Natures of Nuclear Forces Indicated  
by the Photodisintegration  
of the Deuteron, IV  

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It is shown that there appear large  
differences in the computation of  
\( d(r, p)n \) process at  
\( E_r \approx 90 \text{ Mev} \) by the different  
natures of phase shifts which can account  
for 170 Mev  \( p-p \) scattering data.\(^1\)

In Table I four sets of phase shifts  
which are fitted to 170 Mev  \( p-p \) scat­
ering data (without including the  
polarization data) are shown\(^1\), and the  
calculated results on the photodisintegra­
tion of the deuteron at  
\( E_r = 87 \text{ Mev} \) by  
these phase shifts are given.\(^2\)

At our energy m.d.* is very small if  
we assume \( \delta_0 = 19° \),\(^3\) also the contribu­
tion of m.q. and e.q. to \( \sigma_{ep}^* \) and \( \sigma_T \)  
are quite small.\(^4\) Therefore we have  
only calculated e.d. The method of the  
computation of e.d. is same with that  
used in the previous letter.\(^5\)

In Table I we have shown the case  
in which only the first term of \( j_1(kr) \)  
is adopted in the computation. Because  
the higher order terms of \( j_1(kr) \) would  
make \( \sigma_{ed} \) increase by about 20% at our  
eynergy,\(^3\) we should multiply 1.2 to \( \sigma_{ep} \)  
and \( \sigma_T \) of Table 1 in the comparison  
with experiment.

The experiments give\(^6\)

\* Symbols used here are same with those used  
in the previous papers. (See reference 5.)
\[ \sigma_{\text{np}} = (4.5 \sim 5.5) \times 10^{-29} \text{cm}^2, \]
\[ \sigma_{\gamma} = (7 \sim 9) \times 10^{-29} \text{cm}^2 \]

at our energy.

We see that class A can well account for the data, but it is not for class B. Class B gives below one half of \( \sigma_{\text{np}} \) of class A.

Because it seems that the effect of the virtual pions is yet unimportant at our energy,\(^7\) only class A would remain to be favourable. Particularly, the set A is most favourable in the sense that it account for both polarization data and \( d(\gamma, \rho)n \) in the approximation assumed.\(^1\)

It is important to note that the phase shifts of class A is not much different from that to be expected from pion potential. More detailed analysis and illustration will be published in due time.

Table 1. Phase shifts of 170 Mev \( p-p \) scattering (in degree)\(^1\) and the corresponding cross sections (in unit of \( 10^{-27} \text{cm}^2 \)), when we put \( j_1(k_\rho r) \rightarrow k_\rho r/3 \), are shown. The higher order terms of \( j_1(k_\rho r) \) increase the cross sections by about 20%.

<table>
<thead>
<tr>
<th></th>
<th>( \delta_0^0 )</th>
<th>( \delta_1^0 )</th>
<th>( \delta_1^1 )</th>
<th>( \delta_1^2 )</th>
<th>( \sigma_{\gamma} )</th>
<th>( \sigma_{\text{np}} )</th>
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<td>19</td>
<td>22</td>
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<td>-19</td>
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<td>-46</td>
<td>15</td>
<td>3</td>
<td>4.91</td>
<td>1.82</td>
</tr>
</tbody>
</table>

2) The formulas of \( d(\gamma, \rho)n \) are given in N. Austern, Phys. Rev. 108 (1957), 637.
3) S. H. Hsieh, To be published.
5) S. H. Hsieh, To be published.