, gamma ray astronomy is not out of the woods yet. The Sagittarius source needs to be checked before people can be sure about it, and there is plenty of room for improvement in knowledge of its position. Then there are serious doubts about the magnitude and extent of the galactic background of Clark *et al.* But a good start has been made.

PARTICLE ACCELERATORS

Mirabelle and Serpukhov

THE largest of the four bubble chambers earmarked for use on the giant 76 GeV proton accelerator at Serpukhov near Moscow is due to be transported from its construction site in France within the next few months, and the French are naturally pinning great hopes on the new machine. The Russian accelerator is at present the most powerful accelerator in the world and will remain so until the American accelerator at