

physical sciences

ASTRONOMY

Solar wind flow around Venus

Observations made by instruments on the U.S. Venus probe Mariner 5 and Russia's Venus 4 (SN: 11/4/67, p. 439) indicate that the interaction of the solar wind with earth's sister planet is quite different from that with earth.

In these two cases, there is a bow shock wave, and most of the solar wind appears to be deflected around the atmosphere. But Venus's shock wave is much closer than the earth's is, according to observations made last fall.

Dr. Leverett Davis Jr. of California Institute of Technology reported some plausible but tentative deductions from observations to the National Academy of Sciences meeting in Pasadena. On the sunward side, he believes, the solar wind flux was balanced by a combination of magnetic pressure, originating from passing interplanetary magnetic fields and not from the planet, and ionospheric gas pressure. The earth's own magnetic fields keeps its shock wave far out.

There may also have been, he suggests, a stagnant, high density wake in which there was very little magnetic field effect.

ASTRONOMY

Eros observations yield solar distance

Although the distance to the sun has been known accurately for several years from extrapolation of radar observations of Venus and the laws of celestial mechanics, scientists like to have independent verifications of such fundamental constants to insure against unknown sources of error.

One good non-radar technique involves measurement of the motion of asteroid 433, Eros, whose orbit is strongly affected by the earth's gravity. Long-continued observations of its erratic path yield an accurate value of the earth's mass relative to the sun's; from this the solar distance is readily calculated.

The most extensive study to date of this kind has been completed by Jay H. Lieske of Yale University Observatory, who used 8,639 Eros observations extending from pre-discovery photographs in 1893 to 1966.

He calculates the sun-earth distance—so basic it is called the astronomical unit—at 92,957,200 miles, plus or minus 50 miles. This agrees almost exactly with the value based on radar observations of Venus adopted by the International Astronomical Union four years ago, it is reported in the October SKY and TELESCOPE.

GEOLOGY

Aerobic origin for hard coal suggested

Available evidence suggests the existence of two separate and different processes of coal formation, Dr. Frits W. Went of the University of Nevada believes. One produces the oxygen-containing substances predominant in lignite or brown coals; the other leads to low-oxygen hard coals and anthracites.

The soft coal process occurs underground in peat bogs, Dr. Went reported to the National Academy of Sciences meeting at the California Institute of Technology. The

hard coal is produced in the air: Light energy transforms volatile plant products into high carbon, sootlike products that can be filtered out of the air.

Dr. Went points out that the obvious similarities between anthracite coal and oil formation in the earth's crust—the bituminous content of many coals and the asphaltic component of oil source deposits—result from their similar origin. Both are derived from volatile plant products turned by sunlight into condensation nuclei that are precipitated and can be deposited and stored in sedimentary geological formations.

CHEMISTRY

Rare isotopes sold for first time

Three transplutonium radioactive isotopes—californium 252, americium 243 and curium 244—have been placed on public sale by the Atomic Energy Commission.

The price for californium 252, one of the world's rarest materials, would be \$450 billion per pound, if a pound were available. The price is more reasonably stated as \$100 for one-tenth of a microgram. The other two isotopes cost \$100 a milligram and will be sold in quantities up to 10 milligrams at one time.

In the past, samples of these elements have been made available only to Government and university research departments in the United States and abroad. This is the first time they have been available for sale to commercial and industrial applicants.

All three elements are good sources of neutrons, largely unavailable otherwise except from reactors or other expensive equipment.

Their applications to research is expected to have far-reaching effects in treating cancer, yielding higher quality industrial products and increasing energy resources.

ASTRONOMY

Galaxies with companions

Some galaxies have companion bodies apparently linked to their spiral arms. They were found during scrutiny of high resolution photographs taken with the 200-inch telescope at Mt. Palomar, California. Dr. Halton C. Arp of Mt. Wilson and Palomar Observatories has studied six of the best examples. The galaxies have approximately the same red shifts as the companions, meaning that they are the same distance from earth.

If the systems are gravitationally bound and the companions are not escaping, there are conclusions that can be drawn: Rotation in the main spiral galaxy should wind up the connections to the companions in about a billion years. This is about the time required for a spiral galaxy to make one full rotation, Dr. Arp reported to the NAS meeting.

Since the connecting arms are not observed to be wound up in this class of objects, the combinations are not older than a billion years, much younger than most galaxies are thought to be.

Since a companion is attached to the main galaxy's center by a luminous filament—the spiral arm—he suggests that the material now forming the companion was ejected from the nucleus of a larger galaxy some billion years ago.