ASTRONOMY

New Star Dating Method

A new method of dating stars, based on measurements of lithium, makes possible spotting very young stars and also promises to give important data on the development of stars.

➤ THE FIRST EFFECTIVE technique for measuring the ages of large numbers of stars like the sun has been developed.

Providing a powerful research tool for astronomers, the new dating technique is based on relatively simple measurements of a single chemical element, lithium. The age calculations can be applied to both young and "ordinary" stars, as well as to the sun itself.

The new method makes possible spotting very young stars among the myriad stars in the sky. With further development, the technique appears certain to give astronomers important evidence on such problems as the origin of stars, the rate of star formation and the cycle of stellar evolution.

Details of the new star dating system were reported to the American Astronomical Society meeting at Tucson, Ariz., by Dr. George H. Herbig of the University of California's Lick Observatory on Mt. Hamilton.

The dating system is based on evidence that young stars are rich in lithium, the lightest of all metals, and that the amount of the element drops off at a relatively steady rate as the star grows older. The method requires only a single observation of an individual star.

Light from the star is focused through a telescope and spread into its "rainbow" spectrum. A photograph of the spectrum reveals the dark lines characteristic of various chemical elements. Relative strength of the lithium line can then be interpreted as an indication of the star's lithium abundance.

Dating dwarf stars (like the sun) has previously been largely a matter of guesswork, based on indirect evidence and requiring extensive observations, and interpretation of complex and sometimes conflicting data.

Evidence from several sources has led to development of the new system:

1. Discovery that very young "T Tauri" stars, less than five million years old, contain relatively large amounts of lithium.

2. Knowledge that the sun, an "ordinary" star about five billion years old, has very little lithium.

3. Findings by geochemists that stony meteorites, believed formed from the sun's original materials, have a rich lithium abundance equaling that in the young T Tauri stars.

Fitting these pieces of evidence together, Dr. Herbig concluded that the sun is continuously "devouring" its own lithium.

This can be explained by the process of "convective circulation" in the sun's outer layers. Lithium is carried from the sun's relatively "cool" surface, about 11,000 degrees Fahrenheit, to a deeper layer, where the impact of hydrogen nuclei at temperatures of about five million degrees is sufficient to split each lithium atom into two helium atoms and thus account for the element's gradual destruction.

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PHYSICS

Harnessing Light Seen

➤ HARNESSING light for communications has been brought much closer to reality with two discoveries reported to the American Physical Society meeting at Washington, D. C.

1. A method of making the extremely intense beam of laser light have any desired color by passing it through a crystal, much as the dial on your radio is used to tune different stations at their assigned frequencies.

2. A method of amplifying this single-colored light beam by passing it through a liquid to achieve the same kind of amplification, called "parametric," now applied so successfully to radar waves.

With further developments, about which many physicists are optimistic, light waves could be used to carry communications across the country, being amplified as necessary. Because of the color selection, the number of channels available for communications would be increased more than a million-fold. The color selection and amplifying method were reported by Dr. Robert Terhune of Ford Scientific Laboratory, Dearborn, Mich.

Lasers give light a million times more intense than the sun. The light is of only one frequency, or one pure color. Laser light has previously been mostly in the red and infrared portions of the spectrum.

The crystal used in Dr. Terhune's experiments to change the color of laser light was ADP, or ammonium dihydrogen phosphate.

Scientists are hopeful that a pure green light, which can now be produced, could be used in undersea communications, guidance and antisubmarine search devices, or light sonar.

Dr. Terhune also reported success in focusing the laser beam to obtain intense electric field strengths as high as two and a half billion volts per square inch, strong enough to cause electrical breakdown of air. He showed a picture of a laser-caused spark in air, or "laser spark plug."

However, Dr. Terhune cautioned that the laser is not practical as an ignition system for an automobile engine. It does offer a new method for studying in detail the combustion process inside a cylinder.

The amplification method might also be applied to astronomy, enabling scientists to detect much fainter heavenly objects than now possible.

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Milky Way Galaxy Age

➤ THE HEAVY ATOMS of the Milky Way galaxy in which earth, its sun and other planets are located are from 10 to 15 billion years old.

This age was found using a new method of radioactive dating reported to the American Physical Society at Washington, D. C., by Dr. Donald D. Clayton of California Institute of Technology. The method for measuring the time the atoms were created is based on the natural laws of radioactive disintegration.

The radioactive element known as rhenium-187 breaks down very slowly into osmium-187. This disintegration is so slow that 600 million years are need for one percent of the rhenium to be transformed into osmium.

However, because the rate is known, the time at which rhenium was created can be calculated if the fraction of atoms that have since decayed to osmium is known.

Dr. Clayton reported that his research had solved this decay problem. He then calculated that rhenium atoms were created six to ten billion years before the formation of the solar system, about four and a half billion years ago.

The heavy atoms are believed to have been created in explosions of supernovas within the Milky Way galaxy.

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COMMUNICATIONS

Satellite Communication Said More Expensive

➤ THE USE of satellites for communication with underdeveloped countries may be considerably more expensive than conventional methods, Dr. Leland L. Johnson of the Rand Corporation, Los Angeles, believes.

Broadcasting television programs to underdeveloped countries through ground stations would be much more expensive than sending films by air, he pointed out.

Direct broadcasting from the satellites to individual receivers is not yet technically feasible, he said, thus ruling out the likelihood of satellite broadcasts direct to areas behind the Iron Curtain.

Use of satellites for telephone communications would be most feasible for linkage between major international centers, where phone traffic is already heavy, Dr. Johnson reported in California Management Review, Spring, 1963.

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