ASTROPHYSICS

Propose Heavens Are Hot

A theory that the universe is "hot," which could explain such phenomena as the origin of cosmic rays and galaxies with a bright radio "halo," has been proposed.

THE HEAVENS are hot, not cold as has been supposed.

This theory has been proposed by Prof. Thomas Gold of Harvard University and Prof. Fred Hoyle of Cambridge University, England. Their idea of a "hot universe" complements the steady-state hypothesis for the origin of the universe they suggested, with Hermann Bondi of London, several years ago. According to the steady-state theory, matter is being formed continually, and the universe has always looked and always will look as it does now.

The hot universe theory explains some puzzles, such as the origin of cosmic rays, and of galaxies and the bright radio "halo" that surrounds them. The two astronomers discuss their theory in the "Paris Symposium on Radio Astronomy," published by Stanford University Press.

Galaxies are great scattered islands of billions of stars. The Milky Way in which the sun and its planets, including earth, are located is only one of millions of such giant groups of stars. Galaxies hurtle thousands of miles a second through space filled with a tenuous hydrogen gas. The hydrogen atoms of this gas in intergalactic space may have temperatures up to 100 million degrees, Profs. Hoyle and Gold suggest.

Their theory does not mean that an intergalactic space traveler who put his arm out the window would be burned; his arm would freeze. This is because the hydrogen atoms, although they have an average temperature of 100 million degrees as measured by their speed, occur only one or two in each cubic yard of space. The concentration of heat is, therefore, close to zero.

Although one or two atoms per cubic yard seems small, the universe is so large that the number of tons of hydrogen gas in space is close to the figure 10 followed by 48 zeros.

The hot universe theory explains how galaxies may be formed from the hot hydrogen gas in space. Compared with the energetic hydrogen atoms in intergalactic space, the star galaxies themselves are cold. As they speed through space, the star galaxies leave a cold pocket in their wake. The hot gas condenses around this cold pocket, on a scale of thousands of light years, and a galaxy is born.

In time, nuclear reactions will produce other chemical elements from the hydrogen starting material.

The radio halo detected around galaxies is produced by radio waves emitted by the gas. Hot hydrogen gas surrounding a colder galaxy would have sufficient energy to produce the observed radio emission, Profs. Hoyle and Gold believe.

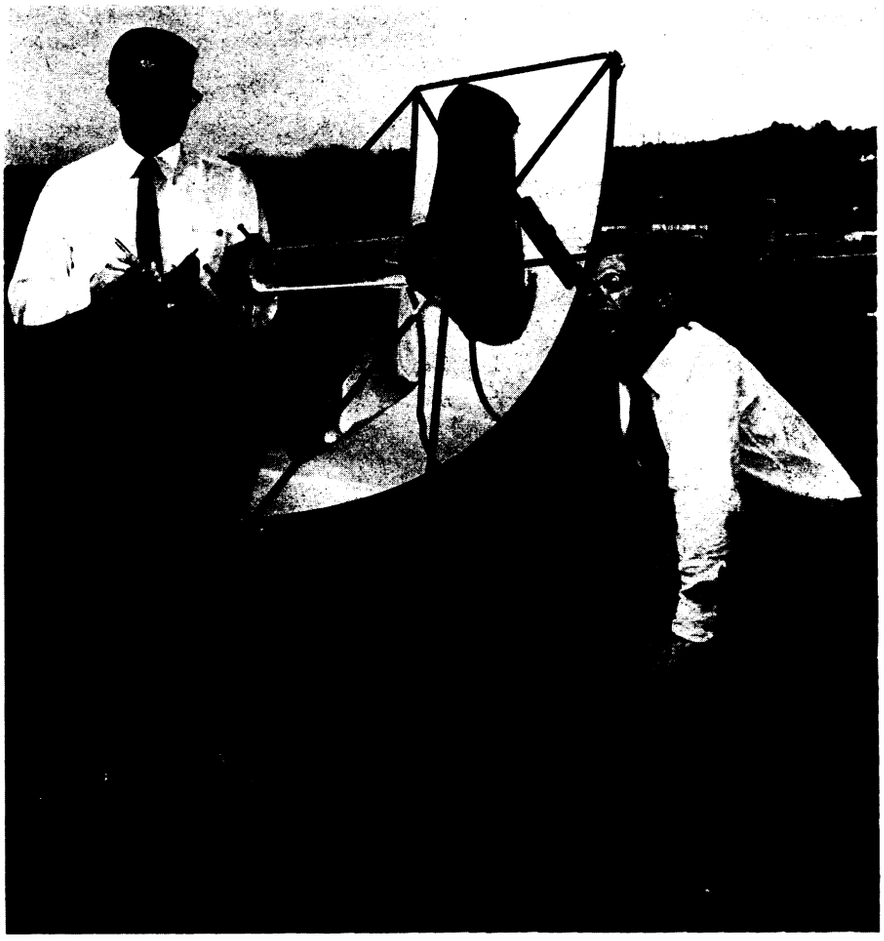
In trying to explain the origin of cosmic rays in the past, astronomers have tailored their theories to fit the main assumption that the universe between the galaxies is cold. Cosmic rays, therefore, could not arise in such energyless space, and the current view is that this radiation originates only within galaxies and is accelerated by magnetic fields.

However, certain very energetic cosmic rays cannot be explained by this theory since the magnetic field strengths of galaxies are not high enough. In the hot universe theory, cosmic rays could arise everywhere, and enough energy would exist in intergalactic regions for such energetic radiation to originate there.

While galaxies speed away from one another, in the space between them new galaxies arise. Thus the average density of these great "star islands" remains the same; the average age of the galaxies in one part of the sky would be about the same as the average in another region.

The hot universe provides a mechanism for the origin of these new galaxies. In addition, it argues against another view of the origin of the universe, which regards all matter now in space as once part of a huge "primeval atom" that exploded some five billion years ago and has been expanding ever since. If this were true, the hot universe could not exist since the expansion would have cooled the original material too greatly.

Science News Letter, July 11, 1959



***THERMOELECTRIC GENERATOR**—A solar-powered thermoelectric generator for tapping the energy of the sun is put through its paces on the roof of a Boeing Company building in Seattle. Developed jointly by Westinghouse engineer Niles F. Schuh (left) and Boeing engineer Ralph Tallent (sighting through telescope at the sun), the generator can convert the energy of the sun into 2.5 watts of power—enough to power a radio transmitter far out in space. Boeing and Westinghouse said the generator may have application in long-mission satellites and manned space vehicles of the future. The concave, highly polished reflector, which resembles a "fun house" mirror, collects the sun's energy and concentrates it on a portion of the cylinder shaped generator in front of the reflector.*

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to *The Science News-Letter.* www.jstor.org