seems clear, and is supported by other available data. The values given are $10^4/t^2$, and are proportional to the torsional rigidity of the bundles.

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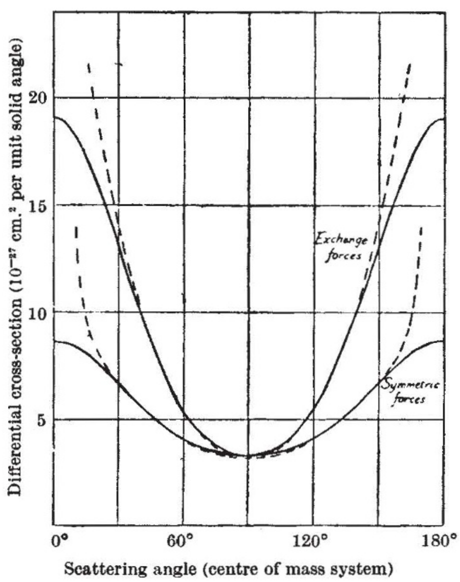
Scattering of Like Particles at 100 MeV.

PREVIOUS calculations[1] of the cross-sections for neutron–proton scattering at 100 MeV. have been extended to the case of scattering of like particles. Assuming the forces are independent of the charge, the constants of the exponential potential $V \exp(-r/a)$ can be obtained from the deuteron problem. For $a = 0 \cdot 5 \times 10^{-13}$ cm. the values of V were found to be 191·2 MeV. in the even singlet states for both exchange and symmetric forces, and 313·5, 104·5 MeV. in the odd triplet states for exchange and symmetric forces respectively. (These states are the only ones that occur for like particles.) The cross-sections for proton–proton scattering were obtained by modifying the neutron–neutron calculations to allow for the Coulomb interaction.



Full lines, neutron-neutron scattering; broken lines, proton-proton scattering

The differential cross-sections in the centre of mass system are shown in the diagram (both incident and scattered particles are counted). As for the neutron–proton case, the difference between the scattering for exchange and for symmetric forces is marked only at extreme angles; here, however, the former is always the greater, so that the total cross-section for exchange forces is significantly larger than that for symmetric forces. The total cross-sections, including for comparison those for neutron–proton scattering, are:

	Exchange force	Symmetric force
Neutron–neutron	$9 \cdot 1 \times 10^{-26}$ cm.^{2}	$5 \cdot 9 \times 10^{-26}$ cm.^{2}
Neutron–proton	$8 \cdot 7 \times 10^{-26}$ cm.^{2}	$8 \cdot 8 \times 10^{-26}$ cm.^{2}

Ashkin and Wu[2] have calculated the ratio of neutron–proton to neutron–neutron cross-sections in the Born approximation in the limit of very high energy. For the energy and potential used here, the Born approximation gives the ratio 1·0, 2·6 for exchange and symmetric forces respectively, compared with 1·0, 1·5 obtained from the exact calculation. Thus great care must be taken in using the results of the Born approximation at these energies.

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Measurements of α-Particle Energies with the Crystal Fluorescence Counter

MEASUREMENTS of low α-particle intensities are usually carried out by counting ionization impulses produced either in Geiger counters or in ionization chambers connected to an amplifier. The latter method has the advantage of allowing a rough evaluation of the energy of the particles, as the number of ions produced in the chamber is accurately proportional to the energy of the ionizing particle, needing 32 volts for the production of one pair of ions in air. This method has the drawback that it needs rather high amplification.

We have developed a new method of measuring single particles by counting the impulses of light quanta produced in fluorescent substances, different for different sorts of radiation (α-, β- and γ-radiation)[1]. This method has the advantage that it needs only low amplification, and that the reacting material need not be enclosed in a vacuum tube but is easily accessible from all sides. Hitherto no quantitative energy measurements have been accomplished by this method. For such investigations two questions have to be solved: How does the yield of light depend on the energy of the energizing particle, and what is the shape of the impulse-intensity distribution curve for particles of equal energy? In other words, do particles of the same energy give rise always to impulses of equal intensity? As a matter of fact, this is not so with the powdered fluorescent substances generally used, due to the large light-scattering taking place in these materials. We have overcome this difficulty by employing large single fluorescent crystals of cadmium sulphide, which are especially suitable for such measurements, due to their high transparency for light. These crystals are prepared in our laboratory by R. Warminsky according to a method of R. Frerichs[2]. By appropriate treatment of these crystals we have obtained a brilliant red fluorescence on excitation with α-particles. The energy-yield of cadmium sulphide is comparable to that of the best zinc sulphide.

With these crystals we have carried out the following experiments. In a vacuum tube just above the window of a photo-multiplier we placed a crystal of several square centimetres surface area about 4 cm. away from a polonium α-particle source. By altering the pressure in the tube we could vary the energy of the α-particles impinging on the crystal from zero