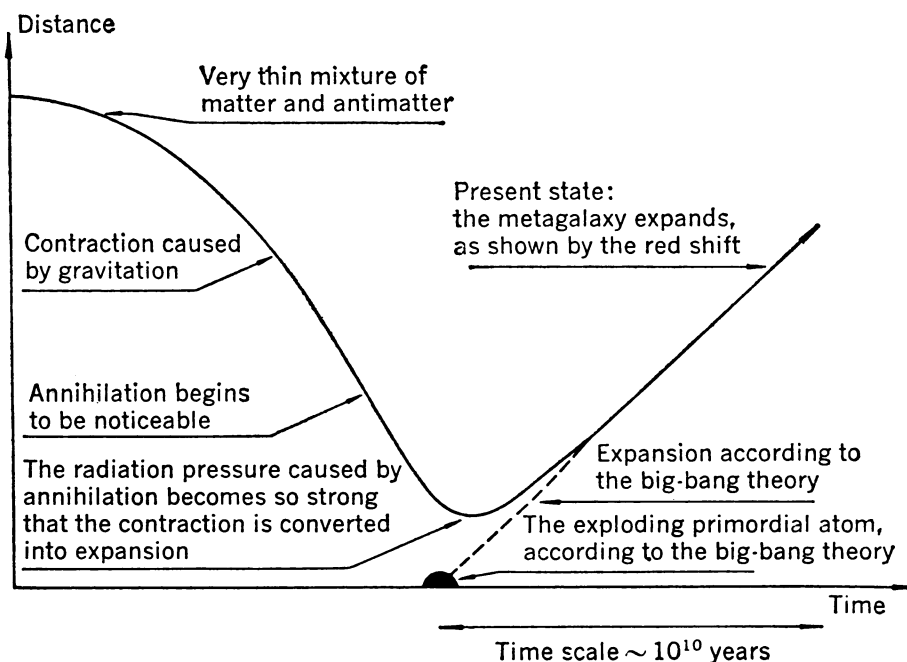


Hannes Alfvén



(“Worlds-Antiworlds: Antimatter in Cosmology” by Hannes Alfvén, W. H. Freeman and Company. Copyright © 1966. See SN: 1/14, p. 46)

Expanding universe, beginning with thin gas of matter and antimatter.

Antimatter and Creation

by Ann Ewing

The stars and galaxies that we observe are customarily assumed to consist of ordinary matter. A world-famed Swedish physicist now suggests that any theory of the universe not having a spot for antimatter is omitting half the objects in the sky, as well as a logical explanation, for quasars, supernovae, some radio stars and the creation of the universe itself.

Dr. Hannes Alfvén, professor of plasma physics at the Royal Institute of Technology, Stockholm, believes that at-c-m-smashing experiments showing symmetry in the production of particles and antiparticles force those who look at the data without any preconceived notions to conclude that matter and antimatter are coequals in the cosmos.

Dr. Alfvén charges that cosmological theories based on the assumption that the universe contains only matter and no antimatter are “logically unsatisfactory.” He also suggests that astronomical spectacles resulting when large masses of antimatter annihilate ordinary matter might well be seen from earth as the puzzling quasars, supernovae and some radio stars.

In developing his new cosmological theory, Dr. Alfvén leans heavily on the work of Dr. Oskar Klein, former professor of theoretical physics at the University of Stockholm. In both Dr. Klein’s and Dr. Alfvén’s view, the initial condition of the universe was an

extremely dispersed gas of subatomic particles and antiparticles.

Under gravitational attraction, this “ambi-plasma” contracted until annihilation occurred, producing a radiation pressure that reversed the gravitational contraction. All the galaxies were then formed, and constitute what Dr. Alfvén calls the metagalaxy, which he uses synonymously with the “universe.”

In broad outline the theory has some resemblance to the expanding universe model. It differs critically, however, in several aspects of the “beginning.”

First, the universe started as an extremely tenuous gas mass consisting of equal numbers of elementary particles and antiparticles that began to contract by gravitation.

Second, instead of attributing the current expansion of the universe to an initial explosion of superdense ordinary matter, and only ordinary matter, it is assumed that annihilation of matter and antimatter reversed the inward gravitational collapse. This reversal is suggested to have taken place gradually on a time scale of several hundred million years, rather than the minutes or hours assumed in the “big bang” theory of creation.

And third, the turning point required an average density of matter of only one particle for every hundred cubic centimeters, which is a few thousand times higher than the aver-

age density now measured for the metagalaxy. The expanding universe picture, on the other hand, requires an initial density equal to that of nuclear matter itself.

Dr. Alfvén believes in a long time period for the reversal, rather than one dramatic event, because, although the mean value for galactic ages is 10 billion years, the value is not exact for every galaxy. One galaxy may have an age of 10.3 billion years, while another may be only 9.7 billion years old.

