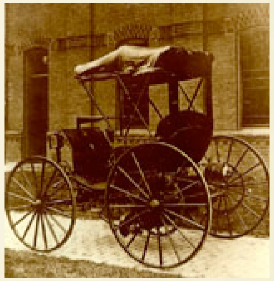
Half a Century of PRL

Fermilab, 15 October 2008

Robert Garisto

Outline

- **Birth of *The Physical Review***



- ***Letters to the Editor***

- **First fifty years of *PRL***

- **Present and future**

Outline

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Outline

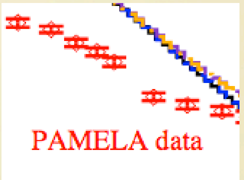
- **Present and future**

  - How PRL Works

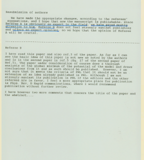
  - Innovations

  - HEP Issues

(*CDF Collaboration)
(†D0 Collaboration)
(‡Tevatron Electroweak Working Group)



  - Correspondence Lessons



$N = a + \frac{\beta}{\lambda^2}$ where N is the refractive index

1893

Birth of *The Physical Review*

Physics Journals Before 1893

Europe:

- *Phil. Trans. of the Royal Society* (UK, 1665)
  A: Physical, Mathematical & Engineering Sciences (1887)
- *Annalen der Physik* (Germany, 1790)
- *Philosophical Magazine* (UK, 1798)
- *Proceedings of the Royal Society* (UK, 1800)
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- *Il Nuovo Cimento* (Italy, 1855)
- *Nature* (UK, 1869)

US:

- *American Journal of Science* (1818)
- *Journal of the Franklin Institute* (1826)
- *Transactions of the Connecticut Academy* (1873)

PHYSIC… …EFORE

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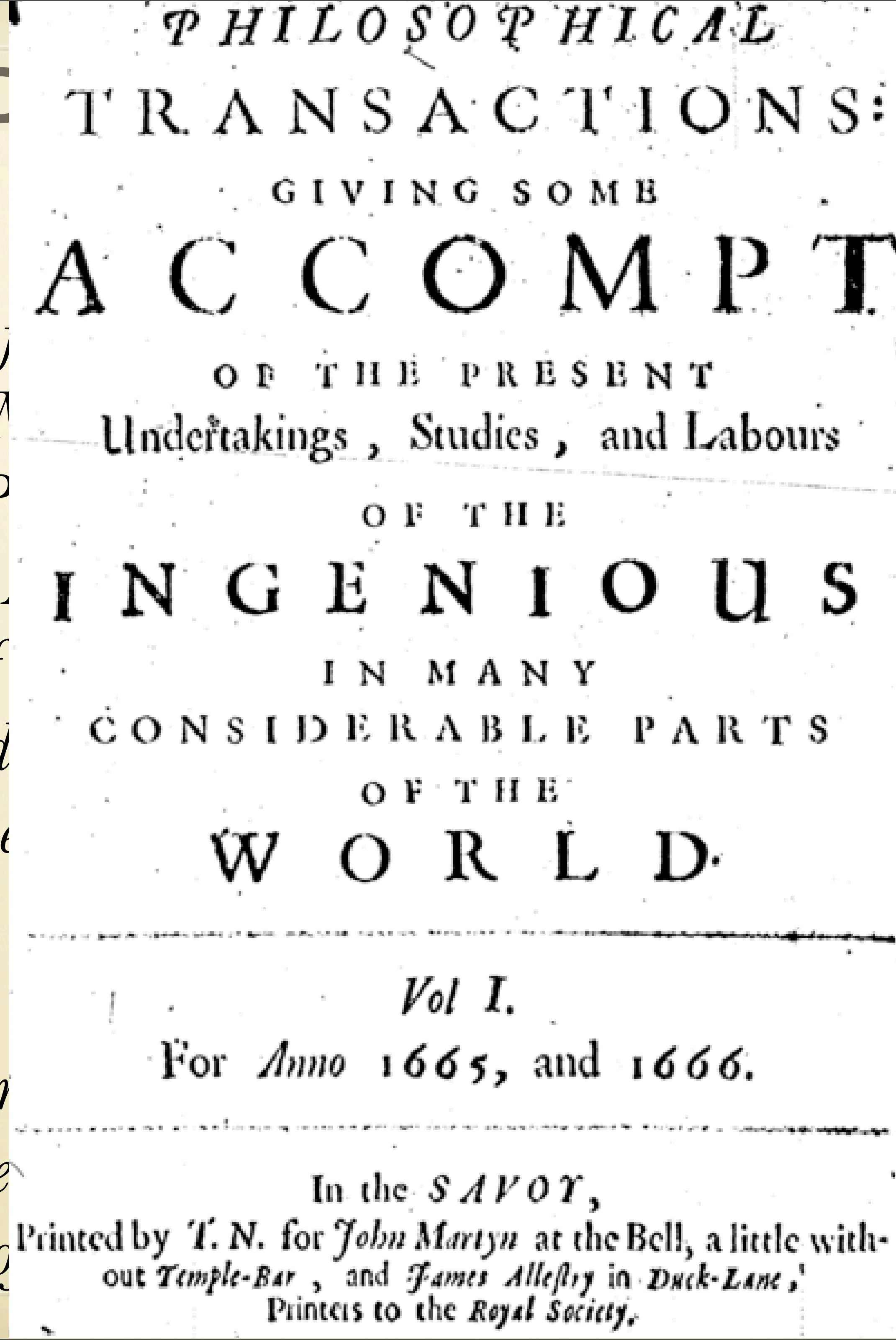

