Title
IDENTIFICATION CURVES FOR HEAVY-MESON AND HYPERON DECAYS

Permalink
https://escholarship.org/uc/item/1jz3k11b

Author
White, Howard S.

Publication Date
1956-09-19
DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.
IDENTIFICATION CURVES FOR HEAVY-MESON AND HYPERON DECAYS
Howard S. White
September 19, 1956
IDENTIFICATION CURVES FOR HEAVY-MESON AND HYPERON DECAYS

Howard S. White
Radiation Laboratory
University of California
Berkeley, California
September 19, 1956

ABSTRACT

Curves are presented for the purpose of facilitating identification of heavy-meson and hyperon decays.
IDENTIFICATION CURVES FOR
HEAVY-MESON AND HYPERON DECAYS
Howard S. White
Radiation Laboratory
University of California
Berkeley, California
September 19, 1956

The curves contained in this report were designed to facilitate the rapid identification of a primary particle which is observed to decay into two particles within a cloud chamber or similar experimental medium. The momentum vectors of the two charged particles involved and the angle included between the vectors will usually be measurable. An assumption as to the identity of the particles involved may immediately be determined to be either consistent or inconsistent with the observed momenta and angle by reference to the appropriate graph.

The kinematic properties of the decay of either a neutral or charged primary may be used to derive the equation

$$E_1 E_2 - P_1 P_2 \cos \theta = C,$$

where the meaning of the quantities is indicated below for the separate cases of a neutral and a charged primary.

**Neutral Primary**

$$C = \frac{1}{2} (M_n^2 - M_1^2 - M_2^2)$$

**Charged Primary**

$$C = \frac{1}{2} (M_1^2 + M_2^2 - M_n^2)$$

Throughout this report, the units are expressed as Bev for energy, and Bev/c for momentum. The masses used for the different particles are given in Table 1.

The evaluation of the equation to find the plotted points was performed on the IBM Type 650 machine at Livermore.

This work was undertaken at the suggestion of William B. Fowler. The table of masses was furnished by George Maenchen, and much of the drafting was done by Arthur Kemalyan and Mrs. Ruth Miller.

This work was done under the auspices of the U. S. Atomic Energy Commission.
<table>
<thead>
<tr>
<th>Particle</th>
<th>Mass (Bev.)</th>
<th>Particle</th>
<th>Mass (Bev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$</td>
<td>0.10572</td>
<td>$p$</td>
<td>0.93823</td>
</tr>
<tr>
<td>$\pi^0$</td>
<td>0.13505</td>
<td>$n$</td>
<td>0.93953</td>
</tr>
<tr>
<td>$\pi^\pm$</td>
<td>0.13955</td>
<td>$\Lambda^0$</td>
<td>1.11470</td>
</tr>
<tr>
<td>$\theta^0, K^\pm$</td>
<td>0.49336</td>
<td>$\Sigma^+$</td>
<td>1.18906</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\Xi^-$</td>
<td>1.3182</td>
</tr>
</tbody>
</table>
KINEMATICS OF $\Lambda^0$ DECAY

$\Lambda^0 \rightarrow p + \pi + q$

CURVES OF CONSTANT $p_\pi$
KINEMATICS OF $\Theta^0$ DECAY

$\Theta^0 \rightarrow \pi^+ + \pi^- + \rho$

CURVES OF CONSTANT $P_\pi$
KINEMATICS OF NEUTRAL DECAY

CURVES OF CONSTANT DECAY ANGLE $\theta$
KINEMATICS OF NEUTRAL DECAY

CURVES OF CONSTANT DECAY ANGLE $\theta$

DECAY $M_1, M_2$

$\Lambda^+$ $\pi$ $\pi$

$\Theta^+$ $\pi$ $\pi$

Bev

$P_2$

$P_1$

$\Theta^+$

$\Lambda^+$

0.01 0.03 0.06 0.10 0.30 0.60 1.0 3.0 6.0 Bev

ZN-1569
KINEMATICS OF $K_{\pi^2}$ DECAY

$K_{\pi^2} \rightarrow \pi^\pm + \pi^0 + q$

CURVES OF CONSTANT $P_\pi$

$P_0$
KINEMATICS OF $K_{\mu 2}$ DECAY

$K_{\mu 2}^0 \rightarrow \mu^+ \mu^- + \nu + \bar{\nu}$

CURVES OF CONSTANT $P_\mu$

\[ P_\theta \]

\[ P_\mu \]

\[ \theta \]

\[ P_0 \]

Bev

ZN-1572
KINEMATICS OF $K_{\mu_2}$ DECAY

$K_{\mu_2}^\pm \rightarrow \mu^\pm + \nu + q$

CURVES OF CONSTANT $P_{\mu}$

$P_0$

$P_{\mu}$

$\theta$

$\theta'$

$P_0$

$P_{\mu}$
KINEMATICS OF $\Sigma^+$ DECAY

$\Sigma^+ \rightarrow P + \pi^0 + q$

CURVES OF CONSTANT $P_f$
KINEMATICS OF CHARGED DECAY

CURVES OF CONSTANT DECAY ANGLE
\( \theta = 5^\circ, 10^\circ, 20^\circ \) TOWARDS DECREASING \( p_0 \)

- \( K^+ \)
- \( K^0 \)
- \( \Sigma^+ \)
- \( \Sigma^0 \)
- \( \Xi \)
KINEMATICS OF CHARGED DECAY

\[ P_0 \]

\[ P_1 \]

\[ \theta = 10^\circ, 20^\circ, 30^\circ \] TOWARDS DECREASING \( P_0 \)

\[ \kappa \eta, \kappa \mu, \Sigma^+, \Sigma^0, \Xi, \]
KINEMATICS OF CHARGED DECAY

CURVES OF CONSTANT DECAY ANGLE

$\theta = 20^\circ, 30^\circ, 40^\circ$ TOWARDS DECREASING $P_0$

$P_0$  $P_1$  $\theta$

$K_0, \pi_0$  $K_0, \mu_0$  $\Sigma^+$  $\Sigma^-$  $\Xi$

ZN-1582
KINEMATICS OF CHARGED DECAY

CURVES OF CONSTANT DECAY ANGLE

$\theta = 40^\circ, 50^\circ, 60^\circ$ TOWARDS DECREASING $P_0$
KINEMATICS OF CHARGED DECAY

CURVES OF CONSTANT DECAY ANGLE

$\theta = 60^\circ, 80^\circ, 100^\circ$ TOWARDS DECREASING $P_0$

$P_0$ vs $P_1$
KINEMATICS OF CHARGED DECAY

\[ P_2 \]

\[ P_1 \]

CURVES OF CONSTANT DECAY ANGLE

\[ \theta = 100^\circ, 120^\circ, 180^\circ \] TOWARDS DECREASING \( P_0 \)

\[ \text{K} \]

\[ \text{\( \Sigma^+ \)} \]

\[ \text{\( \Sigma^- \)} \]

\[ \text{\( \Xi \)} \]

\[ \text{\( \eta \)} \]
This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.