physical sciences

PHYSICAL CHEMISTRY

Structure of water

The structure of liquid water is generally viewed according to one of two models, say Drs. Jerome Schiffer of Temple University and Donald F. Hornig, the President's Science Adviser. One model proposes that when ice melts, large numbers of hydrogen bonds break; the second proposes that the hydrogen bonds merely bend.

But, Drs. Schiffer and Hornig point out in the Nov. 1 JOURNAL OF CHEMICAL PHYSICS, when the infrared spectrum of water is compared with those of simple hydrates, anomalies show up that cannot be explained in terms of either of these models. Investigation of the anomalies, the two chemists say, shows that molecules in liquid water are highly distorted by collisions and that the distortion involves the hydroxyl (OH) bonds.

GEOPHYSICS

Ions in layers

The metallic elements of which meteorites consist—iron, magnesium, sodium, aluminum and nickel—are found at altitudes between 80 and 120 kilometers, where meteors disintegrate in earth's atmosphere. Distribution of these elements was expected to be randomly diffuse.

Metal elements that have become ionized are not so distributed, Dr. Rocco S. Narcisi of the Air Force Cambridge Research Laboratories has found. He analyzed data from 13 rocket flights launched from widely spaced sites. One kind of metal ion will predominate at a certain level, his analysis showed.

In one profile, thin layers of iron ions were centered at 105 kilometers and silicon ions at 115 kilometers. A thicker layer containing ions of all the metals was found at 93 kilometers.

Dr. Narcisi believes the separation of metal ions of differing types continuously produced at various altitudes depends not only upon ionospheric motions and ion chemistry, but upon the type of meteor; a stony type would vaporize at a higher altitude than an iron one.

SOLID STATE PHYSICS

Enhancement of particle etching rates

The use of etching solutions to reveal the paths of charged particles in irradiated insulating materials is a technique of increasing importance in several disciplines, ranging from nuclear physics and space exploration to geology and archaeology (SN: 5/11/68, p. 452).

The responsiveness of plastic particle detectors is due to the high increase in chemical reactivity along the particle track, where the etching rate is 1,000 to 10,000 times faster than for the rest of the detector. Three General Electric scientists have now found that exposure of a polycarbonate film, previously bombarded by charged particles, to ultraviolet light in an oxygen atmosphere increases in the etching rate significantly.

This permits immediate processing and analysis of the sample, Dr. Warren DeSorbo and his co-workers of the Research and Development Center in Schenectady, N.Y., report in the Dec. 28 NATURE.

METEORITICS

Counting meteorites

Two networks of cameras, the Prairie Network in the United States and the All-Sky Network in Czechoslovakia and West Germany, have been recording bright meteors for several years. Their combined results show, say Drs. Richard E. McCrosky and Zdenek Ceplecha, that the number of fireballs that burn up in the earth's atmosphere is larger than was expected while the number of meteorites collected on the ground is apparently less than expected.

As a provisional explanation they suggest in Smithsonian Astrophysical Observatory Special Report No. 288 that most of the objects observed are low density fragile meteors that undergo nearly complete ablation or burnup.

PLANETARY ASTRONOMY

Mascons and dynamics

Mass concentrations (mascons) such as those recently discovered on the moon and confirmed during the Apollo 8 flight (SN: 1/4, p. 8), may be responsible for certain anomalous dynamic features of the moon and two planets, says Dr. Brian T. O'Leary of Cornell University.

The moon's response to forces that would tend to rotate it, its moment of inertia, varies according to the axis of hypothetical rotation one calculates it for. The axes of significant interest are the moon's actual rotation axis, the earth-moon line and an axis tangential to the moon's orbit.

Theories of hydrostatics and tidal forces predict that the moments of inertia about these three axes will differ, but observations show them differing by about 10 times more than the prediction. The maria under which the mascons lie are distributed in such a way that the mascons could account for this extra difference, says Dr. O'Leary.

Mars and Mercury have similar dynamical imbalances, and Dr. O'Leary points out that they also have circular bright areas like lunar maria. In both cases, he says, the bright areas are so distributed that mascons beneath them could account for the dynamic anomalies.

PLANETARY ASTRONOMY

Surface temperature of Mars

A temperature map of the daytime face of Mars has been drawn by David D. Morrison of the Smithsonian Astrophysical Observatory in Cambridge, Mass. His map is based on observations made by two other scientists with an infrared radiometer attached to the 200-inch telescope atop Mt. Palomar.

Morrison finds that the temperature range in the bright areas is from 303 to 180 degrees K. The darkest areas of the planet have noon temperatures 4 to 6 degrees higher than the surrounding bright areas. At the minimum equatorial temperature of about 180 deegrees K., a major fraction of atmospheric water vapor should condense each night, he says in Special Report No. 284.