PHILOSOPHICAL
TRANSACTIONS:
GIVING SOME
ACCOMPT
OF THE PRESENT
Undertakings, Studies, and Labours
OF THE
INGENIOUS
IN MANY
CONSIDERABLE PARTS
OF THE
WORLD.

Vol I.
For *Anno* 1665, and 1666.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, and *James Allestry* in *Duck-Lane*, Printers to the *Royal Society*.

Physics Journals Before 1893

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} **None Solely Physics**

Physics in 1893

- Classical Gravity & Electromagnetism (9 years after Maxwell's equations, 4 yrs prior to discovery of the e^-)
- Ether in doubt (6 yrs after Michelson-Morley experiment, published in the *American Journal of Science*)
- Statistical Mechanics and Thermodynamics
    - J.W. Gibbs published mainly in *Transactions of the Connecticut Academy*, run by his brother in-law.
- Most physics is done in Europe

US Physics in 1893

- About 200 people in US doing physics, much of it applied
- There was no physics-only journal in the US, much less one focused on fundamental research.
- H. A. Rowland wrote in *A plea for pure science* (1884):

  "American science is a thing of the future...consider what must be done to create a science of *physics* in this country, rather than to call telegraphs, electric lights, and such conveniences by the name of *science*."

  He then laments the quality of books and periodicals in the US.

  A young PhD who worked with Rowland was Edward L. Nichols, who went on to be physics chair at Cornell.

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Henry Augustus Rowland
First APS President

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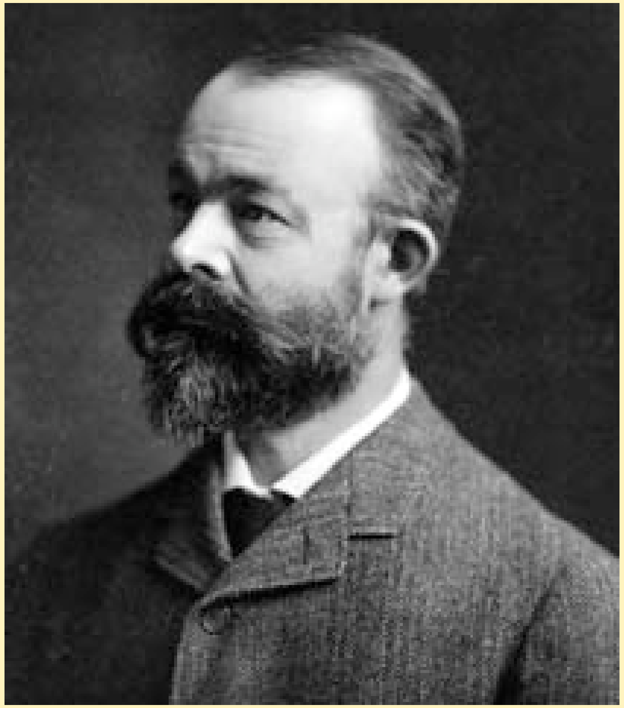

