

PHYSICS-ASTRONOMY

Creation of Galaxies

It took a tenth of the present age of the universe for the galaxies to evolve into their present general shape, according to latest theory.

➤ WHEN the universe was a tenth as old as it is now, the great masses of stars called the galaxies (like our Milky Way) were formed.

It took that time, 300,000,000 years, from the beginning of things for the universe to evolve into the general shape that it now is.

This new view of the past life of the cosmos has been figured out by Dr. George Gamow, mathematical physicist of the George Washington University, Washington, D. C., author of "Biography of the Earth" and other books.

He has figured it out quite literally, for the formulae that he derives to express the size and mass of the galaxies are written in the simple and elemental terms of the properties of the elementary atomic nuclei (hearts of matter).

A few months ago Dr. Gamow joined in fixing the original temperature and density of the expanding universe when it was a few minutes old. In the beginning, all creation was a highly compressed gas made up of neutrons (now best known as the

trigger of atomic bomb fission). This gas (heavy as iron) started decaying into protons and electrons and building up the heavier chemical elements. The stuff of the universe was completely made in about one hour.

This probing into the origin of the universe is called by Dr. Gamow "alpha, beta, gamma" stuff because it was done by a team of R. A. Alpher, who got his Ph. D. for it, Dr. H. Bethe, the Cornell physicist famous for the atomic energy theory that keeps the sun stoked, and Dr. Gamow.

Now Dr. Gamow is following the expansion of the universe further. Starting with these initial conditions and the correct proportion of the various kinds of atoms that were "cooked" at the beginning, he finds that the size and mass of the great clouds of stars can be calculated from the initial conditions. And since the universe got into its essentially present shape, nine times as much time has elapsed as was necessary to create the galaxies.

"I am quite excited about these new

results on the evolution of the universe," Dr. Gamow told Science Service. "It seems to me to be the best piece of work I have done since the theory of radioactive decay 20 years ago."

Dr. Gamow is lecturing during the summer at Ohio State University. He got the idea for his new researches on the universe while visiting the giant telescopes on Mt. Palomar and Mt. Wilson, and he developed the new theory while riding back east on the Superchief.

In the complex formulae that show the relation between the microcosmos of the atomic nuclei and the macrocosmos of the stellar galaxies, Dr. Gamow uses the elementary charge, the quantum constant, the mass of the proton, the velocity of light, Newton's gravitational constant, and the binding energy of the deuteron. From these he derives the diameter of the stellar galaxies as 12,000 light years and the mass of the galaxies as 15,000,000 times that of the mass of the sun. This corresponds roughly with the dimensions and mass that the astronomers find for some of the galaxies, although the Milky Way in which we live is a giant and considerably larger.

A preliminary communication on his new theory has been sent by Dr. Gamow to the *Physical Review*, journal of the American Physical Society, and a longer account to *Nature* (London).

Science News Letter, July 31, 1948

ENTOMOLOGY

Red Dye Test Detects Wheat Weevil Infestation

➤ WEEVIL INFESTATION in wheat, long a cause of major grain and flour losses but extremely difficult to detect, can now be shown up very easily by means of a new test devised by J. C. Frankenfeld, U. S. Department of Agriculture entomologist. He simply soaks samples of suspected grain for a few minutes in a dye containing acid fuchsin, a coal-tar product long used in biological laboratories for staining microscope slides. Cherry-red dots appear on grains in which weevil eggs have been laid.

The test depends on the female weevil's method of laying her eggs. She gnaws a hole through the coat of the grain, deposits an egg in it, and seals it up with a plug of jelly-like material, which soon hardens and becomes so much like the grain in color that it is practically impossible to detect.

However, the hardened plug stains vividly red with the fuchsin dye, while the grain fails to take up the color. Thus the weevil's own device is turned against her offspring.

For the protection of the new wheat crop, the Department of Agriculture recommends thorough clean-up of bins and disposal of old grain, coating the walls with residual-type DDT or other persistent insecticide spray before filling, and fumigation of filled bins during August.

Science News Letter, July 31, 1948

The diameter of stellar galaxies:

$$D = \frac{2^{49/8} s^{7/4} \pi^{7/4} e^2 h^{3/4} \epsilon^{15/4}}{3^{29/8} m^{29/4} c^{35/4} G^{5/4}} = 1.1 \cdot 10^{22} \text{ cm} = 12,000 \text{ light years}$$

The mass of galaxies:

$$M = \frac{2^{43/8} s^{7/4} \pi^{5/4} e h^{5/4} \epsilon^{5/4}}{3^{29/8} m^{15/4} c^{5/4} G^{7/4}} = 3 \cdot 10^{40} \text{ g} = 1.5 \cdot 10^7 \text{ sun masses.}$$

Here:

- e — is elementary charge
- h — is quantum constant
- m — is the mass of proton
- c — is the velocity of light
- G — is Newton's gravitational constant
- ε — is the binding energy of deuteron.

EVOLUTION OF UNIVERSE FORMULA—This shows the relation between the microcosmos of atomic nuclei and the macrocosmos of stellar galaxies as worked out by Dr. George Gamow, mathematical physicist of the George Washington University, Washington, D. C.