2019 papers by Stephen Parke

1. **"Scalar Nonstandard Interactions in Neutrino Oscillation"**
S. F. Ge and S. J. Parke.
arXiv:1812.08376 [hep-ph]
DOI:10.1103/PhysRevLett.122.211801
Phys. Rev. Lett. **122**, no. 21, 211801 (2019)
IPMU18-0206, FERMILAB-PUB-18-487-T
INSPIRE-HEP entry

2. **"Neutrino Oscillation Probabilities through the Looking Glass"**
G. Barenboim, P. B. Denton, S. J. Parke and C. A. Ternes.
arXiv:1902.00517 [hep-ph]
DOI:10.1016/j.physletb.2019.03.002
Phys. Lett. B **791**, 351 (2019)
IFIC/19-07, FERMILAB-PUB-19-009-T
INSPIRE-HEP entry

3. **"Simple and Precise Factorization of the Jarlskog Invariant for Neutrino Oscillations in Matter"**
P. B. Denton and S. J. Parke.
arXiv:1902.07185 [hep-ph]
DOI:10.1103/PhysRevD.100.053004
Phys. Rev. D **100**, no. 5, 053004 (2019)
FERMILAB-PUB-19-072-T
INSPIRE-HEP entry

4. **"Comment on Daya Bay's Definition and Use of Δm^2_{ee}"**
S. J. Parke and R. Zukanovich-Funchal.
arXiv:1903.00148 [hep-ex]
FERMILAB-PUB-19-078-T
INSPIRE-HEP entry

5. **"Sub-GeV Atmospheric Neutrinos and CP-Violation in DUNE"**
K. J. Kelly, P. A. Machado, I. Martinez Soler, S. J. Parke and Y. F. Perez Gonzalez.
arXiv:1904.02751 [hep-ph]
DOI:10.1103/PhysRevLett.123.081801
Phys. Rev. Lett. **123**, no. 8, 081801 (2019)
FERMILAB-PUB-19-136-T, NUHEP-TH/19-03
INSPIRE-HEP entry

6. **"Compact Perturbative Expressions for Oscillations with Sterile Neutrinos in Matter"**
S. J. Parke and X. Zhang.
arXiv:1905.01356 [hep-ph]
FERMILAB-PUB-19-042-T
INSPIRE-HEP entry

7. **"Constraint on the solar Δm^2 using 4,000 days of short baseline reactor neutrino data"**
A. Hernandez-Cabezudo, S. J. Parke and S. H. Seo.
arXiv:1905.09479 [hep-ex]
FERMILAB-PUB-19-190-T
INSPIRE-HEP entry

8. **"Eigenvalues: the Rosetta Stone for Neutrino Oscillations in Matter"**
P. B. Denton, S. J. Parke and X. Zhang.
arXiv:1907.02534 [hep-ph]
FERMILAB-PUB-19-326-T
INSPIRE-HEP entry

9. **"Eigenvectors from Eigenvalues"**
P. B. Denton, S. J. Parke, T. Tao and X. Zhang.
arXiv:1908.03795 [math.RA]
FERMILAB-PUB-19-377-T
INSPIRE-HEP entry

10. **"Fibonacci Fast Convergence for Neutrino Oscillations in Matter"**
P. B. Denton, S. J. Parke and X. Zhang.
arXiv:1909.02009 [hep-ph]
FERMILAB-PUB-19-462-T
INSPIRE-HEP entry

11. **"Why matter effects matter for JUNO"**
A. N. Khan, H. Nunokawa and S. J. Parke.
arXiv:1910.12900 [hep-ph]
FERMILAB-PUB-19-490-T
INSPIRE-HEP entry

3 & 3+

Neutrino

Flavor Transformations

Matter/Vacuum

4 papers:

hep-ph:

Simple and Precise (~0.04%) Factorization of Jarlskog in Matter

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Measurement of Δm^2_{21} by Daya Bay/RENO

$$\Delta m^2_{21} \leq \frac{1}{15} \Delta m^2_{ee}$$

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Neutrino Flavor Transformations Matter/Vacuum

hep-ph:
New simple relationship between eigenvalues, $\widehat{m^2}_i$, and mixing angles, $\hat{\theta}_{jk}$, in matter; (Rosetta)

