ASTRONOMY

Life on Tiny, Dark Stars

Life forms possible, Dr. Harlow Shapley suggests, on many of the millions upon millions of unseen tiny "stars" sprinkling the vast reaches of space, Ann Ewing reports.

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➤ THE HOPEFUL search for life in the universe has moved closer to our sun—almost next door to earth, astronomically speaking.

Upon the crust of dark and tiny stars, amazingly cool, the latest theory is that there may be protoplasm, the stuff of living things.

If anyone of less authority than Dr. Harlow Shapley, emeritus director of Harvard College Observatory, had suggested the existence of what he calls Lilliputian stars, of a size between the star we know as the sun and the next closest star, the idea might not be taken seriously. However, Dr. Shapley is one of the world's leading authorities on the birth and growth of the universe.

He believes that the space between the stars, including that between the sun and Alpha Centauri, is sprinkled with billions of invisible dark stars that are smaller than the sun but larger than the giant planets, such as Jupiter. These objects are cool, for stars. But they are of the right size to have crusts that are warm enough to maintain water in a liquid state.

The photograph on the front cover shows the planet Jupiter drawn to scale (circle) against a small portion of the sun's surface. Invisible objects in space could be half-way in size between Jupiter and dwarf stars much smaller than the sun.

Therefore, they would be suitable as a place where living things could develop.

Thus, the nearest life beyond the earth, excepting for possibly Mars, may be on the surfaces of such small, cool stars. These objects cannot now be seen but eventually may be discovered as sources of radio waves. They may be more numerous than recognized stars.

One of them may some day drift into the sun's system of planets, Dr. Shapley suggests. If so, it could be detected by its reflection of sunlight or through the disturbances it causes in the motions of outermost comets and planets.

Dr. Shapley has named the largest of these unseen bodies, which might be one-fiftieth of the sun's size, Lilliputian stars. The smallest, which might be one five-hundreth the sun's size, he calls Brobdingnagian planets.

He bases his suggestions for the existence of these stars on the generally accepted theory of star birth. This views the forerunner of the sun and planets as a diffuse mass slowly contracting because of its own gravitational attraction.

This mass consisted of dust particles of various sizes and gas that was mostly hydrogen, although very minor amounts of heavier elements were present. The chemistry of the earth's crust supports this view.

It is also supported by the spacing of the planets, the peculiarities in rotation of the sun and planets, and a variety of evidence from meteors, comets, asteroids and the zodiacal light.

The keys to Dr. Shapley's suggestion of crusted stars are the questions, "Why is the sun just so big?" and "Are there stars of all sizes, or only stars like those we see and catalogue?"

Dr. Shapley and others have concluded that the upper limit of stellar size would be about five times the sun's mass. On the other hand, a star a great deal smaller than the sun would not generate enough internal heat from gravitational compression to shine noticeably in the visual or photographic wavelengths. It would not tap the nuclear energy source that maintains the sun's radiation.

However, Dr. Shapley believes that in any "reasonable theory of planet formation," there must be innumerable, free-roaming bodies of very small mass. Jupiter, he notes, has one-thousandth the mass of the sun, while the earth is only one three-hundred and thirty-thousandths that of the sun. Nevertheless, each was able to condense from the nebulous gas to its present size.

Therefore, Dr. Shapley concludes, space must be "rich in independent dark bodies with masses between one-tenth and one-thousandth the sun's mass."

The earth's surface is kept livably warm by sunlight and by its own internal heat, which is due both to gravitation compression and radioactivity. Jupiter is about five times farther from the sun than the earth and receives, therefore, relatively little heat from solar radiation. However, it gets a good deal of heat from gravitational pressure, which would be available in the complete absence of the sun or any other neighboring star.

"Among the billions of planetary systems in the Milky Way galaxy," Dr. Shapley said, "and the multitrillion planets in the billions of other galaxies, there must be innumerable instances where the planets are much bigger than Jupiter and therefore must have richer internal sources of heat."

The unseen companion of the star known as 61 Cygni is probably such a body, Dr. Shapley said. Its existence is known because of its gravitational effect on the motion of its parent star.

There is no reason to believe that the crusted stars, or self-warming planets, must be associated with stars. Of the wandering objects, those of one-hundredth the solar mass are probably much more numerous than those of a tenth; and those one-thousandth more numerous than those one-hundredth.

At some size between that of Jupiter and the dwarf red stars, the surface temperature must be right for a permanent crust to form and for water molecules to appear in a liquid state—not steaming hot, not frozen cold.

Then, Dr. Shapley believes, "something momentous can and undoubtedly does occur.

"Slowly but inevitably, with lightning playing on the primitive atmospheric gases, natural chemical reactions produce amino and nucleic acids—the forerunners of proteins, of biological cells and of organisms."

Even if the right conditions occurred very infrequently, "cosmic numbers are big enough and cosmic time is long enough to permit living organisms to occur abundantly," Dr. Shapley said.

The chemical make-up of a lightless star must be much the same as on earth. However, if life exists on such self-warming planets, it would seem a "strange kind of bio-synthesis" to humans. There would be no need for eyes like those humans and animals possess. On the other hand, there might be built-in receptors for long wave radiation or for magnetic fields. The array of sense organs could differ widely from one body to another.

Although these cool dark stars are everywhere in space, better instruments than earthlings now possess are needed to detect them. The hundreds of sources of radio waves that have not been identified could be Lilliputian stars.

Dr. Shapley said that the imagination "boggles at the possibilities of self-heating, giant planets that do not depend, as we do, on the inefficient process of getting warmth through radiation from a hot source, the sun, millions of miles away."

Only one two-billionths of the sun's outgoing radiation is blocked by the earth, and only a fraction of that radiation is used in photosynthesis, the process by which green plants convert the sun's energy into food. Photosynthesis is a very inefficient method of providing terrestrial energy, compared with the efficient operation of a Lilliputian star of optimum mass.

Such a body, unlike the earth, would not be parasitic on a neighboring star, not dependent on a parental star for its energy supply. It would be self-warming. Its biology might have to be anaerobic, or oxygen-free, as are some earthly forms. If so, like bacteria, its organisms might not rise to what humans consider great importance.

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