physical sciences

FLUID PHYSICS

Thermomagnetic force in oxygen

In gases composed of molecules of two or more atoms application of a magnetic field can change certain bulk properties that are not affected by magnetic fields in gases composed of single atoms. Both the thermal conductivity and viscosity can be so changed.

A new experiment, reported in the July 6 PHYSICAL REVIEW LETTERS by Drs. Mark E. Larchez and T. W. Adair III of Texas A&M University at College Station, Tex., shows that magnetic fields also affect the so-called radiometer force. This force is caused by heating the gas, and is experienced by a metal vane, for example, as the sum of the impacts of gas molecules streaming away from the heater.

In the experiment the heater was at the bottom of a tube of gas, the radiometer vane some distance above it. For monatomic gases application of a magnetic field brought no change in the radiometer force, but for polyatomic gases (O_2, N_2, NO) an additional force equal to one or two percent of the field-free force appeared. It was directed downward instead of up.

Drs. Larchez and Adair attribute this and the other magnetic changes to the nonspherical shapes of the polyatomic molecules. The field changes the orientation of the molecules and thus the way they collide with each other. The properties in question depend on the way the molecules collide.

Changing the orientation of the spherical atoms of monatomic gases should have no such effect.

PARTICLES

Confirmation of L meson

A few years ago a group of European physicists reported a meson with a mass about 1,780 million electron volts, called an L meson, that decayed by various paths into a K and two pi mesons. An experiment by Dr. Nicholas P. Samios and eight associates at Brookhaven National Laboratory confirms the L meson, they report in the July 6 PHYSICAL REVIEW LETTERS, but finds no evidence of some of the intermediate decay paths reported by the Europeans.

OPTICS

Laser light into thin films

Because it is highly coherent, laser light could be used to carry messages. One possibility is to use laser light in a kind of optical microcircuitry analogous to the electric microcircuitry now used. In such a circuit thin-film strips of optically conducting (transparent) material would replace the electrically conducting strips.

A major problem has been getting the light from the laser into the thin film in such a way that it runs down the film. One way is to shine the laser on the edge of the film. A lot of light gets lost this way; aiming has to be very precise, and if the film vibrates, it can go out of the beam. A second approach is to shine the beam on the broad side of the film and attach a prism to bend the light into the film. This is efficient, but attachment of prisms is not compatible with the methods of manufacturing integrated circuits.

A third method, both efficient and compatible, is reported in the June 15 APPLIED PHYSICS LETTERS by Drs. Mark L. Dakss, Lawrence Kuhn, Paul F. Heidrich and Bruce A. Scott of International Business Machines Corp. in Yorktown Heights, N.Y. It consists of fabricating a diffraction grating directly on the surface of the film. Experiments with this arrangement showed that 40 percent of incident laser light at 6,328 angstroms wavelength was bent and went down the film strip.

PARTICLES

Point positrons

As physicists have probed the elementary particles with projectiles of higher and higher energy, they have found that most of the particles have a structure: They take up a certain volume over which their mass and electric charge appear to be spread.

A major exception to this trend is the electron. No matter how high the energy of the probe, the electron always behaves as if its electric charge were concentrated at a geometric point.

As befits a mirror image, there is now evidence that the electron's antiparticle, the positron, is a point particle too.

Dr. J. E. Augustin and 10 colleagues of the Laboratoire de l'Accélérateur Linéaire at Orsay in France used that laboratory's colliding beam apparatus to smash together beams of accelerated electrons and positrons. Using colliding beams made about 4,000 times as much energy available for structure probing as would have been available if one of the beams had been struck against a stationary target.

The result, they report in PHYSICS LETTERS, Vol. 31B, p. 673, is consistent with no structure for the electron or the positron.

PLASMA PHYSICS

Quick Tokamak

Last year Russian physicists working toward controlled nuclear fusion had great success with a type of device they have developed called a Tokamak.

The Russian success so impressed the U.S. Atomic Energy Commission that the AEC decided to reverse field and concentrate effort on Tokamaks in the future (SN: 4/11, p. 373). A major necessity was to get a Tokamak operating as quickly as possible.

That has now been done: Princeton University now reports that the first American Tokamak is operating.

The Princeton Tokamak was made by converting another device, the so-called Model C Stellarator, with which the staff of the Princeton Plasma Physics Laboratory had been working for years. Both Stellarators and Tokamaks are toroids or doughnut shapes.

The conversion changed the shape of the device somewhat. The Stellarator was an oval, but the Tokamak is a perfect circle 22 feet in diameter. The diameter of the tube in which the plasma is contained was increased from 4 inches to 11 inches. Although the device is somewhat smaller than the biggest Tokamak the Russians now have, it will be able to make and inject a new plasma for experimental testing every 20 seconds compared to every 400 seconds.

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