collaborating with another organization—the Institute of Physics and the Physical Society—in organizing a conference on the contribution of the government laboratories to industrial physics. The conference will be held in Harrogate from June 7 to 9, when the industrialists will hear fifteen papers from scientists in government laboratories and will discuss ways of overcoming obstacles to the use of new technology and ways in which exploitation can be assisted. Finally, there will be a discussion on making innovation pay.

The papers will include contributions on explosive forming, material processing by glow discharge beams, friction welding, the use of reinforced plastics in large structures, laser holography, computer aids to engineering design, and optics as an aid to industry. These could all help British industry, but the feeling persists that the companies who need the help most are least likely to attend. The companies that do attend, on the other hand, will probably know it already, from literature sources.

More Space for Research

BRITISH space science is a recent development, so young that its grand old men are barely middle aged. Most of them were on hand last week when Dr. F. E. Jones of Mullard, Ltd., opened the first outstation of the Department of Physics at University College, London, which has been involved in British space research since the very beginning. The new laboratory, which will be directed by Professor R. L. F. Boyd, is at Holmbury House, a fine country house once visited by Gladstone and bought for University College as a gift from the Mullard Company.

The laboratory, appropriately called the Mullard Space Science Laboratory, will be concerned with the design of experiments to be flown in rockets and satellites. There are a number of ways in which these can be launched: solid fuel Skylark rockets can be fired to a height of about 300 km from the Woomera range in Australia; ESRO rockets are also available, flying from Kiruna in Sweden or from Sardinia, and the admirable NASA co-operative arrangements allow a number of experiments to be flown from Cape Kennedy or from the Western Test Range in California. The newer satellites, such as the NASA orbiting solar observatory, offer great increases in payload, greater electrical power and improved calibration. The newest and smallest vehicle is the Petrel rocket now being developed by the Atomic Weapons Research Establishment at Aldermaston for production by Bristol Aerojet. This will enable cut-price soundings to be made from the new range at South Uist in the Hebrides.

Perhaps surprisingly, then, there are plenty of opportunities to fly well designed experiments. If there is a great emphasis on careful design, it is because a mistake can cost three years work and perhaps £50,000; not much by NASA standards, but a great deal to University College, whose grant from the Science Research Council has been about £150,000 per annum. (Last week it was announced that in the next three years the S.R.C. will be providing a further £509,000.) The laboratory is now working on experiments for eight satellites and more than thirty rockets; these will include new work in ultra-violet astronomy, as well as the more familiar British work on the ionosphere.

Infra-red Astronomy

ON May 1 and 2 the Royal Society organized a Discussion Meeting on the relatively new subject of infra-red astronomy. As with other wavelength ranges that have recently been opened up in astronomy, the infra-red has provided many surprises, and reports of these were among the highlights of the meeting. The first day was devoted to the Moon, planets and stars.

Drs. Salisbury, Menzel and Goetz described their various measurements on the temperature distribution of the lunar surface. One controversial question was the existence of hot spots which might indicate volcanic activity on the Moon: Dr. Low has observed a hot spot at 20 microns, but other observers working at 8–14 microns have been unable to detect it. Mr. Saslaw discussed the chemistry of Jupiter's upper atmosphere and how organic molecules produced there by photochemical reactions would affect Jupiter's infra-red emission. He emphasized the need for further laboratory measurements of important reaction cross-sections. Dr. Solomon examined the infra-red opacity of the Venus atmosphere caused by pressure-induced absorption bands. In order to explain the surprisingly high surface temperature of Venus by a greenhouse effect, carbon dioxide must dominate the atmosphere unless the total pressure is higher than is currently believed.

The most exciting new infra-red observation at the meeting was reported by Dr. Low. He has found a diffuse region, probably behind the Orion nebula, the observed infra-red emission of which at 20 microns is greater than that of any other object in the sky. The object has an average temperature of about 100° K but becomes brighter toward the centre. If it is associated with the Orion nebula, it would have a diameter of about 20,000 astronomical units, a luminosity of about a million suns, and a mass greater than about a thousand $M_\odot$. How can this be explained? Dr. Cameron suggested a turbulent gas cloud of 1,000 $M_\odot$ in which about 500 stars are just beginning to form. An alternative interpretation offered by Dr. Harwit is that of a large dust cloud surrounding only a few young stars in a later and much brighter phase than the stars described by Dr. Cameron. It may be possible to distinguish between these models by making millimetre radio observations.

The second day was concerned with extended galactic objects such as nebulae and dust clouds, with extragalactic objects and finally with observational techniques. Professor Osterbrock outlined his calculations on line emission in the infra-red from H II regions and planetary nebulae. He hoped that future observations would disprove his predictions so that his rather doubtful assumptions could be modified accordingly. Dr. Peebles described his exciting speculations about young galaxies. He estimated that they had passed through a very bright phase at a time in the past corresponding to a red-shift relative to us in the range 10 to 30. Most of their emission would then be shifted into the infra-red and be spread over a patch of about 15 seconds of arc, because of the magnifying gravita-