K- Proton, K°- Proton,
K- Deuterium Scattering and Absorption Processes,
and 1405 MeV Y°*-Resonance (*).

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Summary. — In order to describe the low-energy K -p, K°-p and K -d interactions, six new sets of energy-dependent s-wave K -nucleon interaction parameters solutions, called solutions X1, X2, Y1, Y2, Z1 and Z2, are constructed as functions of the width of the 1405 MeV Y°*-resonance, by linear interpolations between Ross and Humphrey's amplitudes at low values of K -momentum, Watson's amplitudes at 400 MeV/c and by requiring the Y°*-resonance as an s-wave bound state of K -nucleon system. It is found that the K -p and K -d scattering processes are rather insensitive to the width of Y°*, whereas the Σ-hyperons production cross-sections favor 50 MeV for Y°* width (solution Z2). Also, it is observed that the contribution of Y°*-resonance to the at rest K -d capture rates is within the uncertainties of experimental measurements (< 20%).

1. – Introduction.

The experimental data on K- proton scattering and absorption processes for K- laboratory momentum k_L below 300 MeV/c have been obtained by Ross and Humphrey (*). Their investigations give rise to two sets of s-wave zero effective-range KN' interaction parameters solutions, called solution I and solution II, which provide a good fit to the low-energy K -p data, and are listed in Table I. It is important to notice that Ross and Humphrey's solution I is characterized by positive value of q_o whereas solution II has q_o negative, q_o being the value of the phase angle q between the I = 0 and I = 1 s-wave

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Table I. - Two sets of s-wave zero-effective-range $\bar{K}N$ scattering parameters, determined by Ross and Humphrey, which best fit the $K^-\text{proton}$ data up to 300 MeV/c (*).

<table>
<thead>
<tr>
<th>Solution</th>
<th>$a_0$</th>
<th>$b_0$</th>
<th>$a_1$</th>
<th>$b_1$</th>
<th>$\epsilon$</th>
<th>$\phi_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>$-0.22$</td>
<td>$2.74$</td>
<td>$0.02$</td>
<td>$0.38$</td>
<td>$0.40$</td>
<td>$60.3^\circ$</td>
</tr>
<tr>
<td></td>
<td>$\pm 1.07$</td>
<td>$\pm 0.31$</td>
<td>$\pm 0.33$</td>
<td>$\pm 0.08$</td>
<td>$\pm 0.03$</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>$-0.59$</td>
<td>$0.96$</td>
<td>$1.20$</td>
<td>$0.56$</td>
<td>$0.39$</td>
<td>$-63.2^\circ$</td>
</tr>
<tr>
<td></td>
<td>$\pm 0.46$</td>
<td>$\pm 0.17$</td>
<td>$\pm 0.06$</td>
<td>$\pm 0.15$</td>
<td>$\pm 0.02$</td>
<td></td>
</tr>
</tbody>
</table>

(*) The parameters $a_0$, $b_0$, $a_1$ and $b_1$ are given in fermi units.

$K^-p \rightarrow \pi+\Sigma$ amplitudes for $K^-\text{capture}$ at rest. Recently, Tripp et al. have analysed the $K^-\text{p}$ data in the region of $(300-500)$ MeV/c $K^-$-momentum (2). They have found that due to the interference between the s-wave $\Sigma$-production amplitudes and the 1520 MeV ($k_L = 395$ MeV/c) $I = 0$, $\pi\Sigma$-resonance ($Y^{**}_0$) in $d_3$ state, the sign of $\phi$ is necessarily negative at the position of $Y^{**}_0$. As has been pointed out by Akiba and Capps (3), since no violent fluctuations are observed experimentally in the $\Sigma^-/\Sigma^+$ ratio from zero-energy to the energy of $Y^{**}_0$, an appeal to the continuity in the energy-dependence of the $\Sigma^-/\Sigma^+$ ratio from zero energy to this resonance energy requires the phase angle $\phi$ to be negative in the entire energy range. This condition is satisfied only by the parameters of Ross and Humphrey's solution II and not by those of solution I. This implies that the $\bar{K}N$ interaction parameters of Ross and Humphrey's solution I are not adequate to describe $\bar{K}$-nucleon scattering and absorption processes. However, the parameters of solution II do not provide an adequate fit to the experimental data on $a)$ the ratio $\sigma(K^0_s+p \rightarrow K^0_s+p)/\sigma(K^0_s+p \rightarrow \pi+Y)$ and $b)$ the cross-sections for the scattering of $K^-$-meson by deuteron (4), giving too high values for these rates. As has been discussed earlier (5), this disagreement is probably due to the large value of $I = 1$, $\bar{K}N$ scattering which the parameters of solution II predict.

Very recently, Watson (6) has fitted the $K^-\text{p}$ data for $k_L$ in the range of $(350-450)$ MeV/c by including the $I = 0$ and $I = 1$ amplitudes in $p_4$ and $p_3$ states. Like Ross and Humphrey, Watson has found that all the available data on $K^-\text{p}$ scattering and absorption processes can be fitted quite well in