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ELASTIC SCATTERING OF 48.2-MEV ALPHA-PARTICLES

Robert E. Ellis and Larry Schecter

April 22, 1955

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ELASTIC SCATTERING OF 48.2-MEV ALPHA-PARTICLES*

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University of California, Berkeley, California

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In view of the recent interest in the elastic scattering of alpha-particles by heavy nuclei[1, 2, 3, 4, 5] it seems desirable to report the results of investigations that have been under way here for some time.

The angular distributions of 48.2-Mev alpha particles (from the 60-inch cyclotron at Crocker Laboratory in Berkeley) elastically scattered by Au and Ag nuclei have been investigated in considerable detail for angles between 7° and 135° in the laboratory system (Figs. 1 and 2). The most striking difference in these distributions from those recently reported is the extreme departure from Coulomb scattering at angles beyond about 40°. According to Blair's model this may be attributed to the effect of collisions by the incident alpha particle with the nucleus. At these energies the incident particles interact strongly with the nucleus in spite of the Coulomb barrier, and it is reasonable to expect that a satisfactory theoretical explanation of these detailed distributions may shed light on the form of the interaction potential. As the figures show, the sharp cutoff model is clearly unsatisfactory, although for forward angles the general features are reproduced. Attempts are being made to find a satisfactory fit to the data by modifying Blair's theory to include a gradual cutoff of the interaction radius. In addition an approach is being made using an optical model with a potential having real and imaginary parts. The complexity of the analysis has been mitigated by the cooperation of the electronic computing section at the University's Livermore laboratory.

Work is continuing in order to extend the distributions to wider angles, and other targets will be bombarded in order to determine the possible effects of shell structure on the interaction.

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* This work was done under the auspices of the U. S. Atomic Energy Commission.

