

## ASTRONOMY

# Life in All Solar Systems?

Virtually every star in the universe, a scientist suggests, is the center of a solar system possessing planets with intelligent life—By Ann Ewing

► MAN APPARENTLY is not alone in the universe.

Hundreds or thousands of planets not far from the earth, astronomically speaking, may well have intelligent life forms.

Not only the sun, but virtually every star has planets, Dr. Harrison H. Brown of the division of geological sciences, California Institute of Technology, Pasadena, suggests. At least two of the four or more planets circling around each visible star might have an environment suitable for life forms with earth-like chemistry.

Dr. Brown, who is also foreign secretary of the National Academy of Sciences, believes listening for signals from intelligent life forms or looking for evidence of unseen planets around other solar systems could prove "profitable and exciting." He urges increased efforts to find planets outside the solar system, using either ground-based or satellite-mounted telescopes.

If planetary systems are as plentiful as Dr. Brown's studies show, other life forms would be both "abundant and diverse," since there could be as many as 100 billion planetary systems in the Milky Way galaxy.

He calculated the likely occurrence of planets the size of Mars, which is about half earth's size, and found that on the average each star should have four planets similar to earth or Mars. Such planets would be found not only around visible stars but also around invisible stars, heavenly objects too small to shine by their own light as the sun does.

Dr. Shiv S. Kumar of the Goddard Institute for Space Studies, New York, has estimated that there are 20 invisible bodies for each visible star. All stars visible to the naked eye, except the Andromeda Nebula, are part of the Milky Way galaxy, a collection of some hundred billion stars.

In his calculations, Dr. Brown took into account the likely chemical composition of planets in relation to stars. He found that there may be 60 objects more massive than Mars for every star. Many others would be circling unseen stars, dark bodies that Dr. Brown calls "black dwarfs."

He suggests that in the neighborhood of the sun there are 1,270 bodies the size of Jupiter, or larger, for every 100 visible stars. Invisible stars, with their accompanying planets, should be nearly as numerous as visible stars, Dr. Brown reported in *Science*, 145:1177, 1964.

Dr. Brown notes that most scientists believe life forms would exist only on planets being heated by their "sun" to a degree somewhere between that received by Venus and that received by the asteroids. Therefore, earth-type planets would be more numerous near stars of high luminosity than near stars of low luminosity.

About two and a half years ago, Dr. Harlow Shapley, emeritus director of Harvard College Observatory, suggested that millions upon millions of unseen tiny "stars" sprinkle the vast reaches of space. Such stars would be half-way in size between giant planets like Jupiter and dwarf stars much smaller than the sun.

Dr. Shapley suggested that life would exist on the crust of these tiny, dark and surprisingly cool stars. Some of these stars with life forms on their surfaces would be between the earth and the next closest star, Alpha Centauri.

Such stars would therefore differ from the stellar systems envisioned by Dr. Brown, which have planets circling invisible as well as visible stars.

• *Science News Letter*, 86:199 Sept. 26, 1964

## PHYSICS

## New Theoretical Model For Ball Lightning

► A NEW EXPLANATION to account for ball lightning, a rarely seen form of a glowing globe floating through the air, has been reported.

The theoretical model devised helps explain the eerie behavior of ball lightning, which dives down chimneys, boils water in barrels and melts airplane wings.

Ball lightning is the result of a concentration around a conductor of the high electrical fields found during a thunderstorm, Dr. David Finkelstein of Yeshiva University, New York, and graduate student, Julio Rubinstein, believe.

The electrical conductor can be air that has previously been ionized, or stripped of electrons, by ordinary lightning, or it can be a pointed object such as a lightning rod. The so-called St. Elmo's fire may be a form of ball lightning.

Ball lightning can be inches or feet in diameter, and lasts from a few seconds to a few minutes. The new model to explain its occurrence was reported in *The Physical Review*, 135:390, 1964. If the Yeshiva University scientists' theory is correct, ball lightning has no relationship to research on controlling H-bomb blasts for peaceful purposes, as some scientists had proposed.

• *Science News Letter*, 86:199 Sept. 26, 1964

## SPACE

## Guidance-by-Stars Uses Three Gyroscopes

► ALTHOUGH the Defense Department has scrapped its program to develop a mobile medium-range missile, research will continue on the highly secret stellar inertial guidance system (STINGS), by which a missile is navigated by the stars.

Perfecting it, with command and control functions, will be the only part of the Mobile Medium Range Ballistic Missile (MM RBM) program to be continued. Although most information on STINGS is highly classified, it is known to use a platform of three gyroscopes to fix courses.

General Precision Inc., Little Falls, N.J., is doing the research.

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Bell Telephone Laboratories

**BEAD LIGHTNING**—A phenomenon related to ball lightning, this pinched, or bead, lightning was photographed near Los Alamos, N. Mex., by Drs. B. T. Matthias, University of California at San Diego, and S. J. Buchsbaum, both of Bell Telephone Laboratories. They estimated its width to be between three and sixteen feet.