cussion rather academic but democracy being what it is a firm decision by Britain's 17% could sway the day.

Four major missions were discussed, the Space Telescope clearly winning the day and being regarded as an instrument of outstanding and paramount importance. It is hoped that the telescope will appear in NASA's 1978 budget although it has already slipped considerably in time and in size, the main mirror now being 2.4 m in aperture. From its 500–600 km high orbit it will be able to detect objects 100 times fainter that those detectable from the Earth's surface (it will be able to pick up 29th magnitude stars) and will have an angular resolution better than 0.1 arc s, some 10 times better than attainable from the ground. Coupled with this diffraction-limited performance is the fact that being free from atmospheric absorption it will have a spectral range of 912 Å to 1 mm. Within our Galaxy it will study the early and late stages of stellar evolution, the position and proper motion of stars, the dust distribution and hydrogen concentration and also our Solar System. Extragalactic work will include investigations of the structure, scale and evolution of the Universe, the structure and content of galaxies and also quasars. It is obviously a project that no astronomical nation wants to be left out of. NASA and the US Congress look to ESA to contribute more than 10% of the cost in return for an equal percentage of the observing time and an involvement in directing the project. This 10% of the cost would be spent in Europe, designing, developing and constructing some of the instrumentation and the technology (for example the faint object camera and the solar arrays). This cooperation would of course mop up a considerable amount of ESA's science budget for a few years and, while recognising the great importance of the project, some of the scientists present at the meeting pointed out that science *per se* would not suffer if we did not participate, the Americans probably going on by themselves, whereas spending the money on specifically European ideas might open up new horizons in different fields.

The second mission considered was again a cooperation wth NASA and involved two spacecraft launched simultaneously towards Jupiter from a space shuttle, and then guided in such a way that one would be deflected by Jupiter towards the north pole of the Sun, the other passing over the south pole. ESA would supply one spacecraft and NASA would use a Pioneer type spacecraft for the other. This "out of ecliptic" mission would provide a new insight into interplanetary and solar physics and the science of the Jovian magnetosphere, mainly by taking the observer away from the plane of the planetary orbits where the large majority of observations have been made to date. The two satellites would obtain a stereoscopic view of the Sun and help to test the fundamental symmetry of the Solar System. The basic experiments would consist of a magnetometer, a plasma probe, a solar particle telescope, a cosmic ray telescope, a receiver for studying radio propagation, a coronagraph and a XUV heliograph. The 85° inclination of the orbits to the ecliptic will enable the development of equatorial structures on the Sun to be followed continuously through several solar rotations.

Three other projects are to be studied further. LIRTS, a 2–3 metre classical, uncooled Cassegrain infrared telescope on Spacelab would provide high sensitivity photometry with high spatial resolution enabling many astronomical objects to be studied through the measurement of atomic and molecular lines in the far infrared. EXPOS again uses Spacelab to fly a set of instruments to study the spectra of cosmic X-ray sources and to detect polarised X-ray emission. The payload comprises a number of large area Bragg spectrometers each selected to study particular features in the 0.5 to 10 keV range. Spatial resolution of about 1 arc min and energy resolution of 10 to 20% at 1 keV is obtained by using an X-ray grating with a large area Walter I grazing incidence mirror. The third project concerned magnetospheric experiments from Spacelab and drew the fascinating picture of a series of tethered subsatellites around Spacelab, like dogs on leads, making multipoint plasma measurements. All these projects have the advantage to the UK that they support research fields in which British scientists are very active and proficient.

The afternoon session of the meeting discussed last year's batch of mission studies and chose the ones that the British scientists would like to go forward for a phase A (feasibility) study. These projects stretched the

Aphids, ants and pheromones

from our Insect Physiology Correspondent

It was shown by J. S. Edwards many years ago that the secretion from the cornicles of aphids consists of oily droplets, now known to be a mixture of triglycerides, in aqueous suspension. On release in contact with a solid surface this secretion quickly crystallises to form a hard waxy plaque. It thus provides a mechanical protection against small predators and parasites.

In recent years the cornicles have been found to liberate also alarm pheromones, which are secreted in response to predators and parasites. Bowers *et al.* (*Science*, **177**, 1121; 1972), isolated and identified *trans-β*-farnesene (TBF) as the alarm pheromone in several aphid species; this secretion seems also to repel other aphids encroaching on occupied feeding sites. As with the alarm pheromones of many insects, TBF is interspecific: it is present in all species examined in the subfamily Aphidinae, and all of them (with the exception of the turnip aphid *Hisdaphis*) show alarm activity to pure synthetic TBF. But other unidentified alarm pheromones are present in addition to TBF and these different blends of pheromone probably account for the different responses in different aphid species. Thus the turnip aphid which fails to react to TBF, secretes this pheromone in its cornicle fluid, and it reacts to the secretions of other aphid species.

Nault, Montgomery and Bowers (*Science*, **192**, 1349; 1976) have now studied the response to these pheromones in the ants which herd certain aphid species. These myrmecophilous aphids enjoying, as they do, protection by their ants from predators, are much less responsive to the alarm pheromones than non-myrmecophilous species. They may walk away on exposure to the alarm pheromone, but they do not drop off the feeding site. At the same time, and not surprisingly, the ants themselves respond to aphid alarm pheromones. In experimental trials it appeared that the ants were prepared to stroke with their antennae any aphid species they were offered; but the different aphid species vary widely in the readiness with which they excrete droplets of honeydew for their ant keepers. Some species will not respond at all. The Macrosiphini were caused to disperse by the ants' stroking: this provoked a predatory response by the ants, and the aphids were carried off to the nest and presumably eaten.

The acceptance of the attentions of ants replaces response to alarm pheromones: the myrmecophilous aphids rely on their ants for protection. Indeed, artificial liberation of TBF leads to attack by the ants, not on the aphids but on any suspected predators by which they appear to be attacked. The threshold of response to the pheromone by the ant is, indeed, even lower than the threshold in the aphids themselves.