Physical Sciences

Limits to conservation of baryons

The overwhelming majority of physical particles are extremely unstable. Stability is found only in the particles that make up atoms. Of these, the neutron, though it does decay, is relatively stable, and the proton and electron are believed to be absolutely stable.

The stability of the proton leads to a principle called the law of conservation of baryons. Baryons are a numerous class of particles, whose paths of radioactive decay lead ultimately to the proton. The law says that the net number of baryons going into some particle reaction (counting baryons as one and antibaryons as minus one) must equal the net number coming out. One baryon may change into another baryon, but the quality of "baryonness" is conserved. The proton being the lightest baryon, cannot decay because to do so, it would have to produce only nonbaryonic particles.

There is lately some theoretical interest in just such a possibility: that the law might be wrong and the proton be capable of decaying into electrons and muons, say. Frederick Reines of the University of California at Irvine and M. F. Crouch of Case Western Reserve University looked for evidence of such a conservation-violating nucleon decay in the data of an experiment concerned with the physics of muons and neutrinos. They find no positive evidence of decay and conclude in the March 4 PHYSICAL REVIEW LETTERS that the lifetime of a nucleon against decays that produce muons is at least 2×10^{30} years, virtually eternal compared to unstable particles.

Superconductivity inches upward

Superconductivity, the property by which certain metals lose all their electrical resistance, would be a grand thing to use technologically were it not for the extreme refrigeration necessary. Every superconductor has a transition temperature above which it becomes an ordinary conductor. Most transition temperatures are near aboslute zero.

But little by little experimenters are discovering metals with higher transition temperatures and gradually the maximum transition temperature rises. A new record is now reported by L. R. Testardi, J. H. Wernick and W. A. Royer of Bell Telephone Laboratories. It is 23.2 degrees K., and it belongs to an alloy of niobium and germanium. It surpasses the previous record, set a short time ago by John Gavaler of Westinghouse Research Laboratories, 22.3 degrees K., which also applies to a niobium-germanium alloy.

The great significance of both these discoveries is that they push superconductivity farther and farther into the region where liquid hydrogen may be used as a refrigerant. This is easier than the use of liquid helium, mandatory for temperatures below about 20 degrees K.

Conditions on Venus

The Soviet space probe Venera 8 landed on the surface of the planet Venus on July 22, 1972, after a parachute descent through the Cytherean atmosphere that took 55 minutes. Preliminary results are now presented in the latest ICARUS by a group headed by M. Ya. Marov. The surface temperature is 741 degrees K. (earth's averages about 283 degrees K.), and the surface pressure is 93 kilograms per square meter. The surface illumination at the center of the day hemisphere is about one percent of the light reaching the upper atmosphere, but this should be sufficient for photography of the surface by future probes.

Climatology

Climate for tomorrow . . .

In a long-*long*-range forecast for the world, a team from the University of Chicago predicts frigid winters in the Mediterranean, balmy weather in Greenland and fewer typhoons in the South Pacific. Looking 50 million years into the future, they have projected the motions of continental drift as causes of radical climatic changes.

Because the Atlantic will have widened, according to paleoclimatologists Theodore Fujita, Alfred Ziegler and Greg Forbes, more of the warm Gulf Current will flow northward, perhaps melting the north polar ice cap and pacifying the bitter northern climate. The northward movement of Africa will close up the Mediterranean Sea, removing the weather buffer that gives the surrounding countries their present enviable conditions.

A new tornado corridor will develop in Europe and East Asia, Fujita predicts, but the opposite is likely to occur in the Pacific Ocean. The reason is that Australia, also moving northward, will not only change from its present dry climate to a moist, near tropical one, but will reduce the number of typhoons in the region by occupying the part of the ocean where they now originate.

And, as they did in the past, North America and the Soviet Union will again join hands, forming a land bridge across what are now the Aleutian Islands.

. . . and yesterday . . .

Tree-ring dating of more than 1,300 trees on Mt. Rainier in Washington state have revealed at least eight separate glacial periods in the region since the early sixteenth century. The rings are variously wide and narrow, depending on increased streamflow at the time due to warmer climate melting the glacial ice.

The wider rings, marking the end of a period of glacial advance, show the periods as ending in 1525, 1550, 1625-60, 1715, 1730-65, 1820-60, 1875 and 1910, says Robert S. Sigafoos, botanist with the U.S. Geological Survey in Reston, Va. Another such period may be building up, he says: many of the glaciers have been advancing for the last 10 to 15 years, after more than a century of retreat.

. . . and the day before

The discovery of a 200,000-year span when volcanic blasts the size of Krakatoa repeatedly rocked the earth is part of the evidence leading a group of University of Rhode Island researchers to the conclusion that volcanoes have had a significant effect on the world's climate.

The 1883 eruption of Krakatoa in the Pacific spewed forth dust and ash which affected sunsets for years after. Ter-Chien Huang, Norman Watkins and David Shaw have discovered, by laboriously analyzing the volcanic dust in seafloor sediments, that a 200-millenium fusillade of such blasts apparently took place between about 1.8 million and 1.6 million years ago. This, the scientists theorize, may well have spewed into the atmosphere a load of dust that averaged some 400 times as thick as that of today.

The last great Ice Age, when ice caps reached as far south as St. Louis, began with a marked climatic cooling at about the same time that the major ash was deposited. This does not prove a connection, but it is at least consistent with the possibility that the increased amount of dust injected into the atmosphere cut down the amount of the sun's heat reaching the surface to the point of triggering the Ice Age.