To verify or disprove any hypothesis about the antimatter content is not now possible. One potential test depends on the fact that subatomic particles of antimatter bend opposite to the direction of ordinary matter when moving through a magnetic field. A test method, however, has yet to be devised. Another test would be to throw ordinary matter, such as a rocket, at suspicious celestial objects to see if annihilation occurs.

One question raised by the chance that regions in space contain large amounts of antimatter is how the matter and antimatter can co-exist in space without annihilating each other. One answer could be that there is an insulating layer between regions of matter and antimatter similar to the insulating layer set up in the “Leidenfrost phenomenon.”

This is an effect that occurs when a liquid is dropped on a hot surface;



... Antimatter

if the surface of a stove, for instance, is hot enough, drops of water falling on it form globules that, rather than evaporating immediately, may last for several minutes. The globules are insulated from the direct heat of the stove by a layer of superheated vapor.

Calculations by Dr. Alfvén on a similar phenomenon for matter and antimatter show that a thin, very hot layer of ambiplasma may provide an adequate insulating boundary.

The prediction of the existence of antiparticles was made by British Nobelist P. A. M. Dirac in 1927 and confirmed by the discovery of the positron, a positively charged electron, in 1932. To verify the existence of antiprotons, negatively charged protons, was an important reason for construction of the bevatron at Berkeley. The first clear-cut evidence for the existence of the antiproton came in 1955, soon after the bevatron started operating. The antineutron was found shortly after that.

The significance of these confirmation's lies in the very fundamental ideas behind Dirac's predictions that the universe should show complete symmetry between particles and antiparticles. Discovery of the antideuteron in 1965 further confirmed not only the terrestrial symmetry of elementary particles and their opposite numbers, but also made much more real the possibility of antiworlds made of atoms of antimatter.

The antideuteron was the first known antinucleus made up of two fundamental building blocks of antimatter, the antiproton and the antineutron.

It was the first complex atomic nucleus of antimatter to be found, and is the antiparticle of the nucleus of the heavy hydrogen atom. Deuterium is the simplest possible complex nucleus, consisting of a neutron and a proton bound by the strong nuclear force.

Existence of the antideuteron means that all the properties of the strong nuclear force are closely mirrored in the antiworld, as had previously been expected but not proven. These properties determine the nature of the compound nuclei of heavier elements that are built up by adding neutrons and protons.

The discovery convinced many scientists that it is no longer possible to question the basic physics part of the cosmological conception of a literal antiworld populated by stars and planets." The antiworld would be made up of negative nuclei surrounded by positrons.

Some scientists have suggested that the Tunguska meteorite that shook Siberia in 1908 was actually an anti-meteorite.

HYDRODYNAMICS



Corning Glass Works

Etched-glass amplifiers: one way to mass-produce fluid control circuits.

Fluidics Is Muscling In

Where electronics once ruled, new technology is making its way.

by Carl Behrens

Hydrodynamic theory has been around a long time. Now it is spawning a technology, fluidics, which is making inroads where reliable, rugged control and amplification are a must.

One of the first beneficiaries of the booming new control systems industry will be the U. S. Navy. And the Navy really needs boiler control help.

At any one time, according to Cdr. J. C. Kaune of the Naval Shipping and Engineering Center in Philadelphia, "over half the boiler automatic control systems in the fleet are partially or wholly inoperative." Main culprits in the breakdown of control systems, he says, are dirty air, rough treatment, and improper adjustment.

To improve this situation, a new control system, using fluidic circuits, is currently undergoing test use at the Philadelphia Naval Shipyard. The new system, built by Bowles Engineering Corp., whose founder, R. E. Bowles, is a fluidics pioneer, is unaffected by dirt in the air, requires little adjustment, and since it has no moving parts, is practically breakdown-proof.

The boiler regulator is a prime example of the kind of precise, rugged fluidic control systems that are now being developed for a wide variety of industrial and military uses. Faster,

more reliable, and cheaper than the conventional systems of valves and motors, these fluidic devices are able to perform the functions of electronic circuits under conditions that would destroy transistor or vacuum tubes.

The similarity between electronic circuits and fluidic systems is startling. In an electronic device, signals are carried by a flow of electrons, which is controlled by various components such as resistors, capacitors, vacuum tubes and transistors. A fluidic signal is carried by a flow of some liquid or gas, usually air, and controlled by strangely-shaped pathways and channels that have exactly the same regulatory effect on the fluid flow as resistors and tubes have on electron flow.

Since fluidic systems use air instead of electrons, and channels instead of elaborate vacuum tubes, and hydrodynamic theory is, if anything, older than electronic theory, it is only chance that fluidic devices weren't developed first. It happened because electronic engineering was developed to meet the needs of long-distance communications not for switching and controls.

Once an electron flow has been turned into a signal and amplified, it is converted, in an antenna, into an electromagnetic wave, which carries the