Edward L. Nichols

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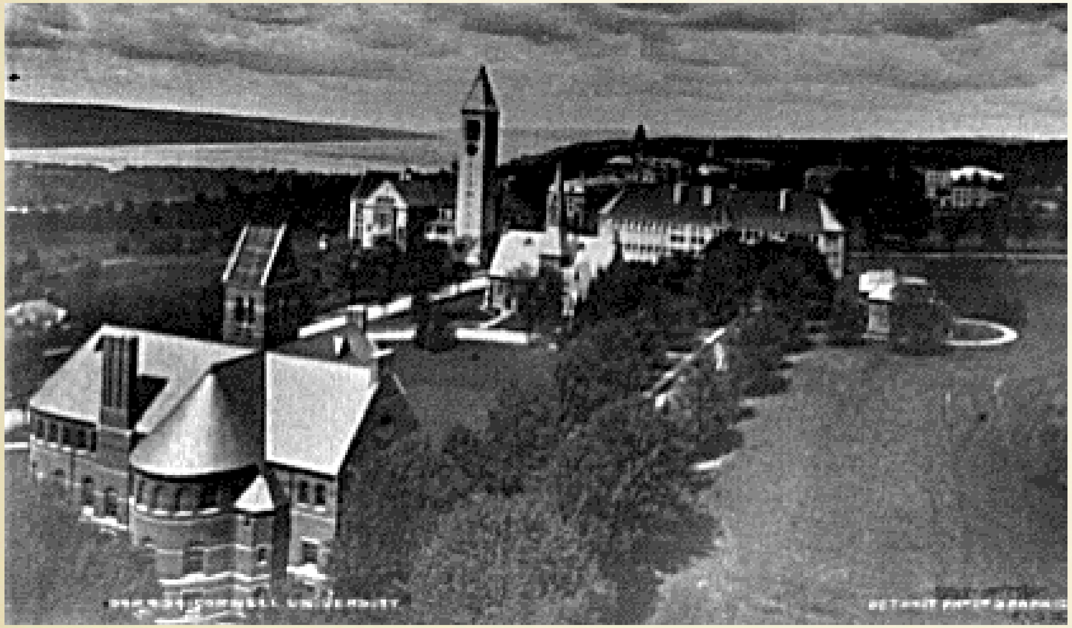
A new Journal

Located at Cornell University



Cornell University, Ithaca, NY
(founded in 1865)

Franklin Hall

A new Journal

Founding Editors:

Edward L. Nichols
(1854–1937)

Ernest Merritt
(1865–1948)

A new Journal

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Edward L. Nichols
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Ernest Merritt
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Frederick Bedell
(1868–1958)

Support Staff: Helen Lyons (for 57 years) & Aloysia King

Volume I. *July–August, 1893.* *Number 1.*

THE

PHYSICAL REVIEW.

A STUDY OF THE TRANSMISSION SPECTRA OF CERTAIN SUBSTANCES IN THE INFRA-RED.

BY ERNEST F. NICHOLS.

