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Metallurgical Laboratory



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Columbia Velocity Selector

A neutron velocity selector is now in operating order at Columbia University. It was built by two graduate students, William Havens and James Rainwater, under the direction of Professor Dunning. Their preliminary work shows that it has higher intensity and better resolution than the earlier Cornell machine. I list below several experiments which they would be in a position to carry out and which would give us valuable information which is needed in our work and which would be extremely difficult to obtain with our present facilities. You will please note that the experiments are in the field of pure nuclear physics and could be represented to the Columbia group as such. However, they have a direct but not obvious importance in our work, as I shall indicate. The program could be carried out without revealing any more about our work than is already known there. All the experiments are of importance in clarifying our ideas about the temperature effect which, as you know, is at present in a very unsatisfactory state. With the velocity selector it is possible to obtain a detailed picture of the way in which the cross sections for slow neutrons vary with energy.







I. The energy dependence of the scattering cross section of graphite for slow neutrons.

Crude experiments which have been carried out at Argonne indicate that the scattering cross section in graphite is markedly dependent on neutron velocity due to the effects of the crystal structure of graphite. The velocity selector will enable us to obtain the detailed [illegible] scattering as a function of energy over the interesting region. It will be important to

make these studies for the various kinds of graphite which we use. We have already reason to believe that the crystal structure of some of the brands are different. Our present knowledge of the absorption cross section of carbon comes from measurements of the diffusion length and of the scattering cross section which is imperfectly known. We should ask Columbia to carry out velocity selector measurements on certain samples of graphite which we will supply.

II. Velocity dependence of the cross section of heavy metal

There are two regions which are of interest and should be explored carefully. The region between .10 ev and 100 ev in which it is known that resonance levels exist. Work in this region has already been carried out at Cornell, but the improved resolution of the Columbia machine makes it desirable to repeat these measurements. We could use a curve with better resolution to improve our understanding of this resonance capture process. We believe that the behavior of the capture process in the region below .10 ev is anomalous due possibly to the existence of a negative resonance level. This behavior might give rise to a temperature dependence of $\eta$ (the number of neutrons emitted per thermal neutron captured by H.M.) A careful study of the behavior in this region has never been made. We should ask Columbia to study the velocity dependence of the cross section of uranium for thermal and resonance neutrons. We should supply the samples.

III. Calibration of neutron thermometers

The velocity selector at Argonne is used to calibrate neutron thermometers. To check the energy scale used at Columbia against the one which is obtained with our velocity selector, we should ask Columbia to measure the transmission of certain Pyrex plates at energy kT.



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