THE REAL PART OF THE *pp* ELASTIC SCATTERING AMPLITUDE AT 2, 4, 6, 8, AND 10 BeV

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Results of measurement of the real part of the pp nuclear elastic scattering amplitude for an energy of 4 BeV and more refined data for energies of 2, 6, 8, and 10 BeV are presented (the analysis of the data took into account relativistic corrections). The differential cross section was measured in the range $0.003 < |t| < 0.2\ (\text{BeV/c})^2$.

RESULTS of measurement of the real part of the pp nuclear elastic scattering amplitude for an energy of 4 BeV and more refined data for energies of 2, 6, 8, and 10 BeV[1] are reported (the analysis of the data took into account relativistic corrections). The differential cross section was measured in the range $0.003 < |t| < 0.2\ (\text{BeV/c})^2$. The experimental technique is similar to that described by Nikitin et al.[2]

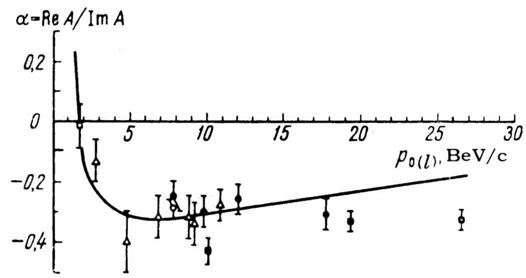
The results of the experiment, together with data of other authors available at this time,[3-6] are shown in the figure. The analysis was made according to Bethe's formula,[7] with radiation corrections as given by Solov'ev:[8]

$$\frac{d\sigma}{d\Omega} = |g_c|^2 + |g_n|^2 + 2g_c\left(g_{nR} + 2g_{nI}\frac{1}{137\beta_l}\ln\frac{2}{\theta}\right),$$

where g_{nR} and g_{nI} are the real and imaginary parts of the nuclear amplitude. This formula contains in the argument of the logarithm a factor 2 instead of the factor 1.06/ka obtained by Bethe (k and a are the wave number and nucleon size). The optical theorem can be expressed by the relation[8]

$$g_{nI} = \frac{P}{4\pi}[\sigma(>\theta_{min}) - \sigma_c(>\theta_{min})] + \frac{2}{137\beta_l}g_{nR}\ln\frac{2}{\theta_{min}}.$$

Here we have in the square brackets the experimentally measured total cross section with the Coulomb cross section subtracted (the nuclear total cross section); θ_{min} is the minimum angle, determined by the apparatus, to which the total cross section measurements were carried out. The last term modifies the usual form of the optical theorem, which is strictly true for neutral particles, by taking account of the contribution to the experimentally measured cross section from interference of Coulomb and nuclear scattering; β_l is the proton velocity in the laboratory system.



Momentum dependence of α = Re A/Im A according to the data of the present work and of other authors in the energy region above 1 BeV; △ – present work; ● – Ref. 4; ■ – Ref. 3; ○ – Ref. 5; □ – Ref. 6.

The smooth curve shown in the figure is the result of Söding's calculations[8] based on dispersion relations. It is evident that the experimental data agree with the theoretical calculations up to 20 BeV.

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