Physical Sciences Notes

NUCLEAR PHYSICS

Transition Radiation Measured

A particular kind of radiation that could be used to measure the velocity of charged particles near the speed of light has been detected in experiments at Brookhaven National Laboratory, Upton, N. Y.

The radiation—gamma rays—was predicted to occur when charged particles pass between media with different electrical characteristics.

In the experiment, carried out by Dr. Luke C. L. Yuan and three other physicists at Brookhaven, protons and pions of known velocity were sent through a stack of thin metal foils enclosed in a vacuum. As they passed from metal into the vacuum, the "transition" radiation was measured. The intensity of the radiation in the forward direction was found to increase in a regular way as the velocity of the particles went up.

If the transition radiation detector can be developed, it will be useful to determine the unknown velocity of particles by the amount of radiation they give off. This in turn could be used to identify unknown particles.

Although other techniques can be used to measure velocity of slower moving particles, the known methods don't work when speeds approach the speed of light in a vacuum.

The research is reported in the Aug. 28 Physical Review Letters.

ASTROPHYSICS

Computer Simulation of Stars

Computer simulation of how a star's interior pulsates has earned the Eddington Medal of the Royal Astronomical Society for Dr. Robert F. Christy of the California Institute of Technology in Pasadena.

He has studied the behavior of two kinds of pulsating stars—Cepheid variables and RR Lyrae stars. Both are easily distinguishable from ordinary stars because their light varies rythmically. RR Lyrae stars brighten and fade in periods of two hours to one day; the Cepheids take from one to 100 days.

Both types of variable stars are of particular interest because their brightness and blink period are related—the longer the period, the brighter the star.

Dr. Christy's most recent researches have concerned Cepheid variables whose dim-bright cycle is about 10 days. Instead of one hump at the crest of each wave representing their peak brightness on a graph, there were two humps. He fed Caltech's IBM 7094 computer with possible values for the mass, radius and luminosity of Cepheids having a 10-day period.

The computer, simulating the behavior of such a variable star, showed a shock wave moving up to the star's surface and another one moving down to its nuclear core. The second wave was then reflected outward from the core to the surface, and this is the wave that produced the second hump on the graph.

Since for only one value of the mass did the computer echo look like a real star, Dr. Christy concludes that the mass of the 10-day Cepheids is only one-half of what it was believed to be. They are now believed to be only three and a half times more massive than the sun, rather than seven times as previously thought.

SOLID STATE PHYSICS

Ultimate Laser Probe

An entirely fresh approach into the nature of matter and antimatter could be made using a highly amplified laser beam, an Australian scientist suggests.

Dr. J. L. Hughes of the Australian Defence Scientific Service, Weapons Research Establishment, Salisbury, South Australia, outlines the possibilities for an "ultimate laser probe" in the August Applied Optics.

To build such a laser, Dr. Hughes notes, would be about as expensive as building a large particle accelerator, the instrument scientists now use to study subnuclear structure. Cost estimates for such large machines as the 200 Bev scheduled to be built at Weston, Ill., run about $2 million per Bev.

Despite the cost, Dr. Hughes believes the effort necessary to build a laser several times more powerful than any now available would be justified. It could be used to study the scattering of light by light, and also for research in plasma physics and photon-particle interactions.

HOLOGRAPHY

Holograms Through TV Tube

Some holograms—three-dimensional images produced by interfering laser beams—are too dim to show up well when reproduced photographically.

To overcome this difficulty, two scientists at Stanford Electronics Laboratories, Stanford, Calif., have used a television camera tube to detect the laser pattern before it forms the image, and a computer to construct the image artificially.

In making holograms, laser light is split into two beams, one going directly to a photographic plate, or in this case to the videcon tube, and the other bouncing off the object. The two beams interfere with each other to form a pattern that depends on the shape of the object.

Ordinarily, a laser light is later shone through the pattern on the photographic plate, and a three-dimensional image is formed in space that duplicates the original object.

In the technique developed by the Stanford Electronics researchers, J. W. Goodman and R. W. Lawrence, the pattern is detected by the videcon tube, which converts it into a large number of electrical signals. These are fed into the computer, which converts them into a pattern that can be recognized, and displays them on a screen.

The research is reported in the August Applied Physics Letters.