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RADIATION LABORATORY

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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

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SUMMARY OF THE RESEARCH PROGRESS MEETING OF OCTOBER 18, 1951

S. Shewchuck

November 29, 1951

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Berkeley, California

SUMMARY OF THE RESEARCH PROGRESS MEETING OF OCTOBER 18, 1951

S. Shewchuck

Radiation Laboratory, Department of Physics
University of California, Berkeley, California

November 29, 1951

I. Photo Resonance Phenomena - Ryokichi Sagane.

This talk by Dr. Sagane was based on four separate articles by him, two of which have appeared in "The Physical Review" and the other two are in process of being published. Most of the experimental work for these articles had been performed at Iowa State College, Ames, Iowa. For purposes of this summary the titles of these articles are given, together with a few excerpts of some of the basic points in each as follows:

1. "Computation of Photonuclear Resonance Curves from Relative Activity Curves Monitored by Induced Radioactivity". "The Physical Review", Vol 84, November 1, 1951, pp 586-587.

"In preference to the "total spectrum method", Katz and Cameron have recently presented their "photon difference method" for obtaining photonuclear cross sections from observed bremsstrahlung activation curves. It is the purpose of the present note to point out that it is possible to obtain results of equal or better accuracy in the energy region of 20 to 100 Mev by monitoring with induced radioactivity.

"The radioactivity induced in a monitor sample is proportional to the integral, over the resonance, of $\sigma_M \times N_{hv}$ (cross section times

number of quanta). The character of the resonance curves for various suitable monitors is known with some accuracy and the relative number of bremsstrahlung quanta has been given by a number of authors. The use of a monitor radioactivity in effect serves to normalize the bremsstrahlung spectra in terms of the area under the $\sigma_M \times N_{hv}$ curves."

2. "Unusual Broad Resonances in $C^{12}(\gamma, n)C^{11}$ and $O^{16}(\gamma, n)O^{15}$ ". "The Physical Review", Vol 84, November 1, 1951, pp 587-588.

"The study of photonuclear resonances has been continued with the use of induced radioactivity as a monitor.

"The relative yield curves for C^{11} and O^{15} are given ...
"The corresponding cross section curves computed by the method.....
[reported in the first article] are shown in Figure 1. It is noteworthy that these resonances are quite similar, each being markedly asymmetrical and exhibiting a prominent high energy "tail" which extends to over 60 Mev. The carbon and oxygen resonances may be contrasted with the more common type illustrated by the copper curve reproduced in Figure 1.

"The high energy cross sections for carbon and oxygen are roughly proportional to E^{-3} , which suggests that this portion of the curve may be interpreted in terms of the nuclear photoeffect."

3. "Photodisintegration Processes with Abnormally Large High Energy Cross Sections". To be published.

"The previously reported character of the cross sections for (γ, n) processes in C and O has led to a search for other photonuclear reactions in which the cross section exhibits a prominent high energy "tail". Relative yield curves have now been obtained, with accuracy

of two to three per cent, for $Zn^{64} (\gamma, n)$, $S^{32} (\gamma, pn)$ and $Al^{27} (\gamma, 2p)$ reactions; in addition, curves with estimated 5 percent accuracy have been found for $Fe^{54} (\gamma, n)$ $Mg^{25} (\gamma, n) + Mg^{26} (\gamma, pn)$ and $Pb (\gamma, p) + Pb (\gamma, pn)$ processes.....

"The consequent cross section curves, computed by the method described earlier, are shown in Figure 3, where curves are being monitored by the integrated cross sections. The curve for $Ta^{181} (\gamma, n)$ is added for comparison.

".....reported broad resonances could be understood as the result of superposition of several different mechanisms of photo-disintegrations such as like the above suggested localized photon absorption, the competitive evaporation from the compound nuclei, the nuclear photoelectric effect and perhaps the so called "pick up" processes may also be included."

