physical sciences

Neutrinos point to pointlike partons

In 1969 a series of experiments were reported that seemed to show that neutrons and protons are composed of granular, pointlike constituents rather than being homogeneous blobs of matter. The constituents were given the name partons (SN: 8/30/69, p. 164).

The experiments used electrons as probes, scattering them inelastically off the target neutrons and protons. One step towards corroboration of the finding is to see whether evidence for partons appears when other particles are used as probes. Now in the Jan. 21 PHYSICAL REVIEW LETTERS comes evidence for partons when neutrinos are used as probes.

The work was done at the National Accelerator Laboratory by a group of 13 physicists (A. Benvenuti et al). In the experiment both neutrinos and antineutrinos with energies up to 160 billion electron-volts were bounced off neutrons and protons. The result gives the ratio of the total interaction cross section (probability) for antineutrinos to that for neutrinos as 1 to 3. This ratio is predicted theoretically if partons are pointlike particles of matter (no antimatter among them) with spins with half a spin unit and if they obey the exclusive Fermi-Dirac statistics, which means that no two of them can be in exactly the same energy state at the same time in the same place.

Black-hole disks unstable

The theory that binary X-ray sources are systems in which one component is a black hole proposes that the X-rays come from a thin disk surrounding the black hole. This disk is matter that comes from the black hole's companion. The particles of matter rotate around the black hole and gradually drift inward, losing angular momentum through viscous effects until they fall into the hole. The disk, as a configuration, is held to be stable.

One of the assumptions on which this picture is based is that the viscous stress inside the disk is directly proportional to the sum of the gas pressure and radiation pressure (from the emitted X-rays). In the Jan. 1 ASTROPHYSICAL JOURNAL LETTERS Alan P. Lightman and Douglas M. Eardley of California Institute of Technology present an argument to show that under the assumption the disk is unstable and would disappear in a few seconds.

They present two alternative modifications of the theory. The one they say is favored by observations of the source Cygnus X-1 indicates that instead of a disk the accreting matter will form a cloud 10 to 100 times as large as the black hole. Such a cloud would produce an X-ray signal that varies chaotically in both intensity and spectral distribution on a time scale of 10 to 100 milliseconds or longer.

The other alternative would permit a disk to form if the viscosity is made to depend on the density of the disk as well as the sum of the pressures. Such a disk would get very dense near the black hole, and it would not produce a chaotic signal like the one seen in Cygnus X-1.

Minor constituents of Jupiter's atmosphere

Spectra of the planet Jupiter obtained in the region around 10 microns wavelength (intermediate to far infrared) indicate the presence of ethane and acetylene in the planet's atmosphere. S. T. Ridgway of Kitt Peak National Observatory reports in the Jan. 1 ASTROPHYSICAL JOURNAL LETTERS that the molecules appear by emission. The proportion of ethane is about four parts in a thousand, that of acetylene about eight in a hundred thousand.

aerospace

Satellite crop imagery meets delays

Time may not be a critical factor in some uses of earth resources photography from space (such as geological explorations) but others (such as crop studies) often depend on prompt dissemination and interpretation of the data. This was emphasized last week at the annual meeting of the American Institute of Aeronautics and Astronautics by Richard A. Phelps of Anderson Clayton and Co., Houston, in a report of efforts to apply such remote sensing to a severe cotton mold.

Earth data from Skylab and from the Earth Resources Technology Satellites are first processed photographically by NASA. Then they are sent to the Earth Resources Observation System Data Center in Sioux Falls, S.D., along with indexing references that cover the date, orbital pass, location and amount of cloud cover. NASA officials admit that their part of the process needs speeding up, and Phelps points out that the data center is in a new building, with a relatively new staff, and has been swamped with orders. "ERTS or Skylab imagery is most valuable to us if available within a few days from date of observation," he says. "Delay of a few weeks can be tolerated in some cases. The imagery is of relatively little value after it is a few months old."

A second problem is locating qualified interpreters of the data. "I have talked to researchers at many of the leading university, government and private-industry research laboratories," says Phelps, "but have yet to locate an individual qualified to interpret color infrared film of cotton fields." NASA aids in interpretation only for its own principal investigators.

Into the wild with satellites

Compact, portable ground stations will be added this summer to the Canadian Telesat communications satellite system, enabling the service to expand into isolated rural areas and "virtually anywhere a ski, float or wheeled aircraft can operate."

The small stations will be transportable aboard twin-engine, short-takeoff-and-landing (STOL) aircraft, while larger, trailer-mounted terminals with 32-foot antennas will be delivered by road to more accessible, but as yet unserviced, areas.

An experiment in stretching the service is scheduled for this month, when the satellite system and other carriers will work with several major oil companies to link arctic exploration sites with the companies' head offices in southern Canada.

Telesat also plans to add, early next year, a satellite digital transmission link between central Canada and the Atlantic Coast terminal of the Cantat II transatlantic cable.

Japan joins the club

Japan has announced plans for its first communications satellite system, scheduled to begin operation in about three years.

The first satellite will be an experimental version, equipped with two high-powered television channels, capable of relaying two broadcasts simultaneously to low-cost ground stations throughout Japan. It is to be placed in a synchronous orbit, keeping it in a fixed position over Japan, in late 1976 or early 1977. The satellite will be built by General Electric's Space Division, Valley Forge, Pa., with subsystem design and support work by Toshiba of Japan.