

The Evolution of Our Universe

Astronomy

WILLEM J. LUYTEN in *The Pageant of the Stars* (Doubleday, Doran):

During the past few decades a large amount of material on spiral nebulae and island universes in general has been painstakingly accumulated by Curtis at the Lick Observatory, Wolf at Heidelberg, Reynolds at Helwan, Egypt, and by Hubble at Mount Wilson, the last of whom, having the 100-inch reflector at his disposal, could penetrate much deeper into space than his predecessors. As a result, a great variety of island universes have been found and when an attempt is made to arrange these in different groups, according to their appearance, as has been done especially by Wolf, Hubble, and Lundmark, the strange fact appears that such arrangement is nearly identical with that proposed by Jeans in England from purely theoretical considerations. In such a case we may feel reasonably confident that Jeans's attractive conception of the origin and development of spiral nebulae must have more than a germ of truth in it.

According to Jeans, the primordial island universe begins as an immense chaotic mass of glowing gas, very nearly in the form of a sphere. As time goes on, and probably as a result of rotation, this sphere begins to flatten out, the nebulae taking on the shape of a bun or a lens. After having spent some time in this flattening process, and having consumed some trillions of years in it, such a system will begin to show signs of internal disturbance. Disruptions and eruptions take place, and the nebulae begins to throw up solid matter from the interior, spiral arms may develop, and even stars may appear on the outside. In a few more trillion years it may have gone through a complete transformation; from an amorphous-looking mass of gas it has become a real spiral. After the nebula has thus found its destination, the process of development appears to become more orderly. The spiral slowly unwinds its arms, opening and producing more stars. It goes through stages similar to those of the Andromeda nebula, and of the spirals in the Big Dipper and in Triangulum. Once started, it cannot stop the process of disintegration; it is doomed, and ultimately even the spiral arms disappear. Nothing is left now but a swarm of stars, a great star cloud, such as the Magel-

lanic Clouds, and, in all probability, the Galactic system. From now on, it becomes possible that some of the more audacious stars begin wanderings of their own, leaving the mother universe and venturing forth in the depths of space. The majority of the stars will probably remain faithful to the main body, but it is now only a question of time as to how long they will manage to keep alive. The smaller stars die first, after having sent their light and heat into the insatiable cold of empty space. The larger stars follow, and finally the whole galaxy is reduced to a conglomeration of dying embers treading their *danse macabre* through the voids of creation and waiting to be gathered into the scrap heap of the cosmos, ultimately, perhaps, to be rekindled.

Such is the drama of the evolution of an island universe as we now see it. With the aid of Jeans's theory and Hubble's observations we can scent the course of nebular evolution along an unmistakable path, looking into the past for hundreds of millions of years, and into space for sextillions of miles. For we must not forget that, in dealing with island universes, we are dealing, in Hubble's words, with a "history of receding horizons." If the light of the Andromeda nebula takes a million years to reach us, then we see this nebula, not as it is now, but as it was one million years ago. Even the nearest of all island universes, the Magellanic Clouds are seen only as they were 100,000 years ago, long before the last ice age on earth. The majority of island universes we observe in times far, far earlier than the appearance of man on earth.

From the scheme of evolution of a universe we may perhaps infer that island universes occupying the same stage of evolutionary progress are comparable in size. Basing our researches on this assumption, we can then make deductions concerning the relative frequency of each type of universe, and about the total number of galaxies in a given volume of space. In short, we can begin to study the population of that greater cosmos, the cosmos of island universes. One significant thing strikes us immediately; namely, that among all the different island universes now known there is not a single one that surpasses the Galactic system in size.

They may all be more or less comparable to each other. The Andromeda nebula represents thus far the maximum dimensions, and even it, with its 50,000 light years diameter, is much inferior to our Galactic system with its diameter of 300,000 light years. These extraneous stellar systems may all be island universes; our Milky Way system is still the only continent among them.

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Forestry In Its Infancy

Forestry

I. W. BAILEY AND H. A. SPOEHR, in *The Role of Research in the Development of Forestry in North America* (Macmillan):

Silviculture is of necessity a more plastic and adaptable art than is agriculture, due to the fact that it is concerned with essentially natural and varied, rather than with highly artificial and stereotyped, units of vegetation, and therefore must modify or revise its methods to meet the requirements of varying complexes of natural and economic factors. There are at present no sound, well-established, fundamentally scientific generalizations for determining in advance the best cultural treatment of a new suit of forest vegetation. Even in those regions, e. g., Europe and Japan, where silviculture is most intensively practiced, it has developed almost entirely through an efficiently systematized empiricism. Thus, the extension of silvicultural management over the earth's vast area of wild forest land must be preceded by a comprehensive descriptive survey and analysis of widely fluctuating natural and economic variables, and by an intelligently formulated program of empirical experimentation—a task, the magnitude and importance of which are not generally recognized by biologists. In other words, from the point of view of the world as a whole, silviculture, in contrast to agriculture, is in the incipient, pioneer stages of its development.

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Great Britain gets more than one-third of her imported goods from other countries of Europe.

In 1928 there was a lower death rate than ever before recorded in this country for typhoid fever, diphtheria, scarlet fever, and tuberculosis.