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1969 J. Phys. A: Gen. Phys. 2 245

(http://iopscience.iop.org/0022-3689/2/2/015)

J. PHYS. A (GEN. PHYS.), 1969, SER. 2, VOL. 2. PRINTED IN GREAT BRITAIN

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Abstract. Experimental total cross sections of 280 kev gamma rays are determined because of the inadequacy of the available data for Pb, Pt and Sn. Satisfactory agreement is observed between experimental values and theoretical values, computed with the latest data on photoelectric coherent and incoherent scattering cross sections.

Studies on the total gamma-ray cross sections are simple and informative, and can be carried out by conducting transmission experiments in a narrow-beam geometry arrangement. The major correction required to be made is that for the small-angle coherently scattered radiation included in the detector and this is applied using the theoretical scattering cross sections reported in the literature. The only available experimental data on the total cross sections of 280 kev gamma rays are those of Wyard (1953). The coherent scattering corrections applied by him may not be adequate, particularly for high Z elements, in view of the large angle of collimation used and the inadequacy of the theoretical coherent scattering cross sections then available. It is possible to reduce further the angle of collimation and hence the correction, at the same time utilizing the more accurate coherent scattering data now available. With this end in view, total cross sections of 280 kev gamma rays are determined in three heavy elements, Pb, Pt and Sn, using the modified narrow-beam geometry developed by Lakshminarayana (1960) and Lakshminarayana and Jnanananda (1961 a, b).

A ^{203}Hg source to provide 280 kev gamma rays was obtained from the Bhabha Atomic Research Centre, Trombay, India, and absorbers of 99·9% pure Pb, Pt and Sn were used. The experimental set-up, method of measurement and the mode of applying the coherent scattering correction were similar to those reported by Lakshminarayana (1960) and Lakshminarayana and Jnanananda (1961 a, b), from these laboratories. In this modified set-up the maximum angle of coherent scattering to be included in the detector was 56′ which is considerably smaller than that of Wyard (1953), thereby reducing the correction significantly.

The latest revised data of McMaster *et al.* (1967)† on the coherent scattering cross sections were used in the theoretical computations. The photoelectric cross sections were taken from the data of Schmickley and Pratt (1967) and the incoherent scattering cross sections from the data of Brown (1966). The total theoretical gamma-ray cross sections at 280 kev in Pb, Pt and Sn are computed by adding the respective partial cross sections and are presented, together with the experimental results, in table 1.

Table 1. Total gamma-ray cross sections of 280 keV energy in bn/atom

Element	Experimental values	Theoretical values
Pb	158·3 ± 2·4	160·5
Pt	134·6 ± 2·0	135·0
Sn	35·4 ± 0·5	35·4

It can be seen from the table that the agreement between theory and experiment is quite satisfactory.

The authors wish to thank Dr. McMaster and Dr. E. Plechaty of Lawrence Radiation Laboratory for kindly supplying the data on coherent scattering cross sections.

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4th November 1968

† The cross-section data of McMaster *et al.* (1967) are revised and are now under publication as a UCRL Report again. These new data are included in the compilation of Plechaty (1968) from the Lawrence Radiation Laboratory, U.S.A. (private communication from Dr. McMaster).

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J. PHYS. A (GEN. PHYS.), 1969, SER. 2, VOL. 2. PRINTED IN GREAT BRITAIN

Exchange diagrams in the theory of nuclear matter

Abstract. It is shown that the result of including all the exchange diagrams in the expression for the binding energy due to four-body correlations in nuclear matter is to reduce the binding energy due to the direct interaction by a factor of about 3/32.

Bethe (1965) has shown that the correct expansion parameter for the ground-state energy of nuclear matter is essentially the density rather than the g matrix. Thus the significant factor has become the number of interacting nucleons rather than the number of g interactions. Kirson (1967) and Sprung and Bhargava (1967) have done calculations within this framework including two- and three-body correlations. Lawson and Sampanthar (1968) have shown how to treat four-body correlations to *all* orders of perturbation theory. This problem has also been treated by Kuriyama (1968). In this letter we show how the inclusion of all exchange diagrams reduces the effect of the four-body direct terms by a factor of about 3/32.

We assume, as was done first by Rajaraman (1963), the following:

(i) The two-nucleon potential does not depend on spin or i-spin.

(ii) The momentum of the hole states is small, i.e. $k_f c \ll 1$ where k_f is the Fermi momentum and c the radius of the repulsive core in the two-nucleon interaction.

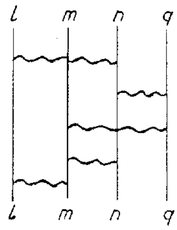

Figure 1. A four-body direct diagram.

Let us consider a connected diagram, shown in figure 1, involving four nucleons. This is a direct diagram since the four nucleons start and end in the same states l, m, n and q. As shown by Kirson (1967), all possible exchange diagrams corresponding to this direct one are obtained by permuting the labels l, m, n and q in the final states of the four nucleons. Figure 2 is an exchange diagram since the final states of the particles 1, 2, 3 and 4 are l, m, q and n (in that order). The assumptions of small hole momenta imply that the contribution due to the diagram shown in figure 2 is essentially the same as that due to the diagram shown in figure 1, except for a minus sign, because of the one exchange of momenta between nucleons 3 and 4.