It might be called an anti-cosmic ray

There is a longstanding rule in physics, the law of conservation of baryons, that says the universe should contain as much antimatter as matter. Any act of creation has to be balanced between the two. If there was zero before, there must be net zero after, counting matter as positive and antimatter as negative. The great cosmological puzzler is that we do not see any large amounts of antimatter in the universe — at least none that we can be sure are antimatter. So a tentative explanation has arisen that maybe antiprotons (which are the stable form of antimatter) are not stable after all, but decay after some lifetime and turn into matter.

Ironically the recent discovery of antiprotons in the cosmic rays tends to make severe difficulties for such an explanation. The observation was made by R.L. Golden, S. Horan and B.G. Mauger of New Mexico State University at Las Cruces and G.D. Badhwar, J.L. Lacy, S.A. Stephens, R.R. Daniel and J.E. Zipse of the Johnson Space Center in Houston. On the night of June 21-22, 1979, they operated an eight-hour balloon flight from Palestine, Tex., during which the data were gathered. The instrument was a magnetic spectrometer, which, by measuring both electric charge and mass, can identify protons and antiprotons. During the flight, the spectrometer found 46 antiproton candidates. The atmosphere and the equipment had been expected to contribute 18.3, leaving the remainder as presumably actual cosmic ray antiprotons. The ratio of antiprotons to protons in the cosmic rays comes out to about five in 10,000.

The account of the observation is published in the Oct. 15 PHYSICAL REVIEW LETTERS. It was received by the journal on Aug. 31 and published without the usual review process.

As an experimental procedure this is the first finding of antiprotons in the cosmic rays, and so it rings bells for cosmic ray physicists. For cosmologists it could cause some difficulties. These antiprotons are apparently nothing primordial, not left over from the creation. They were made, like other cosmic rays, in stellar explosions and other processes in our galaxy. The average "storage time" for cosmic rays in the galaxy, the time they fly around in space before they hit something and lose their identity, is about 10 million years. The observation of cosmic antiprotons implies that they have been around on the average at least that long without suffering radioactive decay.

That's a long lifetime for a supposedly unstable particle, and so this finding could be troublesome to theories that depend on decaying antiprotons. Of course, all the difficulties arise, as Golden points out, because of physicists' bias that laws don't change. Physical laws are considered universal, applying in all times and places. Because of this and similar problems more than one physicist is now ready to try on the idea that laws may be different under extreme conditions, such as the high energies at the creation of the universe or the extreme gravity of the interior of a black hole. If we can repeal conservation of baryons for those events, the problem of a balanced universe goes away, but others may come instead. □

Soviet implosion fusion experiment

Angara-5 is an electron accelerator belonging to the Kurchatov Institute of Atomic Energy in the U.S.S.R. For years anyone circulating among the community of scientists interested in imploded-target fusion heard bits of news of it or was asked for bits of news of it. The definitive news has been released in the Soviet press. It is operating in part.

The electrons that Angara-5 accelerates are driven against a small pellet of thermonuclear fusion fuel. The electron beams cause an implosion of the pellet that ignites thermonuclear fusion in the pellet, and the fusion yields a puff of energy. It has been called a mini hydrogen bomb. From a succession of such puffs a power reactor is expected to develop someday — someday not too distant, according to the Russians.

Angara-5 is the Soviet Union's and the world's most ambitious achievement so far in the department of electron-beam fusion. (Other pellet-fusion experiments are being carried out with laser light, proton beams and heavy-ion beams.) When it is complete, it will deliver 48 beams of electrons to a target. According to the chief scientist of the Soviet electron-beam project, Leonid I. Rudakov, as quoted in Pravda, Angara-5 is intended to demonstrate breakeven, a situation in which more energy is gotten out of the fusions than has to be put in to ignite them. No timetable is given for such an achievement, but a figure of five years is repeatedly mentioned.

It should not be forgotten that this sort of thing may have applications to weaponry. Remarks by Rudakov on a visit to the United States contributed to the flap about "particle-beam" weapons (SN: 5/21/77, p. 329). The feasibility of such weapons has been officially denied, but what has recently become public about the hydrogen bomb shows how desirable they might be if they were feasible.

An American apparatus equivalent to Angara-5 is under construction at Sandia Laboratories in Albuquerque and is scheduled to start operating in about another year. □

Conquering the chronic disease

The first half of the 20th century was a glorious age as far as fighting infectious disease with vaccines and antibiotics goes. But can the latter 20th century and the 21st century do the same with the chronic diseases? Yes, medical authorities concurred last week at a conference in Washington called "Disease Strategies for the 1980s." The conference was held at the Woodrow Wilson International Center for Scholars and was attended by scientists, congressional staff members and the press.

The researchers base their optimism both on past experience with infectious diseases and on present experience with chronic diseases. For instance, there was a time when polio and tuberculosis were thought incurable, points out Lewis Thomas, president of the Memorial Sloan-Kettering Cancer Center in New York City and author of *Lives of a Cell.* Progress is also being made in understanding cancer, in spite of widespread disillusionment with the government's "war on cancer," agree Thomas and Arthur Upton, director of the National Cancer Institute in Bethesda, Md. Scientists still are not sure why cells become cancerous, but they have learned that cancer is not an inevitable part of the aging process, that it is a multistep process and hence possible to attack at various stages, and is triggered by various risk factors.

Central nerve regeneration (a solution to spinal cord injury and possibly also to stroke and some other disorders) was thought impossible a few years ago, but now there is growing evidence that it is feasible, concur Richard Sidman, professor of neuropathology at Harvard Medical School, Albert Aguayo, professor of neurology at McGill University Medical School in Montreal and Donald Tower, director of the National Institute of Neurological and Communicative Disorders and Stroke in Bethesda, Md. Central nerves, unlike peripheral nerves, used to be thought incapable of sprouting new axons if injured, but there is evidence that many central nerves are capable of such regrowth. There is also reason to believe that target cells can respond to regenerated central nerves, provided the nerves make contact with them. The challenge, Aguayo stresses, is to get central nerves to regenerate axons longer distances and to get them to hook up with the right cells.

The authorities tend to agree, however, that conquering the chronic diseases can't be hurried, even with all the money in the world, until a solid research base is first achieved. Or as Frederick Robbins, dean of Case Western Reserve University and a 1954 Nobel laureate, put it, "A practical goal cannot be achieved without a science base; you can't rush it." For instance, he

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