Physical Sciences Notes

GEOPHYSICS

Smithsonian's Standard Earth

A set of constants defining the size, shape and gravitational field of the earth is now available as a three-volume set from the Smithsonian Astrophysical Observatory in Cambridge, Mass. The paper-bound volumes, titled "1966 Smithsonian Standard Earth," contain the theoretical analyses, mathematical details and the methods used to obtain the set of constants.

After taking more than 250,000 sequences of satellite photographs from an international network of 12 Baker-Nunn cameras and after making more than 160,000 precise measurements from these films, scientists at the Smithsonian find they know the relative positions of the 12 cameras to within 10 meters.

The Smithsonian results were compared with those from the Jet Propulsion Laboratory, based on precise relative locations of its Deep Space Instrumentation Facilities obtained from accurate radio tracking of Ranger flights to the moon.

By conventional land surveying techniques, it was possible to link directly the three DSIF stations with three Smithsonian stations in New Mexico, South Africa and Australia. The two geodetic systems were found to agree within their stated uncertainties, a result scientists at both institutions have found extremely encouraging.

Satellite observations also provided the basis for another current Smithsonian publication, "Diurnal and Seasonal-Latitudinal Variations in the Upper Atmosphere."

SOLAR SYSTEM ASTRONOMY

Radar 'Shrinks' the Moon

Although the difference is imperceptible even through a telescope, scientists using radar find the moon is actually 2.4 miles smaller in diameter than had been thought.

They also find that the moon's central region has a bulge ranging from 5,000 feet in the flatlands to 15,000 feet in the mountains. Existence of such a bulge and its size had been a source of controversy among astronomers for many years.

Using a highly sensitive radar system, scientists at the Naval Research Laboratory in Washington, D. C., determined that the average lunar radius is about 1.2 miles less than the previously accepted value of 1,080 miles.

When the radar data is combined with information provided by two moon craft, the central bulge can be measured, Allan Shapiro of NRL reported to the Committee on Space Research (COSPAR) meeting in London (see p. 160).

Although the NRL scientists have been attempting to determine the lunar radius with radar since 1957, a high degree of accuracy was not possible until last year when Lunar Orbiters I and II pinpointed the center of mass for the moon. This value allowed them to complete an equation with which an accurate determination of the moon's radius can be made using radar data.

E. A. Uliana, B. S. Yaplee and S. H. Knowles, all of NRL, were co-workers of Shapiro in making the first accurate measurement of the moon's size.

ASTROPHYSICS

Quasars: Young Galaxies?

Quasars are actually young galaxies in the process of formation, consisting mostly of dark masses not yet shining by their own light as stars do.

This would account for the puzzling light fluctuations over very short periods of time observed for many quasars (SN : 4/22), Dr. W. H. McCrea of the University of Sussex, England, reports in the July 28 SCIENCE. Quasars are extremely intense sources of light, but how they generate such tremendous energy is an enigma.

Dr. McCrea believes that the rapid light variations provide evidence supporting his theory that a quasar is an "early stage in the formation of a system like the nucleus of a galaxy."

At any instant, the optical radiation would come from one or a few temporary stars located among a very large number of protostars. The rapid light fluctuations occur when the dark protostars pass in front of the optically visible star. Variations having a longer time period, Dr. McCrea suggests, are due to the random order in which the stars explode.

ORGANIC GEOCHEMISTRY

New Series of Ancient Chemicals

In recent studies on the origin of petroleum, much emphasis has been placed on the structural relationship between compounds occurring in petroleum and their possible natural precursors, organic molecules that are believed to have survived virtually unchanged from their original form.

A series of compounds, known as the isoprenoid isoalkanes, have received much attention, partly because of their sometimes strikingly high concentrations, partly because of their possible relationship to phytol, a compound formed when chlorophyll is hydrolyzed.

Three scientists working in The Netherlands report in the July 29 NATURE that they have identified a new series of isoprenoid isoalkanes both in crude oils and in bituminous shales dating back to the Cretaceous period some 65 million years ago.

FLUID PHYSICS

Collapse of Turbulent Wake

The turbulent wake that jet planes leave when they climb through the atmosphere can be simulated in a laboratory tank three inches deep, one inch thick and 12 inches long. Exhaust trails of jets taking off illustrate the kind of wake collapse Dr. Allen H. Schooley of the Naval Research Laboratory in Washington, D. C., has studied in miniature.

He reports in the July 28 SCIENCE that his model can be used to obtain quantitative data on the characteristics of turbulently mixed wakes of objects traveling through stratified fluids, that is, fluids more dense everywhere below than above, as are both the atmosphere and the oceans.