physical sciences

PLANETARY ASTRONOMY

Jupiter's radiation mysteries

The sun is considered to be the ultimate source of the energy radiated by the planets. The radiation that comes from the planets is supposed to be either reflected sunlight or radiation generated by solar heating of planetary atmospheres or surfaces. Internal energy of the planets is believed to be negligible as a source.

Jupiter is the main known exception to this rule. Measurements of reflected sunlight lead to the conclusion that the sun heats Jupiter to about 105 degrees K. Measurements of infrared radiation from Jupiter indicate higher temperatures than solar heating is supposed to account for, ranging as high as 134 degrees K. and differing slightly according to the section of the infrared range that happens to be studied.

Drs. Laurence M. Trafton and Robert L. Wildey of the U. S. Geological Survey Center of Astrogeology at Flagstaff, Ariz., have combined the best available infrared observations of Jupiter with the most refined models of the Jovian atmosphere that they can devise.

After making allowance for effects of the earth's atmosphere and the response of their telescope and photometer, they conclude that Jupiter is radiating three to four times as much energy as sunlight delivers to it.

SOLID STATE

Laser damage to dielectrics

Because it concentrates a great deal of energy in a small area, laser light can damage materials that ordinary light would not. Studies of what laser light does to transparent, solid dielectric (nonconducting) materials, show that the damage is much increased if the surface through which the laser light exits is coated with a metal, report Drs. R. A. Masumura and M. R. Achter of the Naval Research Laboratory in the May 15 APPLIED PHYSICS LETTERS.

They irradiated a piece of sapphire 0.152 centimeters thick with light from a laser at 1.06 microns wave length, delivering power at a concentration of 320 million watts per square centimeter. The light produced a few pits and bubbles at the entrance surface and no damage at the exit surface. But after the exit surface had been coated with nickel, extensive damage occurred in the sapphire crystal.

Drs. Masumura and Achter suggest that the damage is caused by a shock delivered to the crystal by confined nickel vapor generated by the light. The light, they say, as it strikes the nickel layer, vaporizes the inside part of it first. The vapor is momentarily confined by the still solid outer portion, and this creates the shock.

CHEMICAL PHYSICS

Tunable laser from organic dye

A laser with an output that ranges from the near ultraviolet through blue and green to yellow can be made from the organic dye 4-Methylumbelliferone (4-MU). The development was reported by Drs. C. V. Shank and A. Dienes of Bell Telephone Laboratories, Holmdel, N.J., A. M. Trozzolo of Bell Telephone Laboratories, Murray Hill, N.J., and J. A. Myer of Avco Everett Research Laboratories in Everett, Mass., in the May 15 APPLIED PHYSICS LETTERS.

Three different solutions of 4-MU, basic, neutral and acid, give broad-band laser light, each over a different portion of the spectrum. The basic solution's band runs from 4,370 to 5,440 angstroms; the neutral from 3,850 to 4,750; and the acid from 4,590 to 5,740.

Putting neutral and acid solutions together gave a laser that was continuously tunable between 3,910 and 5,670 angstroms, they say.

SOLID STATE

Lead-bismuth-glass superconductor

Magnetic fields tend to be inimical to superconductivity, the ability of certain metals at very low temperatures to pass electric currents without resistance. Superconductors act like perfect magnetic insulators, expelling magnetic fields from within themselves. But any magnetic field that happens to be in the neighborhood of a superconductor, including the one generated by its own current, exerts a counterpressure and tries to penetrate the superconductor. If the field gets strong enough, it will destroy the superconductivity.

Dr. James H. P. Watson of the Corning Glass Works reports in the June 1 APPLIED PHYSICS LETTERS that a superconducting alloy of lead and bismuth increases its resistance to magnetic fields 10 times if it is mixed with glass. The metal is forced under pressure into a matrix of porous glass. Inside the glass the metal forms grains separated by barriers, and in some as yet unknown way, this formation of grains increases the maximum field the superconductor can stand from 12,000 gauss to 125,000 gauss.

TEKTITES

Glass on the moon

Tektites are glassy pebbles found in certain areas of the world, notably Australasia and Czechoslovakia. Because their composition differs from that of the terrestrial minerals among which they are found, scientists suspect that their origin is extraterrestrial. The moon has been put forward as a candidate (SN: 7/5, p. 6).

Among the samples brought back by Apollo 12 is one, designated number 12013, that contains glass chemically more like some tektites from Java than it is like any terrestrial igneous rock, reports Dr. John A. O'Keefe of the Goddard Space Flight Center in Greenbelt, Md., in the June 5 SCIENCE.

Against the identification of the glass of 12013 as tektite glass, Dr. O'Keefe admits, is the fact that the abundances of trace elements do not match those of the Java tektites. But he adds that this may not be a serious objection since the total amount of this sort of tektite material available for study is not enough for reliable trace element analysis.

Tektites are supposed by some scientists to be droplets thrown up by the impact of meteorites on the moon. Dr. O'Keefe objects that in that case they should be random samples of the lunar surface. But the surface is either old (billions of years) or basaltic. Tektites are young acid rocks. Dr. O'Keefe suggests that they were spewn out by lunar volcanoes.