

# physical sciences

## PARTICLES

### Symmetries

It used to be believed that any particle interaction would look the same if one simultaneously reversed the electric charges of all participants, changed right handed ones to left handed and vice versa, and reversed the flow of time. Positive charged, right handed particles going into the future would look the same as negative, left handed ones going into the past.

A few years ago evidence was found that in the weak interactions differences did appear when the charge and the handedness were switched. This meant that either differences did appear when all three reversals were done, or that when time alone was reversed a compensating difference appeared that led to no net difference under all three reversals.

For the last few years physicists have been searching for evidence of either sort of variance with no success so far. Another negative result is now reported in *PHYSICAL REVIEW LETTERS*, July 22, by a group from Lawrence Radiation Laboratory.

If there is any variance under the three reversals together, the lifetime of a positive pi meson should differ from that of a negative one. Experimentally the ratio of the two lifetimes comes out to 1.00064 plus or minus 0.00069—no evidence of a discrepancy.

## CHEMISTRY

### Nitrogen fixation

An ordinary electric current is capable of yielding the electrons necessary to fix nitrogen from the atmosphere to form ammonia, two scientists working at Stanford University find.

Nitrogen fertilizer is now synthesized, at the rate of about 12 million tons a year, by chemically reacting gaseous nitrogen in the presence of iron, molybdenum or other catalysts at very high temperatures and pressures.

A method that works at room temperatures and pressures with a titanium catalyst is reported by Drs. Eugene E. van Tamelen and Björn Akermark, in the July 31 *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*.

"Despite the modest yields but because of the practical import," they report their findings at an early stage in the research. With cheap electrical power available in many countries around the world, the laboratory-proved concept that nitrogen in the air can be converted to ammonia under ambient conditions is very attractive.

## PARTICLES

### Mu, U and W

Recent experiments that recorded cosmic ray muons underground have shown particles arriving in strength from angles at which they were not expected. In order to explain this some observers find it necessary to invoke particles never before observed.

One suggestion is that the long-sought W particle, or intermediate vector boson, may be responsible (SN: 5/4, p. 424); another postulates an entirely new particle called U, which would be heavy, stable, electrically charged and unresponsive to the strong interaction.

But the U's don't seem to be there, report Drs. Frederick Ashton, H. J. Edwards, G. N. Kelly, and A. W. Wolfendale of Durham University in England in the July 29 *PHYSICAL REVIEW LETTERS*. In order to make the U's explain the underground results, it was necessary to say they made up a thousandth of all the primary particles striking the top of the earth's atmosphere. But experiments at very low energies by Drs. Ashton, Edwards and Kelly determine that the U's cannot be more than a hundred-thousandth of the primaries.

## SUPERFLUIDS

### Persistent currents decay

Liquid helium in its superfluid state—when cooled below two degrees Kelvin—flows without friction. One result of this is that when currents are set up, they will flow on without any input of outside energy that normal liquids need to overcome friction—in principle forever.

But not in practice. The speed of superfluid persistent currents decays slowly, report Drs. George Kukich, R. P. Henkel and J. D. Reppy of Cornell University in the July 22 *PHYSICAL REVIEW LETTERS*, when the velocity is near a certain critical speed determined by the temperature and density of the superfluid.

At a temperature about one degree Kelvin the velocity drops by 0.02 of its value in about 10,000 seconds.

## PHYSICAL CHEMISTRY

### Molecular distortion in gas

Molecules of carbon monoxide stretch much further in an intense electric field than they ought to, say Drs. R. G. Brewer and A. D. McLean of IBM in San Jose, Calif.

When such a molecule is placed in an electrical field its shape becomes distorted as its positive charges are drawn toward the cathode and its negative charges toward the anode.

But it turns out, as Drs. Brewer and McLean report in the July 29 *PHYSICAL REVIEW LETTERS*, that as the field increases toward the point where it is strong enough to tear an electron loose, the distortion increases by at least 30 percent, and this cannot be explained by the usual calculations.

## ACCELERATORS

### Weston will start to build

Money to begin construction of the 200-400 billion electron volt accelerator at Weston, Ill., is now assured. Senate and House conferees agreed on a compromise that restores some of the money the House wanted to cut out. Both houses have ratified the work of the conferees, and the bill has gone to the White House.

The conferees gave Weston an itemized budget of \$14.6 million. The breakdown gives \$8.7 million for engineering design; \$700,000 for land improvement; \$5 million for construction of transfer hall, booster hall and Linac housing, and \$200,000 for temporary utilities.

No other phases of the project are to be begun with this year's money, but the Atomic Energy Commission is granted flexibility in using a left-over \$2.5 million.

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