WITHIN a few years the study of obscure radiation has been greatly advanced by systematic inquiry into the laws of dispersion of the infra-red rays by Langley,[1] Rubens,[2] Rubens and Snow,[3] and others. Along with this advancement has come the more extended study of absorption in this region. The absorption of atmospheric gases has been studied by Langley[1] and by Ångstrom.[4] Ångstrom[5] has made a study of the absorption of certain vapors in relation to the absorption of the same substances in the liquid state, and the absorption of a number of liquids and solids has been investigated by Rubens.[6]

PR Before *PRL*

- 1893: Birth of *The Physical Review*
- 1899: Creation of the APS
- 1913: The APS takes over *The Physical Review*
- 1929: First *Letters to the Editor*
- 1936: Einstein incident with *The Physical Review*
- 1958: Launch of *Physical Review Letters*

ANNOUNCEMENT OF THE TRANSFER OF THE REVIEW TO THE AMERICAN PHYSICAL SOCIETY.[1]

WITH the present number the AMERICAN PHYSICAL SOCIETY takes over the PHYSICAL REVIEW and assumes the entire responsibility for its conduct. In so doing the society wishes to give expression to its deep appreciation of the great service done to physics and physicists in America by the editors who, in July-August, 1893, put forth the first number of a new journal, and to Cornell University, which assumed the financial risk. There was at that time no journal in this country entirely devoted to physics, and there was no national society. During nearly twenty years the original editors have carried on the arduous task of maintaining this journal on a high standard, and it is difficult to estimate the value of their efforts in furthering the cause of physics in America. In this manner the way for the foundation of the American Physical Society was prepared, and early in its history the society and the REVIEW entered into relations which have continually become closer. The former editors have now thought best to complete their task by transferring their control to the American Physical Society, and the PHYSICAL REVIEW now becomes the journal of that society, national in scope, and looks for the coöperation of all American physicists.

A. G. W.

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A. G. W.

Arthur Gordon Webster

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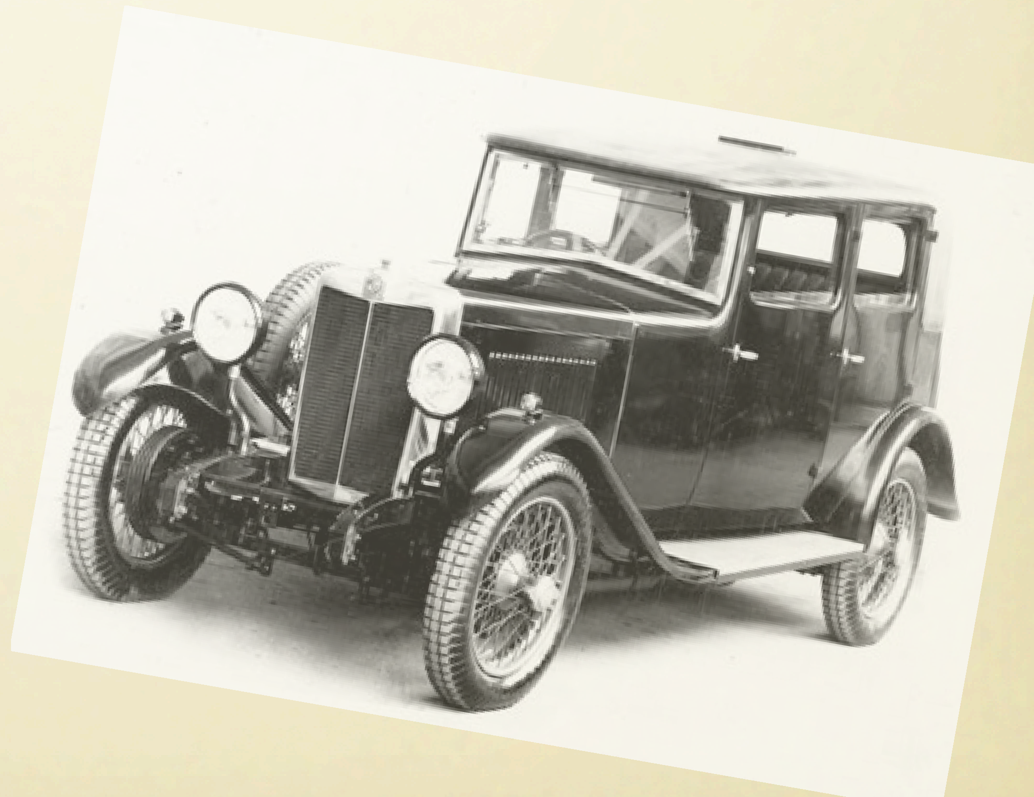
1929:
Letters to the Editor