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3 & 3+

Neutrino Flavor Transformations Matter/Vacuum

math.RA
generalized and proven for an arbitrary NxN Hermitian matrix with the mathematician T. Tao

hep-ph:
New simple relationship between eigenvalues, $\widehat{m^2}_i$, and mixing angles, $\hat{\theta}_{jk}$, in matter; (Rosetta)

Generalization to nxn:

- Let H be an nxn Hermitian matrix
  with eigenvalues $\lambda_i(H)$ and eigenvectors v_i

- Let h_j be the (n-1)x(n-1) Hermitian matrix from H
  with j-th row and j-th column deleted with eigenvalues $\lambda_i(h_j)$

(h_j principal minor of H)

$$|v_{i,j}|^2 = \frac{\prod_{k=1}^{n-1} \left(\lambda_i(H) - \lambda_k(h_j)\right)}{\prod_{k=1,k\neq i}^{n} \left(\lambda_i(H) - \lambda_k(H)\right)}$$

- Phase information is a more complicated expression.
- Numerator is characteristic function for h_j evaluated at $\lambda_i(H)$
- Normalized $\sum_i |v_{i,j}|^2 = 1 = \sum_j |v_{i,j}|^2$

Peter Denton, SP, Terrence Tao, Xining Zhang: arXiv:1908.03759 [math.RA]

