Photon Absorption Results
Reported To Physics Dept.

By Yossi Shenbon '62

The Physics Department's weekly colloquium, Thursday at 4:00 in 26-100, last week featured Dr. W. V. Koch of the U.S. Department of Commerce, National Bureau of Standards. Dr. Koch described recent research, at the bureau striving towards more precise measurements of "Photon Absorption Cross-Sections."

The earlier part of his talk was devoted to reviewing the general concepts relating to the experiments. In classical physics, the term "cross-section" implies a certain area presented by a target in nuclear physics, only a vague semblance of this idea is retained. Depending on the energy of the photons being shot at nuclei, the "cross" presented by the nuclei changes. Photons are not merely stopped or passed, but rather are scattered at various angles to the side. Measuring the distribution of scattered photons enables the experimenter to calculate the cross-section for a photon-nucleus interaction.

At the energies of interest to Dr. Koch's group, two types of photon absorption occur: Compton Scattering, in which the wavelength of the photons changes as they are scattered, and pair-production, where the photon, in the presence of the nucleus, generates a positron and an electron. As the photon energies increase, the Compton process becomes less probable, while pair-production increases; there are corresponding changes in the cross-sections for each type of interaction.

In a certain energy range (different for each element), the two probabilities (before cross-sections) are about equal; some unusual effects occur in this range. In particular, a "giant resonance" appears, in which the cross-section suddenly rises above its normal value at the range. The sharpness of the peak depends on a variety of factors related to the target nucleus.

Dr. Koch next described certain dispersion relations, in a non-mathematical form. Theory predicts that the cross-section for elastic scattering depends on the integral of the absorption cross-section over all frequencies. By measuring this integrated cross-section exactly, a good check on the theory can be made. The whole purpose of the dispersion relation is to relate the absorption cross-section to the scattering cross-section.

Turning from the blackboard to a large number of slides, Dr. Koch described the actual experiment in the first fifteen minutes. In the apparatus, a light spectrum strikes a detector and absorber. Large crystals of sodium iodide (9" long by 5" diameter) were used for this purpose. A coincidence counter is used to improve the reliability of photon detection in the apparatus.

The results showed a fair energy resolution; in some cases the statistical weight of a large number of counts per point allowed a good calculation of the attenuation coefficient of the photon beam, leading directly to a value of the photon absorption cross-section. Carbon and Beryllium are the two elements investigated most by Dr. Koch and his collaborators; he displayed slides showing results of test runs, the predicted "giant resonances," comparison of Beryllium with Carbon, similar data obtained by Soviet scientists, predicted energy-level diagrams, and an assortment of other results. Dr. Koch explained that by finding what energy the resonances occurred, it becomes possible to make qualitative statements about the structure of the nuclei under investigation.

Dr. Koch closed by describing a new laboratory for this purpose operated by the National Bureau of Standards. Here a linear accelerator gives a high-intensity beam of high-energy electrons; the entire system is designed to permit a number of very unique experiments to be done.

Course XIV To Offer "Urban Life Structure"; Field Work Stressed

"The Structure of Urban Life" (14.99), a double credit (16 hour) course, will be offered by the Political Science Department this spring. The course is designed to give, through lectures, reading, and extensive field work, a feeling for what makes the political, social, and economic systems of major cities work. Subjects range from transportation; crime, to urban renewal, to "suburbia," to party politics. 14.99 will be taught by Professor Robert C. Wood, assisted by Barbara Seashole.

Although 14.99 is the only prerequisite, the number that can be accepted is limited.

Eight to ten students from Dartmouth and Simmons will be registered. Anyone interested in taking the seminar should talk with Professor Wood (14N-233) before registering.

Field work comprises a large part of the course. Last year several students interviewed suburban government officials in the Boston metropolitan areas.

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