PHYSICS

Atomic 'Ghost' Tracked

By means of a compound model of the nucleus, the properties of "ghost" resonances that are characteristic of certain nuclei have been successfully explained.

➤ THE MYSTERY of the "ghost" of the atomic world that appears when not expected and is not found when expected has been solved.

Actually, the ghost is a resonance. It would appear unexpectedly in one experiment but not in other similar experiments. The resonance is the occurrence of unusually large numbers of pairs of helium and neon nuclei leaving a carbon target at certain angles when carbon nuclei in an atom smasher at the Chalk River Nuclear Laboratories, Chalk River, Ontario, reached certain energies.

The ghost can be eliminated if a certain way of describing the atomic nucleus, known as the compound model, is used. Such ghosts were created experimentally by bombarding the nuclei of carbon atoms with other carbon nuclei in the Chalk River atom smasher.

Large numbers of pairs would occur at one energy in one experiment, but would not appear at that energy in another. During another experiment, they would occur at a lower or a higher energy. According to the usual rules, they should not have occurred at all.

The physicists who tracked down the elusive ghost were Drs. Einar Almqvist, John A. Kuehner, David McPherson and Eric W. Vogt of Atomic Energy of Canada Limited's Chalk River Nuclear Laboratories. They measured the yield of neon-helium pairs of nuclei under varying energies and angles.

The scientists reported their results in the Physical Review, 136:B84, B99, 1964.

The essential features of the compound nucleus model for the reactions of two carbon nuclei is the "memory" the compound nucleus has for a few basic conservation laws of physics and its lack of "memory" of all other facts about the way in which it was produced. The compound nucleus therefore treats all possible reactions on an equal footing, leading at times to the production of "ghosts."

Because the particles emitted by a compound nucleus are subatomic, they can be viewed as either waves or particles. The wavelets produced by each of many resonances all at the same energy can reinforce or destroy each other. The production of the wavelets is sufficiently complex that their reinforcement or destruction is a random phenomenon. As a result the compound nucleus production process "fluctuates" with energy change.

The fluctuations or "ghosts" appear very much like single resonances (production of certain particles at certain angles and energies) but their origin is different and the amount of fluctuation obeys different laws.

The compound model of the nucleus was first proposed in 1935 by the late Danish physicist Niels Bohr and by the U.S. physicists Drs. Eugene Wigner of Princeton University and Gregory Breit of Yale University.

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Esso Research and Engineering Co.

PROPELLANT COMPOUND TESTING—A static sensitivity test on a high-energy propellant compound is being conducted by John A. Brown, Esso Research and Engineering Company, who heads the project to find methods of desensitizing large quantities of rocket propulsion ingredients.

PHYSICS

Einstein's Principle True for Light Waves

➤ EINSTEIN'S PRINCIPLE of equivalence holds true for electromagnetic waves such as radio and light, two physicists at Harvard University have found in the most precise experiments yet made to test the theory.

The equivalence principle is one of the basic assumptions of Einstein's general theory of relativity. It states that no detectable difference exists between the force of gravity and the force produced by acceleration outside a gravitational field.

Earlier experiments proved the equivalence principle for material bodies, but only recently has the effect of gravity on light, radio waves and gamma rays been detected in the laboratory. Einstein's conclusion was that gravity should lower the frequency of light rays escaping from a gravitational field.

This effect, called the gravitational red shift, has now been measured more accurately than ever before by Drs. Robert V. Pound and Joseph L. Snider. The new measurements confirm Einstein's prediction more surely than ever, giving 99.7% of the expected value with an experimental uncertainty of less than one per cent.

The experiments measured the change in frequency of gamma rays as the source of radiation moved up and down a 75-foot tower. Results are reported in Physical Review Letters, 13:539, 1964.

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ASTRONOMY

Instrument Helps Detect Color on Moon

➤ AN INSTRUMENT that detects different colors on the surface of the moon is under development by the National Aeronautics and Space Administration.

Called a "moon blink," the instrument has already detected a red spot in the crater Alphonsus near the center of the moon. Red spots were observed six years ago in this same area by a Russian astronomer, Nikolai A. Kozyrev.

The "moon blink" helps locate spots of color on the moon by making them appear to blink. This blinking effect is produced by colored filters rotated across the light reflected by a telescope mirror.

The instrument is being developed by Trident Engineering Associates, Inc., Annapolis, Md., from an idea advanced by Dr. James B. Edson of NASA.

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