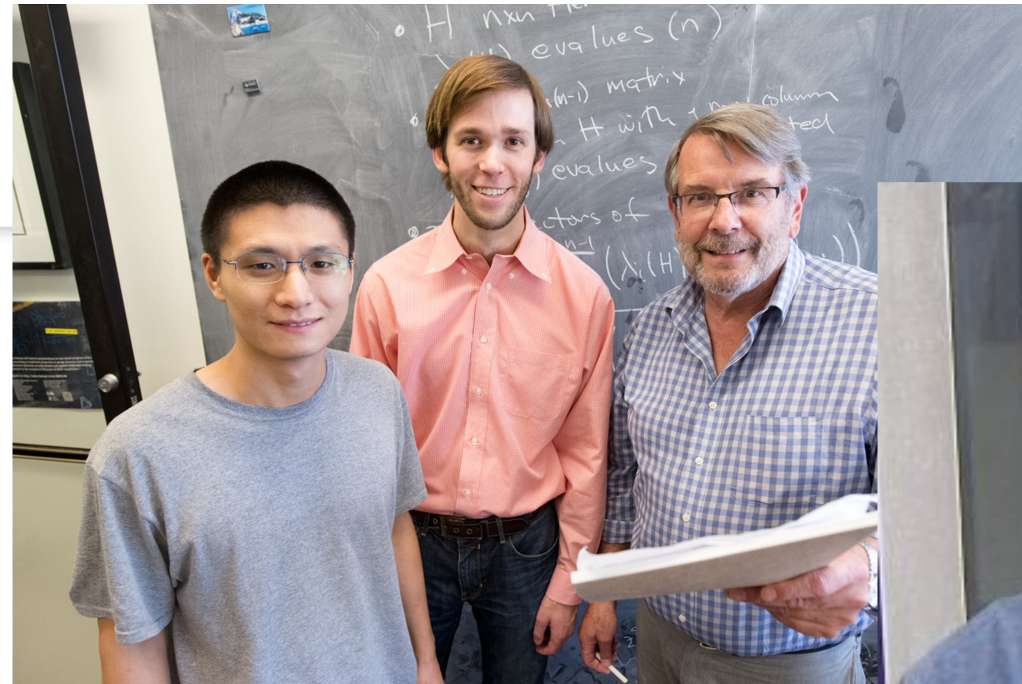
Quanta magazine

Neutrinos Lead to Unexpected Discovery in Basic Math

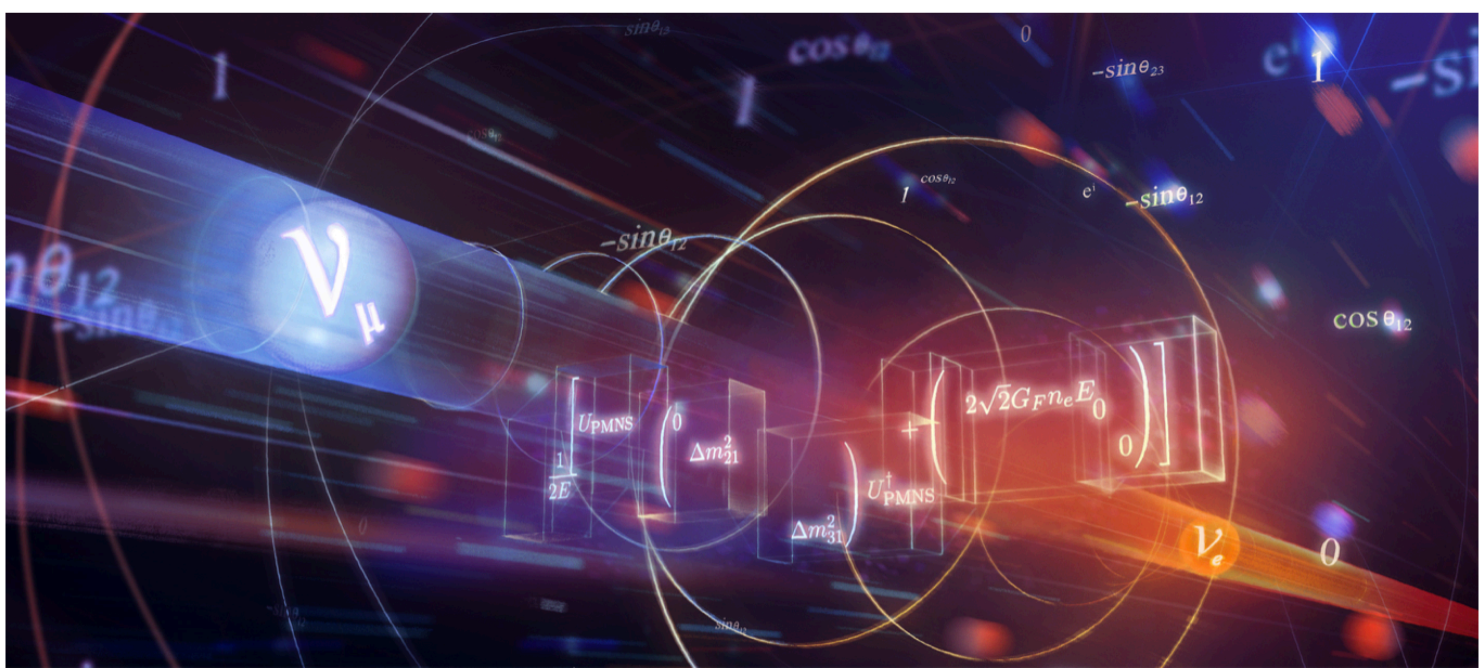
By NATALIE WOLCHOVER

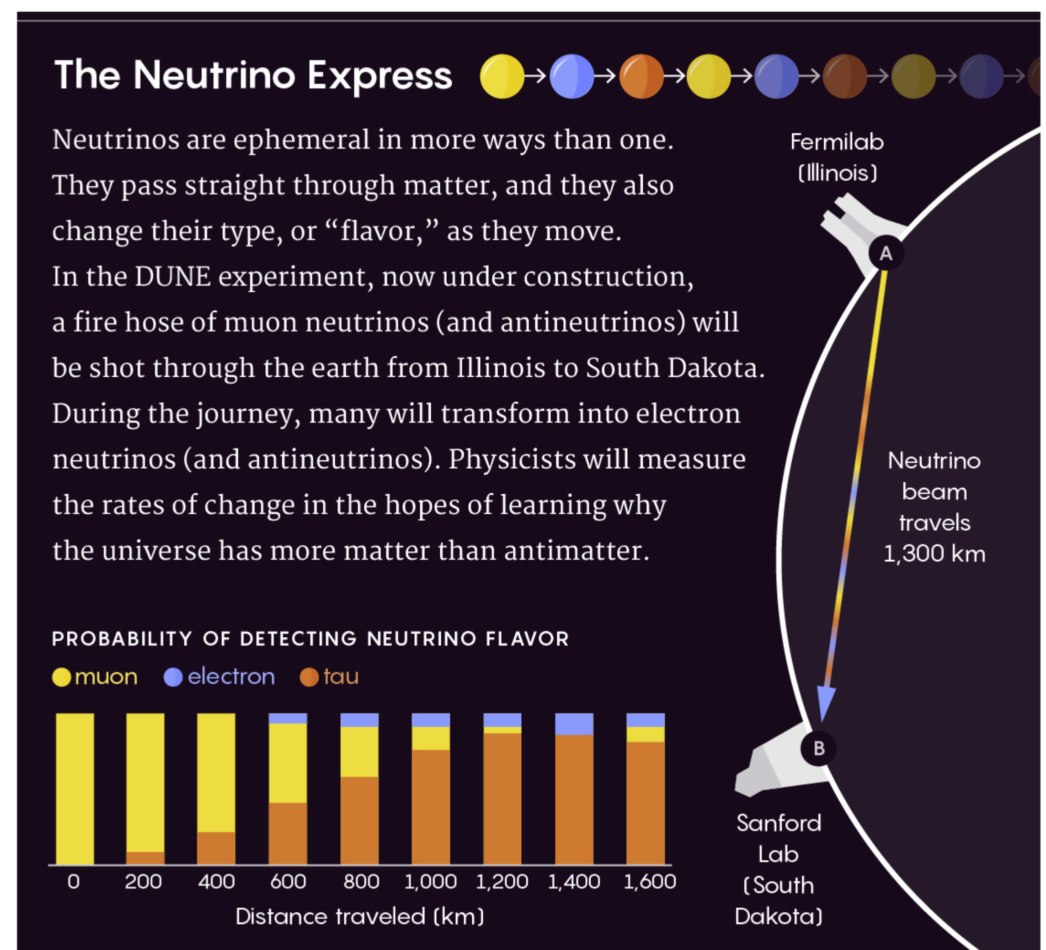
November 13, 2019

Three physicists wanted to calculate how neutrinos change. They ended up discovering an unexpected relationship between some of the most ubiquitous objects in math.



https://paw.princeton.edu/article/mind-mathematician





