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SUMMARY OF WEEKLY RESEARCH PROGRESS MEETINGS
of February 7 and February 14, 1952

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SUMMARY OF WEEKLY RESEARCH PROGRESS MEETINGS OF FEBRUARY 7 AND FEBRUARY 14, 1952

by

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I. Classical Theory of Meson Nucleon Scattering. M. Ruderman.

Various evidences (viz. the change of nucleon spin state in $p + p \rightarrow D + \pi^+$) imply that the meson is coupled strongly to the spin of a nucleon. Classically the scattering of such mesons is similar to the scattering of photons by a point magnetic dipole. There is a resonance in the scattering cross section when the meson frequency equals the free precession frequency; $\sim \frac{\text{Spin Angular Momentum}}{\text{Moment of Inertia}}$.

Also the characteristic resonance shape will appear even if the inertia goes to 0 because after an initial rise the damping will make the cross section go to zero like $1/E^2$. For a very large inertia the scattering cross section is very small and would imply low lying bound states, which have not been observed. Although an infinite set of isobar levels exist classically corresponding to higher value of the total angular momentum, only the lowest ($J = 3/2$) can be excited in a scattering experiment. If the isobar frequency is greater than that frequency at which the damping begins to dominate, the cross section will be doubly peaked; otherwise, it will have a single "resonance". It is possible to fit the shape and size of the $\pi^- + p \rightarrow \begin{cases} \pi^- + p \\ \pi^0 + N \end{cases}$ cross section with $g^2 \div \hbar c \approx 3/10$ with no isobar level, only damping. However, $\pi^+ + p \rightarrow \pi^+ + p$ then has about the same cross section in contradiction to experiment which makes it about three times as large.

II. The UCRL Differential Analyzer. J. Killeen.

The differential analyzer at the University of California Radiation Laboratory is now in operation in Room 108, Building 50. It was built by Earl Sorensen and Carrol Gordon and was designed on the same principle as the Illinois machine. It has, however, a larger capacity and added improvements.

The basic element of the analyzer is the integrator, which is of the ball and disc type. The element is powered by selsyn motors and operates on a system of electro-mechanical connections. Six of these integrators comprises a unit and the analyzer has two such complete units. There is a facility, however, for connecting up a possible 7th integrator to each unit. Each unit has three plotting tables, six multipliers, adders and counters.

The analyzer is not a high speed calculating machine but rather an analog computer with a electro-mechanical system of interconnected integrators designed for solving ordinary differential equations directly for given conditions. In order to solve a problem the biggest task is first restating it in terms which the machine can understand and setting up a wiring diagram for the number of integrators required for the particular problem. After this is done, it is then necessary to determine limits and to set the initial values, scales, counters, multipliers, plotting tables, pens, etc. before turning on the analyzer. The actual running time of the machine is generally less than twenty minutes. Some examples of the applications for the analyzer are in problems on: equation of motion, radial wave equations, radioactive decay series, circuit oscillations, deflection of beams, fluid flow, etc.

A detailed report on the structural and operational features of the differential analyzer together with examples illustrating the solution of problems is expected to be published in the near future. A construction and maintenance report on the UCRL synchro driven differential analyzer has already been published as UCRL-1717 by Earl G. Sorensen, February, 1952.

February 14 Meeting

I. X-ray and Soft Gamma Radiation in Am^{241} and U^{237} Decay. C.I. Browne.

The talk was based on an experiment for which an abstract report UCRL-1516 has been published entitled "L X-rays and Low Energy Gamma Radiation in the Decay of Am^{241}", by C. I. Browne and I. Perlman, Department of Chemistry and Radiation Laboratory, University of California. In addition, this material is being incorporated together with other experiments also into a thesis by C. I. Browne, which is in the process of being published as report UCRL-1764, entitled "Precision Measurement of X-rays and Gamma Rays in Radioactive Decay". The abstract report UCRL-1516 is reproduced as follows:

"The L x-rays and low energy gamma rays given off following the alpha decay of Am^{241} have been studied on a 10-inch bent crystal x-ray spectrometer. Eight gamma rays have been observed in the spectral region of 12-85 kev, with energies ranging from 14.23 + 0.06 to 59.78 + 0.02 kev. The La_1, La_2, $L\eta$, $L\beta_2 L\beta_4$, $L\beta_1$, $L\gamma_1$ and $L\gamma_6$ x-rays of neptunium from gamma ray internal conversion have been observed. They were identified by comparing the observed energies with extrapolations of the Moseley relationship and assuming the identities, the agreement in energy was close. Estimates of relative intensity have been made on both the gamma and x-radiation, and lead to the conclusion that the ratio of vacancies produced in the L shell by internal conversion is $L_I : L_{II} : L_{III} = 6:5:2$. A partial decay scheme is suggested and a number of the gamma ray transitions are shown to be in good agreement with known spacings from alpha particle complex structure."

II. Scintillation Counter Symposium. L. Wouters and R. F. Post.

The scintillation counter symposium was held January 29th to the 30th, in Washington, D.C. After attending the symposium L. Wouters went on to visit the RCA laboratory at Princeton. He spoke chiefly on the improvements and production status of certain photo multiplier tubes at RCA. The tube 4646, which

is going to be in production soon, was described as to structure, capacity, limitations and new development features, such as the small end window tube. It appears that the desired response in the 2400 Å spectral range may soon be possible with a quartz window. Some of the undesirable pulsing characteristics of the tube 5819 were also discussed.

Considerable research at RCA is directed toward improvement of photo cathodes. Experiments with materials as Bi, Cs, Li, etc. are going on to obtain a good photo surface, Li on Sb being the latest surface. RCA is going to put out reliable general purpose transistor units in about a year.

The principle of the synchrotron monochromator at Cornell was described by Wouters where coincidences from recoiling electrons from the target were employed to detect gamma's within a restricted energy interval.

R. F. Post talked on the work discussed during the second day's session of the symposium especially with techniques in scintillation counters. De Benadetti's work using 5819 tubes in fast circuits was mentioned. Zoltan Bey and his fast coincidence circuit using no clipping whatever was described. Papers had been presented at the session in which it was concluded that 3×10^{-10} appears to be about the best that can be done with scintillation counting of moderate energy events even with better photo multiplier tubes than are now available. Law had reported measurements which seemed to show the existence of a random delay time in the secondary emission process with a time constant of 3×10^{-10} NRL has designed a remarkable oscilloscope tube using a helix principle. It can respond to very fast pulses and is worthy of consideration for work requiring extreme speed of response.