

Lawrence Berkeley National Laboratory

Recent Work

Title

AN EXPERIMENTAL EVIDENCE AGAINST THE ANGULAR MOMENTUM NONCONSERVATION SCHEME FOR WEAK INTERACTIONS

Permalink

<https://escholarship.org/uc/item/2vw3267b>

Author

Chen, M.

Publication Date

1968-08-01

RECEIVED
LAWRENCE
RADIATION LABORATORY

SEP 17 1968

LIBRARY AND
DOCUMENTS SECTION

UCRL-18399

cy. 2

University of California

Ernest O. Lawrence
Radiation Laboratory

AN EXPERIMENTAL EVIDENCE AGAINST THE ANGULAR MOMENTUM
NONCONSERVATION SCHEME FOR WEAK INTERACTIONS

M. Chen

August 1968

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

T, E

UCRL-18399
cy. 2

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.

UCRL-18399

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

AN EXPERIMENTAL EVIDENCE AGAINST THE ANGULAR MOMENTUM
NONCONSERVATION SCHEME FOR WEAK INTERACTIONS

M. Chen

August 1968

AN EXPERIMENTAL EVIDENCE AGAINST THE ANGULAR MOMENTUM
NONCONSERVATION SCHEME FOR WEAK INTERACTIONS

M. Chen

Lawrence Radiation Laboratory
University of California
Berkeley, California

It was shown by Franco Selleri¹ that Lorentz-invariance does not necessarily lead to angular momentum conservation. His mechanism for J-violation is to assume the existence of a particle (spurion) with spin, but with zero four-momentum. This particle would appear in weak interaction strangeness changing reactions. Therefore the angular momentum of detectable particles in weak interaction reactions would not be conserved while their energy and momentum would be strictly conserved.

Observing that the spins of the strange particles K, Λ , Σ , Ξ have not been measured directly but have been deduced from the assumptions of total angular momentum conservation, Selleri claimed that several new sets of assignment of spins for strange particles corresponding to different spin values for his spurion, would be consistent with the present experimental evidence.

If the spin of the spurion were $1/2$, Selleri's assignments of spin for strange particles would be:

K	Λ	Σ	Ξ	with selection rules	$\Delta I = 1/2, \Delta J = 1/2$.
$1/2$	1	1	$3/2$		

If the spin of the spurion were 1, his assignments would be:

K	Λ	Σ	with selection rules	$\Delta I = 1/2, \Delta J = 1$.
1	$3/2$	$3/2$		

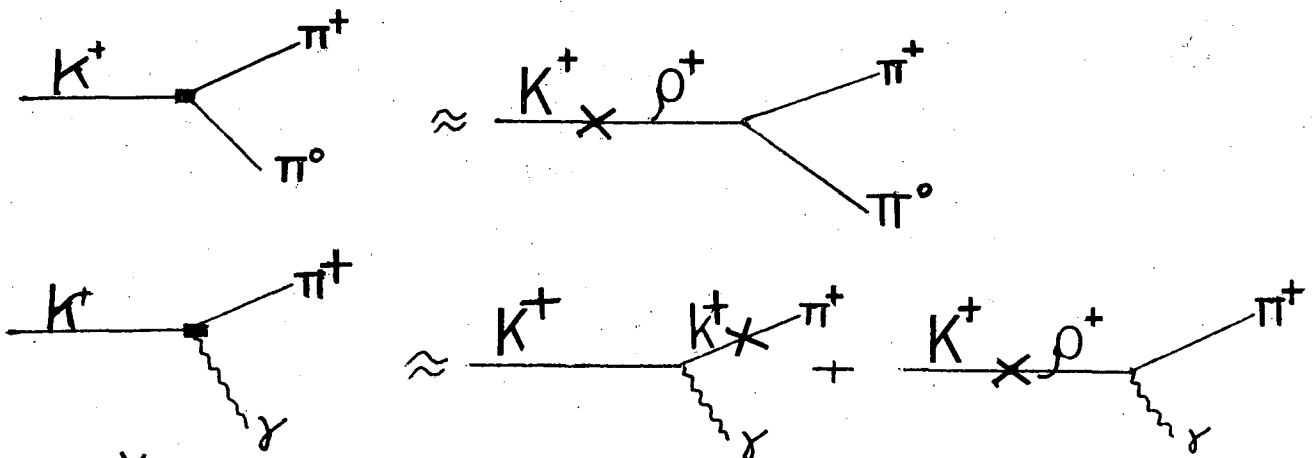
In either of the above schemes, he claims that the new assignments have theoretical advantages over the conventional assignments while both

assignments are consistent with the present experimental data.

Some of the theoretical advantages are:

1. The $\Delta I = 1/2$ rule becomes rigorous in weak interactions.
2. Strangeness conservation in e.m. interactions becomes a consequence of J-conservation.
3. The $\Delta S = 1$ rule becomes a consequence of the $\Delta I = 1/2$ rule.

The weakness of these schemes lies in the assumption of an unobservable particle--spurion, and in the contradiction with the success of the SU(3) scheme. The direct measurements of the spins of the strange particles would prove or disprove this scheme of J-violation, however the experimental measurements are very difficult to carry out. We would like to point out here an experimental result on the upper limit of the decay $K^+ \rightarrow \pi^+ + \gamma$ of 1.52×10^{-4} measured by Friedell et al.² as an indirect evidence against the J-violation scheme. We observe that if the K meson had spin 1/2 (or 1) and the selection rule in strangeness changing weak interactions were $\Delta I = 1/2$ and $\Delta J = 1/2$ (or $\Delta J = 1$), the decay reaction $K^+ \rightarrow \pi^+ + \gamma$ would be allowed in either set of the new spin assignments. Further from the simple Feynman diagrams,



where X means the decay due to weak interaction, we can estimate that with

the new spin assignments, the branching ratio of $K^+ \rightarrow \pi^+ + \gamma$ would be of the order of 10^{-3} if the coupling constant $f_{\pi K}$ is not otherwise suppressed compared with $f_{\rho K}$. This is an order of magnitude higher than the experimental upper limit. Therefore we have here an experimental evidence against the existence of a spurion with nonzero angular momentum but zero four momentum in weak interactions. Only if the πK coupling constant is unexpectedly suppressed, then the branching ratio of $K^+ \rightarrow \pi^+ + \gamma$ could drop to 10^{-4} , comparable to the experimental upper limit. Another experiment is under way to improve the previous result on the branching ratio of $K^+ \rightarrow \pi^+ + \gamma$.

It is a pleasure to thank Professor Emilio Segrè for his support and advice, Dr. Rae Stiening and Dr. Franco Selleri for many helpful discussions. This work was done under the auspices of the United States Atomic Energy Commission.

REFERENCES

1. F. Selleri, Lorentz-Invariance Without Angular Momentum Conservation, submitted to Nuovo Cimento.
2. D. Friedell et al., MIT-2098-389.

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.