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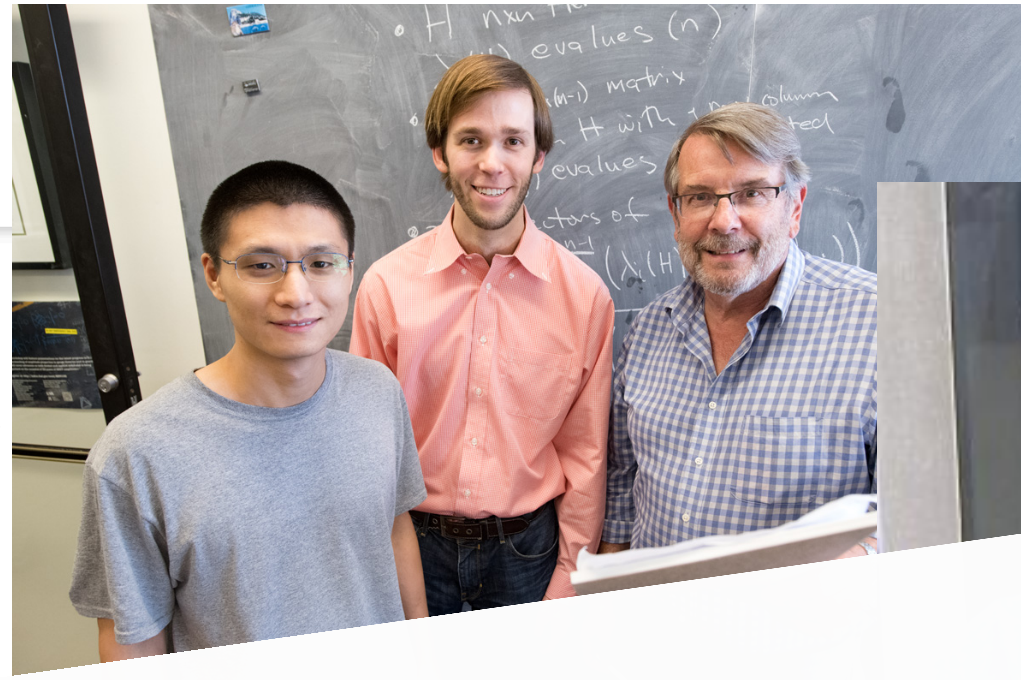

...mathematician

FermiNews article 9/23/2019

From: **Nigel S. Lockyer** lockyer@fnal.gov
Subject: Congratulations
Date: September 27, 2019 at 5:39 PM
To: Stephen Parke parke@fnal.gov
Cc: Joseph Lykken lykken@fnal.gov

Stephen,

Read the article on your linear algebra discovery. Very impressive. Connected to neutrinos no less.

Nigel