

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

ANOMALOUS MESON DECAY

### Permalink

<https://escholarship.org/uc/item/2xd5278f>

### Authors

Karplus, Robert  
Lawson, R.D.  
Ruderman, M.A.

### Publication Date

1955-04-04

UCRL 2966

UNIVERSITY OF  
CALIFORNIA

*Radiation  
Laboratory*

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy  
which may be borrowed for two weeks.  
For a personal retention copy, call  
Tech. Info. Division, Ext. 5545*

BERKELEY, CALIFORNIA

## **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.

UNIVERSITY OF CALIFORNIA

Radiation Laboratory  
Berkeley, California

Contract No. W-7405-eng-48

UNCLASSIFIED

ANOMALOUS MESON DECAY

Robert Karplus, R.D. Lawson, and M.A. Ruderman

## ANOMALOUS MESON DECAY\*

Robert Karplus, R. D. Lawson, and M. A. Ruderman  
 Physics Department, University of California, Berkeley, California

It has been pointed out by Primakoff<sup>1</sup> and others<sup>2</sup> that the sudden creation of rapidly moving particles in meson decay is necessarily accompanied by radiation with the spectrum (classical)  $P(\omega)d\omega \sim d\omega/\omega$ . Primakoff applied this idea to the  $\pi - \mu$  decay, which should be observably anomalous once in 5000 times. Since this rate of radiation increases rapidly with the velocity of the charged decay products, one must expect a much larger fraction of anomalous decays of heavier mesons. The probability for the photon to carry away 1/4 to 3/4 of the average energy of the charged particles is tabulated for those heavy meson decays in which anomalies are most easily noticeable: two-particle decays and decays into charged particles only.

PARTICLE AND DECAY SCHEME	PROBABILITY FOR OBSERVABLY ANOMALOUS DECAY BY ELECTRIC DIPOLE PHOTONS
$\theta \rightarrow \pi^+ + \pi^-$	$\frac{1}{200}$ (constructive interference from two decay products.)
$\gamma^\pm \rightarrow \pi^+ + \pi^- + \pi^\pm$	$\frac{1}{400}$ (constructive interference from three decay products.)
$\Delta^0 \rightarrow p + \pi$	$\frac{1}{1500}$
$\pi^\pm \rightarrow \mu^\pm + \nu$ (1)	$\frac{1}{8000}$

TABLE I

\*

Assisted in part by the Office of Ordnance Research.

-3-

Among the approximately one hundred  $\Upsilon$ -mesons that have been observed there has been reported one anomalous event that can be interpreted as a radiative decay.

## REFERENCES

1. H. Primakoff, Phys. Rev. 84, 1255 (1951).
2. F. Bloch and A. Nordsieck, Phys. Rev. 52, 54 (1937);  
W. Pauli and M. Fierz, Nuovo Cimento 15, 167 (1938);  
H. Primakoff and F. Villars, Phys. Rev. 83, 686 (1951);  
J. K. Knipp and G. E. Uhlenbeck, Physica 3, 425 (1936);  
F. Bloch, Phys. Rev. 50, 262 (1936);  
C. S. W. Chang and D. Falkoff, Phys. Rev. 76, 365 (1949);  
D. Feer, Phys. Rev. 75, 731 (1949);  
L. I. Schiff, Phys. Rev. 76, 89 (1939);  
R. J. Finkelstein and R. E. Behrands, Bull. Am. Phys. Soc. 30, 16 (1955);  
S. B. Trieman, Phys. Rev. 95, 1360 (1954).
3. We are indebted to Dr. Yash Pal for informing us of this observation prior to its publication in the Proc. Ind. Acad. Sci.