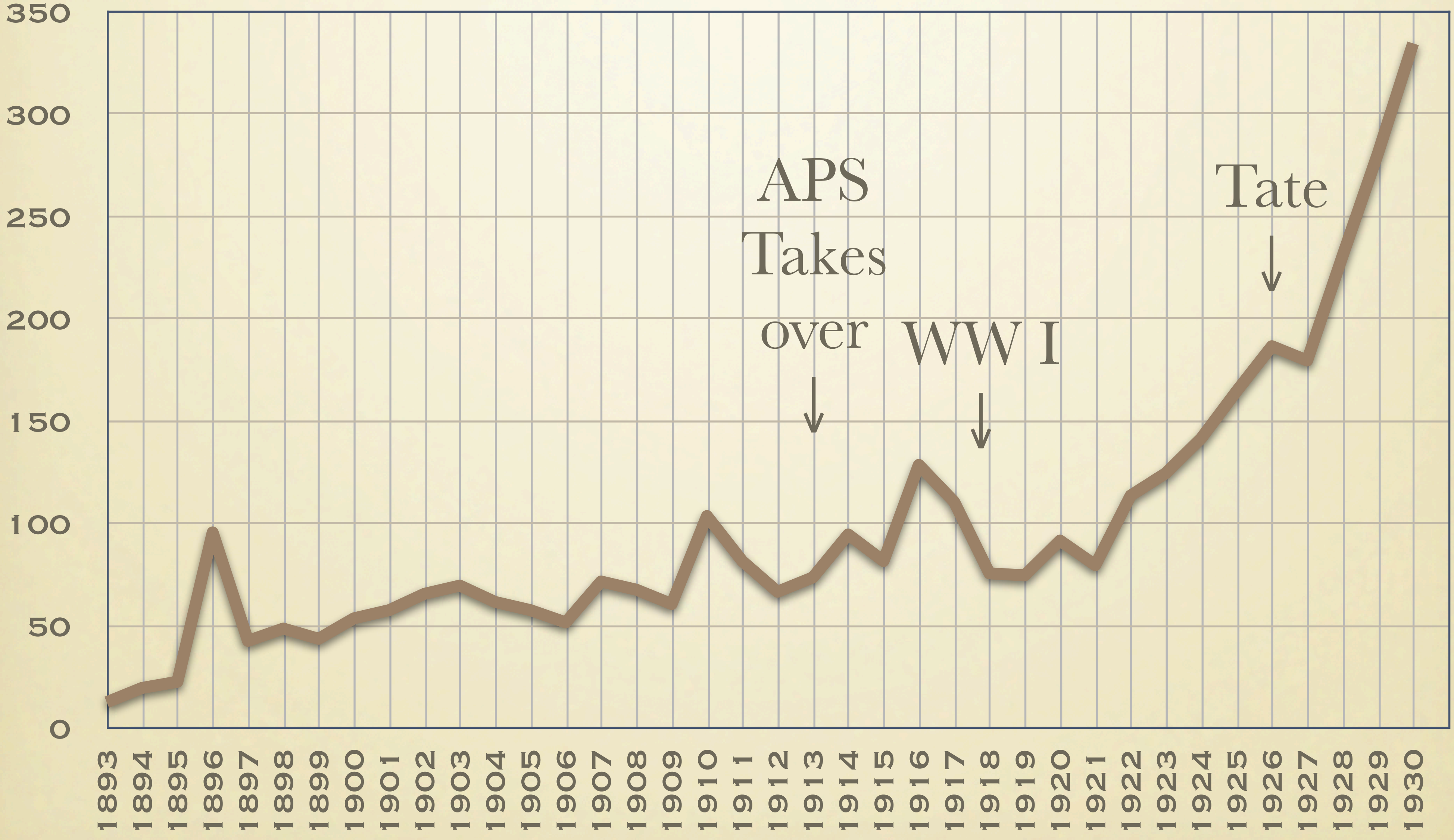
John T. Tate
(1889-1950)

