space sciences

Measuring the corona's temperature

New data from Orbiting Solar Observatory 7 (OSO), launched Sept. 25, indicate that there are clear temperature boundaries between the polar and equatorial regions of the sun's corona. The corona is the tenuous, outer solar atmosphere; it extends millions of miles into space.

OSO 7's instruments determined that temperatures in the main part of the corona were two million degrees F.; the polar regions, one million degrees F.; hot spots, three million to four million degrees F. and solar flares, ten million degrees F. The region of the corona measuring two million degrees F. is composed of two belts extending 20 to 30 degrees north and south of the equator. Before these measurements, scientists had assumed that the corona's temperature was more homogeneous. "This is really a puzzle," says Werner Neupert, OSO principal investigator at the Goddard Space Flight Center in Greenbelt, Md.

These preliminary data tend to support a hypothesis derived from sounding rocket observations that there are seasonal variations in the size of the cooler polar regions of the corona. The cooler areas appear largest during times of least solar activity; they are at a minimum or perhaps disappear during times of intense activity. Solar activity varies with a cycle of 11 years.

Pinning down elusive cosmic ray flashes

Apollo 11 astronaut Edwin E. Aldrin saw light flashes in the spacecraft during his lunar flight (SN: 5/30/70, p. 523). Since then, subsequent crews have conducted inflight experiments recording the time intervals and approximate direction of the flash incidents. Scientists are fairly convinced now that the flashes are caused by ionizing effects of high-energy cosmic-ray particles in the retina. The flash rate averages one to two per minute, per eyeball, per astronaut.

Charles Barnes, Richard Benson and Lawrence Pinsky of NASA's Manned Spacecraft Center in Houston are coinvestigators for a new experiment to find out more about this phenomenon. During the flight of Apollo 16, astronaut Thomas Ken Mattingly will wear a special helmet for an hour that will measure the energy, charge and trajectory of these particles and record the time of penetration. On the helmet are three sets of glass plates containing a nuclear emulsion—one set on each side of the head and one in front. Scientists will then be able to correlate the inflight verbal observations of the flashes with the swaths cut out in the plates by the particles.

Probing the earth's ionosphere

In December NASA will launch the fourth in a series of satellites for the Science Research Council of the United Kingdom. UK 4 (to become Ariel 4 after launch) will orbit at an altitude of 550 kilometers to collect information about the earth's ionosphere.

UK 4 has four British instruments aboard and one supplied by L. A. Frank of the University of Iowa that will measure interactions between plasma, charged particle streams and electromagnetic waves and effects of magnetic storms on the earth's magnetic field. The satellite will also collect data about intense bands of radio noise found in this region.

Ariel 1 was launched in 1962; Ariel 2, in 1964, and Ariel 3, in 1967.

environment

Cheap, pollution-free gas turbine

Gas turbines for automobile use have major liabilities. High-temperature operation produces nitrogen oxide emissions and requires expensive alloys for turbine blades. High operating speeds pose problems of transmission of torque to wheels.

Two University of Oklahoma engineers and a Santa Cruz, Calif., colleague say they have solved the temperature-caused problems with a water injection system.

The new system takes water condensed from engine exhaust and injects it into air entering the combustion chamber, thus reducing the turbine's temperature from 2,200 to 1,500 degrees F. This lower temperature prevents formation of nitrogen oxides (a major component of smog) and allows use of inexpensive stainless steel for turbine blades.

The Santa Cruz member of the team, Walter C. Bauer, says the combustion-related features of the new system have been proved in the laboratory. Still a major problem, however, is to develop a condenser small enough to be feasible for automobiles.

The other two researchers are Darrel G. Harden and Walter J. Ewbank of the University of Oklahoma.

Methyl mercury and reproduction

Grains treated with methyl mercury and eaten by ring-necked pheasants in an experiment conducted for the Canadian Wildlife Service caused interference with reproduction at various stages—but at the same time apparently reduced mortality in adult birds.

Researcher Norvald Fimreite fed the grains—treated at 100, 50 and 25 percent of levels recommended to kill grain fungi—to the pheasants. Three prime effects on reproduction were noted in all three groups: reduced hatchability of eggs, reduced egg production and increased numbers of eggs without shells (listed in order of significance). Apparently the reproductive systems of both male and female birds were affected.

Fimreite says levels of methyl mercury induced in his experimental birds were comparable to those sometimes found in wild birds. Although the methyl mercury apparently reduced mortality in adult birds, the birds fed higher levels showed signs of toxicity.

High PCB levels menace ospreys

Ospreys in the Long Island Sound area have the highest levels of polychlorinated biphenyls (PCB's) of any North American wildlife, according to research by a Cornell University graduate student and a University of California biochemist. PCB's are industrial compounds similar to DDT in persistence, toxicity and concentration up the food chain.

Paul R. Spitzer of Cornell says he and Robert Risebrough of UC Berkeley found PCB levels in Long Island Sound ospreys of up to 2,270 parts per million, many times the level that caused massive embryonic deaths in earlier experiments with other bird species.

The osprey, with a wingspan of about five feet, is a fish predator, sometimes called a fish hawk. Formerly the Long Island Sound area had the greatest known concentration of nesting ospreys, but there has been a major decline in recent years. U.S. Fish and Wildlife Service studies indicate failure of egg hatching is a prime cause of the decline.