news and views

Apollo asteroid Helin

from David W. Hughes

CONSIDERABLE excitement was caused by the discovery in January of asteroid 1976 AA because it has subsequently been found to be the first asteroid whose mean distance from the Sun is less than that of the Earth. Eleanor Helin (California Institute of Technology) discovered the object on photographic plates taken with the 18 inch Schmidt telescope of the Palomar Observatory on January 7. It was then a faint 14th magnitude object in the constellation of Gemini. Using 46 observations taken between January 7 and February 3 Brian Marsden (Smithsonian Astrophysical Observatory) calculated the orbit of the asteroid and this is shown in Fig. 1.

On page 691 of this issue of *Nature*, Morrison, Gradie and Rieke of the Lunar and Planetary Laboratory of the University of Arizona report that the asteroid has a mean diameter of 900 ± 200 m and a visual geometric albedo of 0.20 ± 0.07 . So Helin becomes the smallest asteroid ever to have its diameter measured accurately. (The asteroid will not be spherical but will have an irregular shape rather like that of Phobos, a satellite of Mars.)

A radiometric technique was used to obtain the diameter and albedo. The principle of the technique is simple. A fraction A (known as the albedo) of the total sunlight striking the body is reflected whereas the rest is absorbed. The reflected radiation appears as the visual brightness, whereas the energy absorbed by the body (assuming the

body is in thermal equilibrium and non-volatile) is re-emitted as thermal infrared radiation. The ratio between the reflected and re-emitted radiation gives the albedo. Combining this albedo with either the visual or the infrared brightness of the object gives the radius. Unfortunately there are a few snags. All the infrared radiation cannot be measured from ground-based observatories as the $8\text{--}14\text{ }\mu\text{m}$ and $17\text{--}28\text{ }\mu\text{m}$ windows of the Earth's atmosphere must be used. Second, the infrared emissivity of the soils and rocks on the small airless asteroid must be assumed as must also the dependence of the albedo on the solar zenith angle and on the wavelength of the incident energy. The rotation of the asteroid causes the unilluminated hemisphere to radiate some part of the absorbed solar radiation at the expense of the radiation from the illuminated hemisphere. The mean temperature of the observed disk is thus decreased by an amount dependent on the rotation period and the thermal inertia of the surface, leading to an over estimation of the radius. Morrison (*Icarus*, **19**, 1; 1973) finds that at wavelengths greater than about $10\text{ }\mu\text{m}$ the flux is sensitive to rotation and that all the above factors lead to a 10% uncertainty in the radius and a 20% uncertainty in the albedo.

Spectrophotometric studies indicate that asteroid Helin has a surface which resembles that of stoney, siliceous meteorites and not a carbonaceous chondrite as previously reported (*Sky*

Fig. 1 The orbit of Helin (*IAC Circular*, No. 2915, February 24, 1976). Helin is shown at perihelion (P) and the position of the Earth at this time is also indicated. Helin will reach the aphelion of its orbit (A) on November 9 this year. (γ is the first point of Aries.)

and *Telescope*, **50**, 158; 1976). Siliceous surfaces seem to be common among Apollo and Amor asteroids.

Helin is the 20th Apollo asteroid so far discovered and joins her more distinguished cousins Icarus, Geographos and Toro in this group of asteroids characterised by having perihelia inside the Earth's orbit.

Shoemaker (CalTech) points out that asteroid Helin is also one of the easiest places to get to in our Solar System apart from the Moon. It makes a most attractive target for an unmanned space mission. Asteroids—half way in mass between meteorites and planets—probably are typical of the building blocks which coalesced to form the planets. Not suffering from convective differentiation and geophysical and atmospheric effects as the planets did, they are most probably in the form of the original condensate from the pre-Solar System nebula and as such furnish an outstanding clue to the origin of the Solar System. □

Plasmid exclusion and incompatibility

from J. R. Saunders

MANY bacteria carry self-transmissible plasmids that characteristically inhibit infection with the same or related plasmids. This phenomenon of superinfection immunity is the result of the presence of two genetically and physiologically distinct barriers, surface (entry) exclusion and incompatibility.

Surface exclusion is probably a device to prevent unnecessary mating within a population of homologous male cells. Exponential cultures of bacteria carrying a transmissible plasmid are therefore poor recipients in matings with donor cells carrying a homologous sex factor. Exclusion is believed

to involve recognition by the recipient of a specific (homologous) sex pilus on the donor and result in blockage of the transfer of DNA. It is mediated, at least in part, by the *traS* gene which forms part of the transfer operon of the F factor (Helmuth and Achtman, *Nature*, **257**, 652; 1975; Willetts, *J. Bact.*, **118**, 778; 1974). But the *traS* product is required only in the recipient and not the donor for surface exclusion to occur. The observation that disruption of the mucopolypeptide layer of donor cells abolishes the surface exclusion specified by the R plasmid R1drd19, whereas similar disruption in recipients

has no effect, (Beard and Bishop, *J. Bact.*, **123**, 916; 1975), is therefore surprising. Beard and Bishop suggest that surface exclusion is a barrier to exit of DNA from donor cells rather than, as has previously been assumed, to entry of DNA into a recipient. It is presumed that a component (termed ML factor) associated with and dependent on integrity of the mucopolypeptide in the donor interacts with the *traS* product from the recipient. This leads to prevention of either establishment of stable mating pairs or mobilisation of DNA for transfer. Transport of the *traS* product to the donor must presumably occur