In 1926, *The Physical Review* moves to the University of Minnesota, where John T. Tate takes over as Editor.

In July of 1929, Tate begins *Letters to the Editor*.

Reason: Speed

Published Papers in *The Physical Review*



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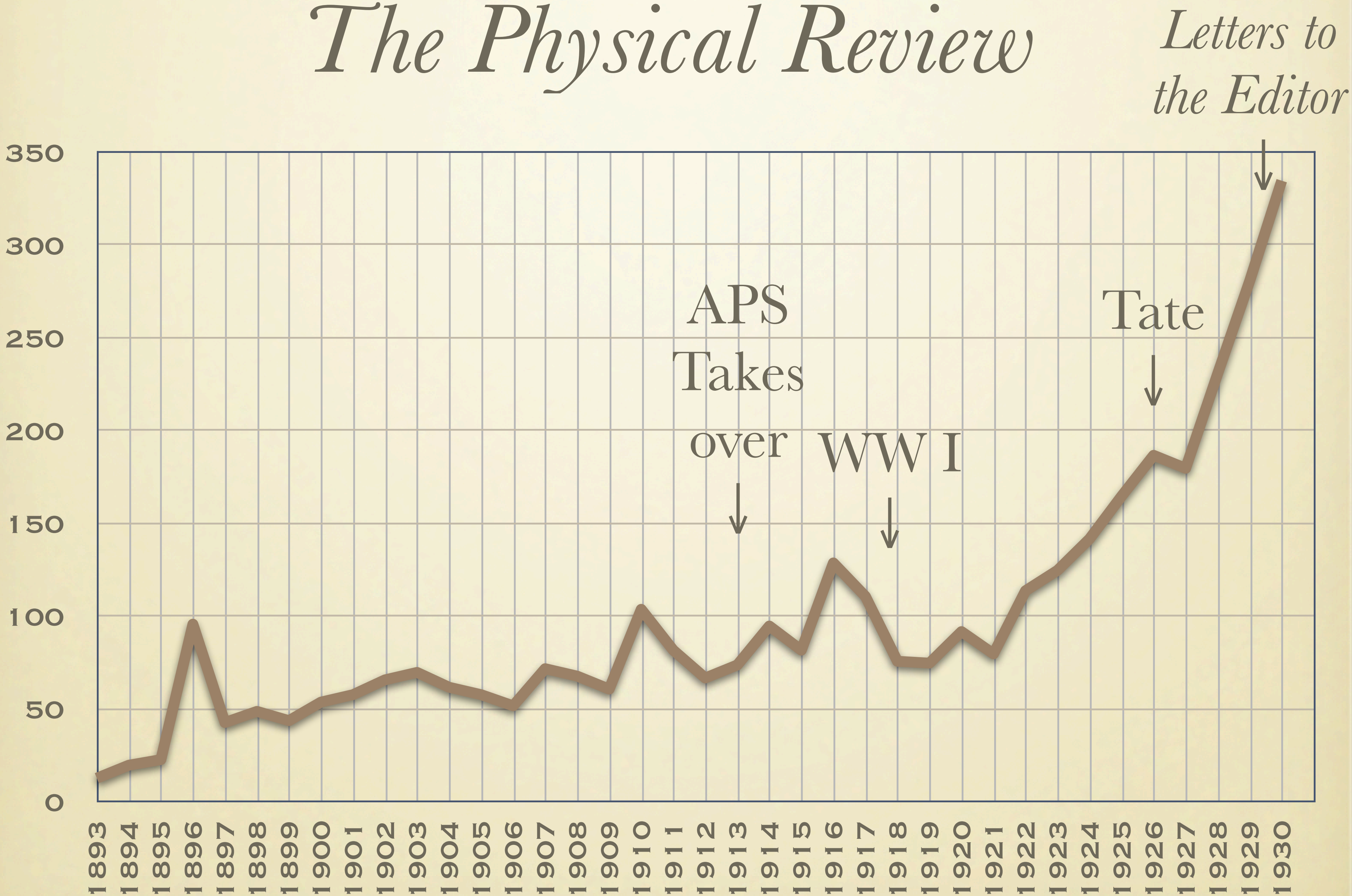

LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the twenty-eight of the preceding month; for the second issue, the thirteenth of the month. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Wind Mixing and Diffusion in the Upper Atmosphere

Progress in theories of the high atmosphere of the earth, as described in recent papers from this laboratory, has depended in no small part upon the paper by H. B. Maris

did not decrease at night in such a way as to agree with the indications from the wireless waves.

In a recent paper (Proc. Roy. Soc., February, 1929) on the diurnal variations of terrestrial magnetism, Professor S. Chapman discussed the question of diffusion and wind mixing. He followed closely but added noth-

facts about the drift of meteor trails, adopted Maris' values of the temperatures and diffusion level, etc., with no reference to the source

Finally, the diffusion of ions enters into Professor Chapman's suggestions towards a theory, as given in his paper, in an interesting way. The question will be discussed in a forthcoming paper.

E. O. Hulburt.

Naval Research Laboratory,
Washington, D.C.,
May 7, 1929.

The Uncertainty Principle

The uncertainty principle is one of the most characteristic and important consequences of the new quantum mechanics. This principle, as formulated by Heisenberg for two conjugate quantum-mechanical variables, states that the accuracy with which two such variables can be measured simultaneously is subject to the restriction that the product of the uncertainties in the two measurements is at least of order h (Planck's constant). Condon* has remarked that an uncertainty relation of this type can not hold in the general case where the two variables under consideration are not conjugate, and has stressed the desirability of obtaining a general formulation of the principle. It is the purpose of the present letter to give such a general formulation, and to apply it in particular to the case of angular momentum.

* E. U. Condon "Remarks on Uncertainty Principles" Science LXIX, p. 573 (May 31, 1929), and in conversations with the writer on this topic.

We define the "mean value" A_0 of an (Hermitean) operator A in a system whose state is described by the (normal) function ψ as

$$A_0 = \int \bar{\psi} A \psi d\tau$$

where the integral is extended over the entire coordinate space. The Hermitean character of A (i.e.

$$\int \bar{\phi} A \psi d\tau = \int \bar{\psi} A \phi d\tau$$

for arbitrary ϕ, ψ) insures the reality of A_0. The "uncertainty" ΔA in the value of A is then defined, in accordance with statistical usage, as the root mean square of the deviation of A from this mean, i.e.

$$(\Delta A)^2 = \int \bar{\psi} (A - A_0)^2 \psi d\tau.$$

The uncertainty principle for two such variables A, B, *whose commutator* $AB - BA = hC/2\pi i$, *is expressed by*

$$\Delta A \cdot \Delta B \geqq h |C_0| / 4\pi$$

i.e. the product of the uncertainties in A, B *is not less than half the absolute value of the mean of their commutator.*

that div $(a_x, a_y, a_z) = 0$. The expression for $(\Delta A)^2$ may be written, on integrating once by parts, using the fact that div $(a) = 0$ and discarding the resulting surface integral, in the form

$$(\Delta A)^2 = \int |(A - A_0)\psi|^2 d\tau.$$

We are now in a position to apply the Schwarzian inequality[2]

$$[\int (f_1\bar{f}_1 + f_2\bar{f}_2)d\tau][\int (g_1\bar{g}_1 + g_2\bar{g}_2)d\tau] \geqq |\int (f_1 g_1 + f_2 g_2)d\tau|^2$$

Taking

$$\bar{f}_1 = (A - A_0)\psi = f_2, \; g_1 = (B - B_0)\psi = -\bar{g}_2$$

and reducing the integral on the right hand side by integration by parts we find

$$\Delta A \cdot \Delta B \geqq \tfrac{1}{2} |\int \bar{\psi}(AB - BA)\psi d\tau|,$$

the required result.

