physical sciences notes

GEOPHYSICS

Upper atmosphere electrons

Investigations of high-speed electrons that continually bombard earth's atmosphere from space are being carried on by Great Britain's new, low-cost rocket, Petrel. Petrels are being launched from the South Uist rocket range in the Hebrides Islands off the Scottish coast. The first scientific payload carries electron experiments devised by the Science Research Council's Radio and Space Research Station.

The electrons in question arrive from somewhere outside the atmosphere. Where is not known, but the Van Allen belts are suspected.

At high latitudes the bombardment is so severe that the atmosphere is made to glow, producing the auroras. At the same time the normal layer of ionization in the atmosphere is so violently disturbed that radio communications are disrupted.

Questions to be answered by the Petrel experiments are: In what numbers do the electrons arrive? How fast are they going when they enter the atmosphere and how much do they change the normal ionization?

Petrel is a solid-fuel rocket developed jointly by the Ministry of Technology's Rocket Propulsion Establishment, The Atomic Weapons Research Establishment and Bristol Aerojet Ltd.

ASTROACOUSTICS

Sound may power interstellar maser

Acoustical waves generated in interstellar graphite flakes may be the ultimate source of the anomalous radio power put out by the hydroxyl radicals in interstellar gas clouds.

Hydroxyls, combinations of one hydrogen and one oxygen atom, have been seen in interstellar space since 1963, but because of the peculiar manner in which they radiate they were at first not recognized for what they are.

Hydroxyls radiate a distinctive pattern of sharply defined radio frequencies. These were found in the 1963 emanations (at first dubbed mysterium) but the ratios of their intensities were not what quantum mechanics predicted for the molecules in a natural state.

Observers finally decided that the mysterium was indeed hydroxyl, but that it was subject to some kind of maser action that accounted for the unusual intensities. The problem was explaining the origin of the maser action.

Now Dr. N. C. Wickramasinghe of the Institute of Theoretical Astronomy, University of Cambridge, suggests (in NATURE, March 23) that interstellar graphite flakes—stellar debris—may play a part.

He notes that acoustic pulses of microwave frequency can be amplified in certain semiconductors (graphite is one) and generate electromagnetic pulses of the same frequency.

The process would be started by shock waves that set the flakes into rotation. Interaction between the rotation and the interstellar magnetic field would build up the acoustic vibrations. The radio waves they then generate would pump the hydroxyl's emissions.

COSMOLOGY

Ghost quasar images

A theory that the entire universe may act as a lens and form multiple images of single quasars has been put forward by Dr. Vahe Petrosian of California Institute of Technology and Dr. Edwin Salpeter of Cornell University.

Einstein's theory of general relativity predicts that light rays will be bent by the gravitational effects of massive bodies. Drs. Petrosian and Salpeter reason that if the universe were the proper shape and mass were properly distributed inside it, then it might bend light rays from quasars so as to form images of them in places where they are not.

The quasars most susceptible to multiple imaging would be those with red shifts of 1.95. These do in fact appear in large numbers and they do appear to be at the same distance in space as the multiple images of the new theory would be.

Observation of several quasars in the same part of the sky with identical properties (not only red shift) should support the theory. But, the authors point out, the theory is complex and observations are difficult. So statistical analysis of observations over a long period of time may be necessary.

The theory is published in THE ASTROPHYSICAL JOURNAL for February.

ASTRONOMY

Stratoscope II tests successful

Stratoscope II, Princeton University's balloon-borne telescope system, has successfully undergone tests in a simulated space environment run by the General Electric Company at King of Prussia, Pa. The telescope, which is three stories tall, and weighs nearly four tons, was tested to verify that its remotely controlled system will operate reliably at the low temperatures and in the rarified atmosphere it will encounter in flight.

Plans are to launch Stratoscope II from the National Center for Atmospheric Research Scientific Balloon Flight Station in Palestine, Texas, sometime this spring. The flight will begin about an hour before sunset and will last all night. The telescope will drift with the wind, but a complicated electronic guidance system will allow it to remain locked on a star or planet so that photographs with exposure times up to half an hour can be made. The optical system is capable of a photographic resolution of 0.1 second of arc—equivalent to distinguishing objects 30 inches apart at a distance of 1,000 miles.

Purpose of the flights is to put the telescope above 98 percent of the atmosphere so as to get the clearest photographs yet of planets, gaseous nebulosities, stellar systems and galactic nuclei.