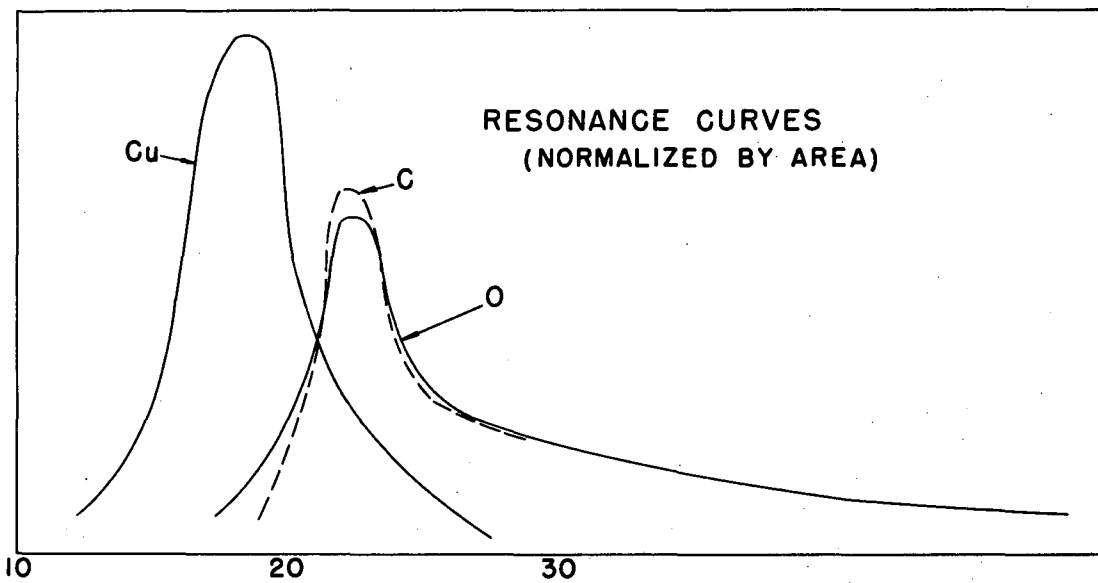
4. "relative Probabilities of Diverse Photonuclear Reactions from Zn^{64} and Fe^{54} ". To be published.

"With the use of a high energy X ray beam with its adjustable maximum energy up to 67 Mev, measurements were made leading to relative cross sections versus E_{γ} for (γ, n) , (γ, pn) , $(\gamma, 2n)$ and $(\gamma, 2np)$ reactions on the same parent isotope Zn^{64} or Fe^{54}

"....., results reported here show that the fall off of (γ, n) cross section above 20 Mev is due not only to competition from other reactions, but also to a fall off in the total cross section for gamma-ray absorption".

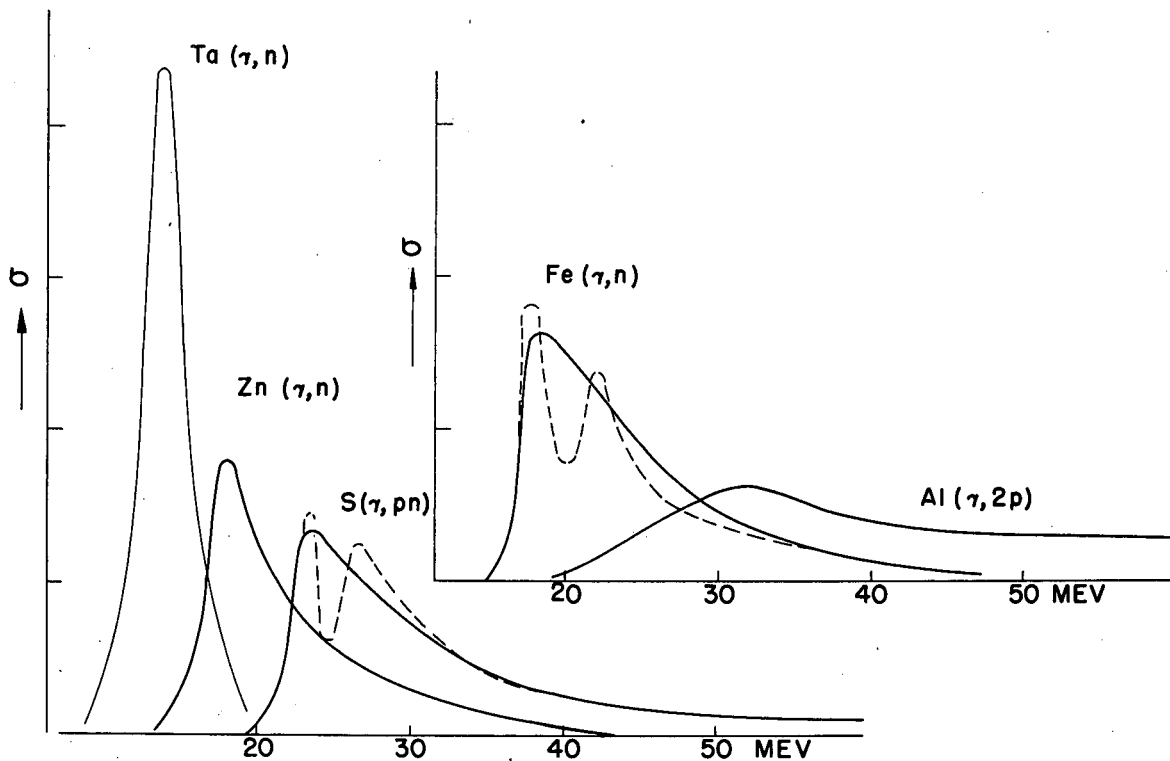
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Figure 1



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Figure 3

THE CROSS SECTION CURVES COMPUTED FROM THE DATA GIVEN IN FIGURE 1. DASHED LINES CORRESPOND TO THE CASES WHERE THE HUMPS IN THE RELATIVE YIELD CURVES ARE TAKEN INTO ACCOUNT.