with the histories of the geomagnetic field and the Earth's molten core. The present geomagnetic dipole moment is 8×10^{25} gauss cm^3 and has remained within an order of magnitude of this figure since the Pre-Cambrian. Furthermore, available evidence suggests that over the past few million years the mean geomagnetic dipole has tended to increase and that since its formation the molten core has grown. Assuming the Moon's progress to be comparable, 1×10^{20} gauss cm^3 may represent the order of magnitude of the lunar moment for at least several hundred million years. In this case the magnetization of any rock returned by Apollo II will, if it exists at all, be barely detectable.

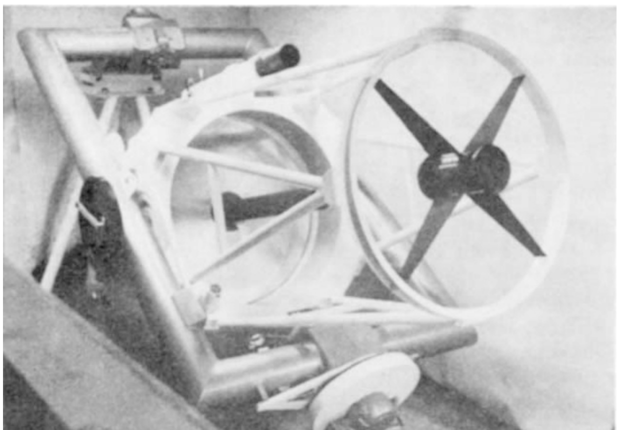
ASTRONOMY

Dusty Stars?

from our Astronomy Correspondent

THE realization that theoretical astronomy needs a thorough knowledge of the behaviour of celestial objects in spectral bands other than the optical and the radio has deservedly brought infrared astronomy out of the murky corner of the literature which it has occupied so far. The grant which the Science Research Council has just awarded to the team at Imperial College means that an overdue start can at last be made on the construction of a respectable flux collector (*Nature*, **221**, 214; 1969). But there is a long way to go before Britain has the expertise which the Americans are building up, which is one reason why the SRC is helping to finance the infrared cooperative of the Universities of California and Minnesota, which will train up to three postgraduate students at a time. The other explanation for the expenditure is the importance British theoreticians attach to having a say in the American programme, and being in close touch with the results.

A report in *Astrophysical Journal* by F. C. Gillett of California, F. J. Low of Arizona, and W. A. Stein of California and Minnesota is just a whiff of the sort of results which theoreticians hope to get from the new generation of infrared telescopes (**154**, 677; 1968). In an investigation of the spectra of several stars in the wavelength range 3 to 14 microns, the American team verified what had already been deduced from wide band observations—that stellar spectra do not perfectly follow a black body law in the infrared. But what has now been done is to examine the spectra of seven stars at moderate resolution, giving a clearer picture of how the discrepancies with the black body curve are made up of a number of emission and absorption features. The spectrometer which was used had already seen service—for example in observations of the planetary nebula *NGC* 7027 (*Astrophys. J. Lett.*, **149**, L97; 1967)—but unfortunately was lost in a fire after the most recent set of measurements were taken. A replacement spectrometer has now been constructed by the California–Minnesota collaborative to carry on the work.



A 60 inch infrared telescope with metal primary mirror, built by Astro Mechanics Ltd, which the California–Minnesota group hopes to buy.

The commonest features of the spectra were a broad absorption band between 4·5 and 5·5 microns, which could be the result of CO molecules in the atmospheres of the stars, an absorption at 8 microns, and an emission near 10 microns. One of the stars also deviated from the black body curve at shorter infrared wavelengths, probably because of absorption by hot water vapour in the star's atmosphere. But it is the detection of absorption and emission features at 8 and 10 microns respectively which most struck Gillett, Low and Stein. They put forward two tentative explanations. One is that an infrared excess at long wavelengths might come about from a judicious combination of opacity and temperature in stellar atmospheres. A more attractive possibility for the peak at 10 microns is that it somehow arises by emission from a cloud of dust around the star, on a more ambitious scale than the dust cloud around the Sun, showing up as the zodiacal light. A model along these lines has already been published by Wayne Stein of Princeton to account for earlier wide band measurements which also showed an emission at 10 microns in some cases (*Astrophys. J.*, **145**, 101; 1966). According to Gillett, Low and Stein, the extra emission they detected from the star μCep, for example, could come about on this model from a cloud of one micron particles of total mass very roughly that of the Earth, at a distance of 10^{10} km from the centre of the star. But in view of the importance which is beginning to be attached to interstellar dust in the evolution of the universe, the matter is unlikely to rest here.

ELEMENTARY PARTICLES

The Bootstrap in Difficulties

from a Correspondent

THE bootstrap idea in elementary particle physics has great attractiveness and simplicity. It does away with the notion of any truly elementary particles by requiring that all particles be bound states of each other; for example, the rho meson is a particle caused by the binding of two pi mesons due to the force produced by the exchange of the rho meson itself between two such pi mesons.

Many calculations have been made in an attempt to show that the bootstrap idea does really work for strongly interacting particles, and even to show that the internal symmetries of these particles arise in a bootstrapped fashion. Gasiorowicz[1] has reviewed these calculations, which have not all agreed with each other, partly because they have different starting points,