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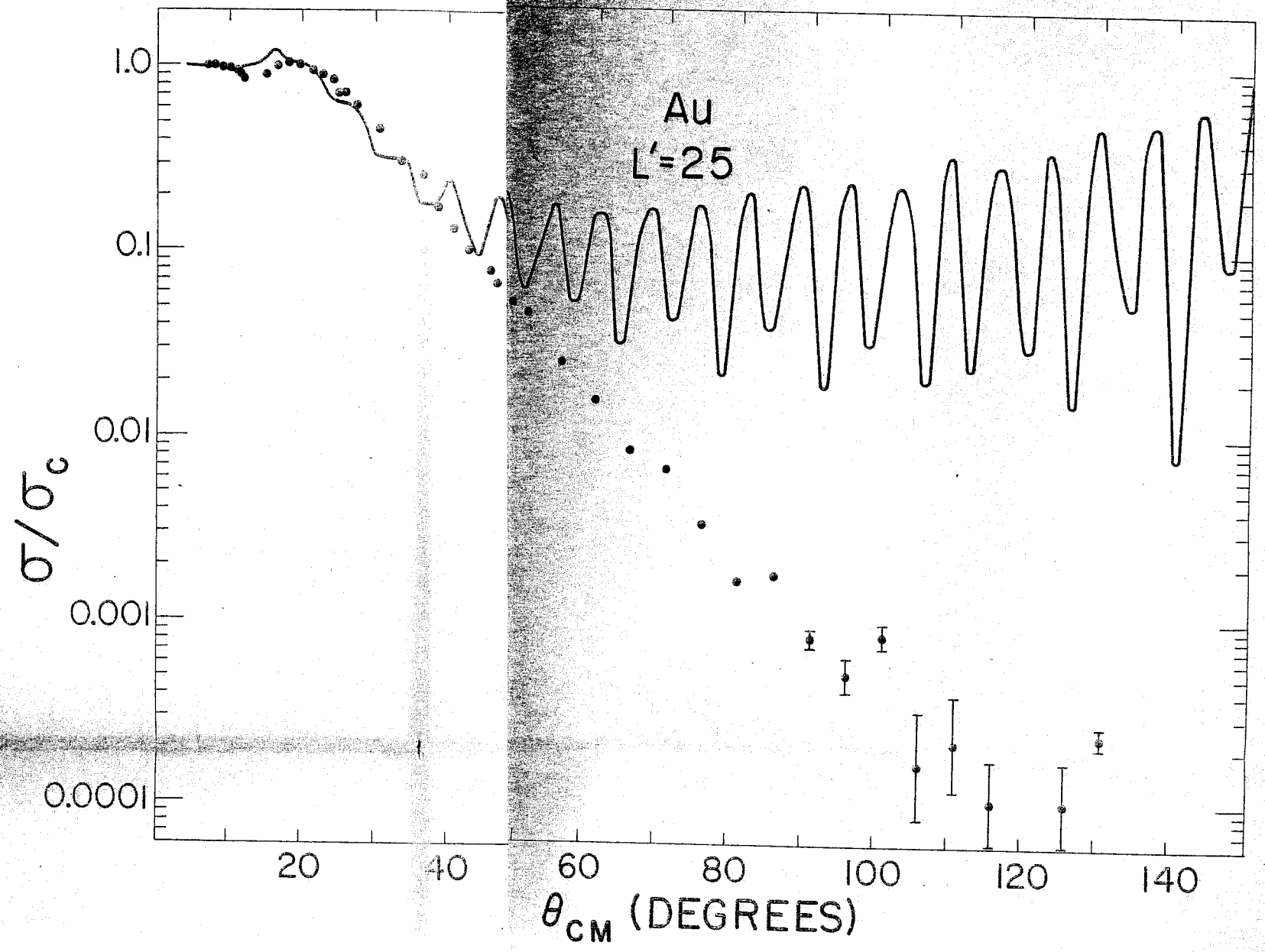
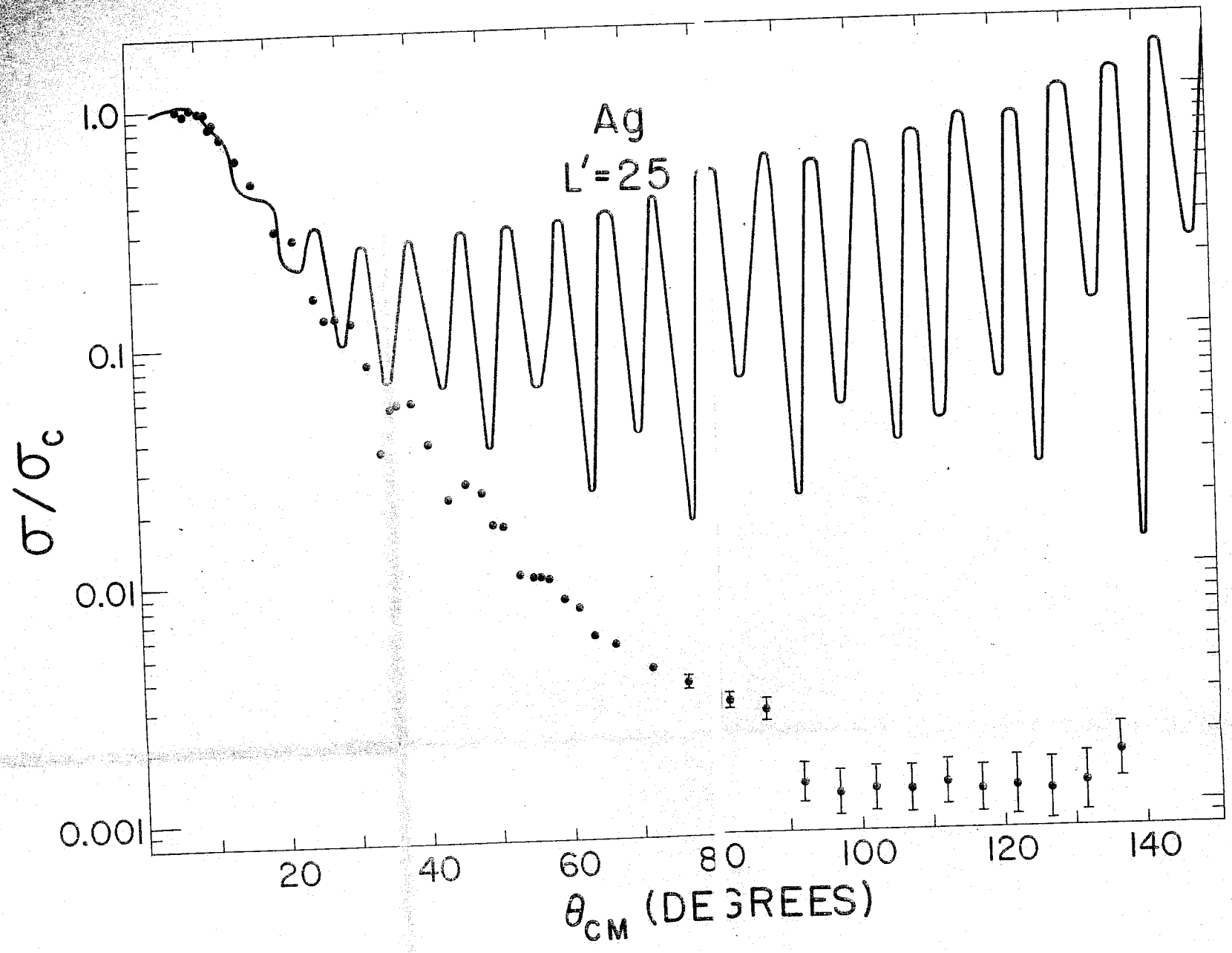
Figure Legends

Figure 1. Angular distribution (relative to Coulomb scattering) of elastically scattered alpha particles from Au. The curve represents the distribution predicted by Blair's sharp cutoff model.

Figure 2. Angular distribution of(relative to Coulomb scattering) elastically scattered alpha particles from Ag. The curve represents the distribution predicted by Blair's sharp cutoff model.


Au
L′=25
1.0
0.1
0.01
0.001
0.0001
σ/σc
20
40
60
80
100
120
140
θCM (DEGREES)


Ag
L′=25
1.0
0.1
0.01
0.001
σ/σc
20
40
60
80
100
120
140
θCM (DEGREES)