[1] Cf. proof of special case $A = p$, $B = q$ in H. Weyl "Gruppentheorie und Quantenmechanik" pp. 66, 272.

[2] Weyl, l. c. p. 272.

$$\psi = f(r) e^{im\phi} P_l^m(\cos\theta)$$

where the pole of the spherical coordinates lies on the z-axis. Then M_z, $M^2 (= M_x^2 + M_y^2 + M_z^2)$ have the definite values

$$M_z = M_{z0} = mh/2\pi, \; M^2 = l(l+1)(h/2\pi)^2$$

the mean values of M_x, M_y are zero and the uncertainties are given by

$$(\Delta M_x)^2 = (\Delta M_y)^2 = \tfrac{1}{2}[l(l+1) - m^2](h/2\pi)^2, \quad \Delta M_z = 0.$$

Now from the uncertainty principle for M_x, M_y we find

$$l(l+1) \geqq m(m+1)$$

which is in fact the case. This example shows that for $m = l$ the equality holds; the inequality is consequently the most restrictive one that can be deduced for angular momenta, for we have here a case in which the ultimate limit has (in principle) been reached.

H. P. Robertson

Palmer Physical Laboratory,
Princeton, N. J.,
June 18, 1929.

The Emission of Positive Ions from Metals

During an investigation of the critical initially but these disappeared after a few that div $(a_x, a_y, a_z)=0$. The expression for $(\Delta A)^2$ may be written, on integrating once by parts, using the fact that div $(a)=0$ and discarding the resulting surface integral, in the form

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$$\bar{f}_1=(A-A_0)\psi=f_2,\quad g_1=(B-B_0)\psi=-\bar{g}_2$$

and reducing the integral on the right hand side by integration by parts we find

$$\Delta A\cdot\Delta B \geqq \tfrac{1}{2}\left|\int\bar{\psi}(AB-BA)\psi d\tau\right|,$$

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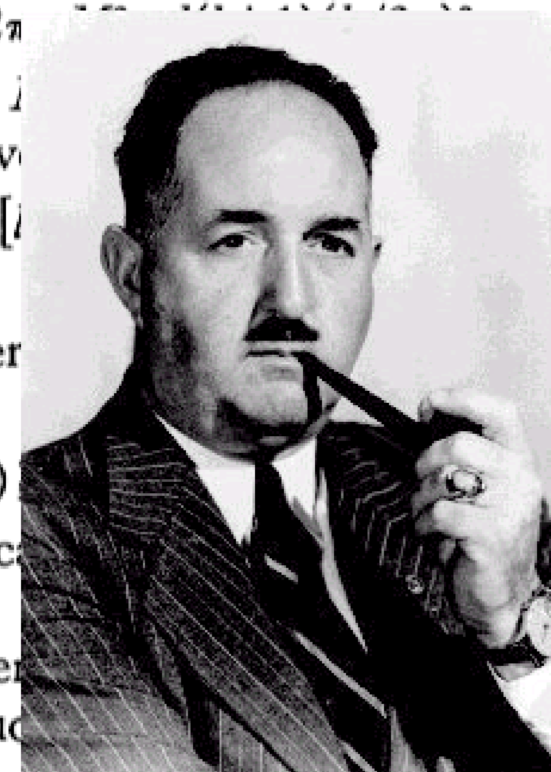

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By the mid 1930's, *The Physical Review* was becoming *the* journal for physics. Shipments of *The Physical Review* to Europe were awaited by physicists there†,

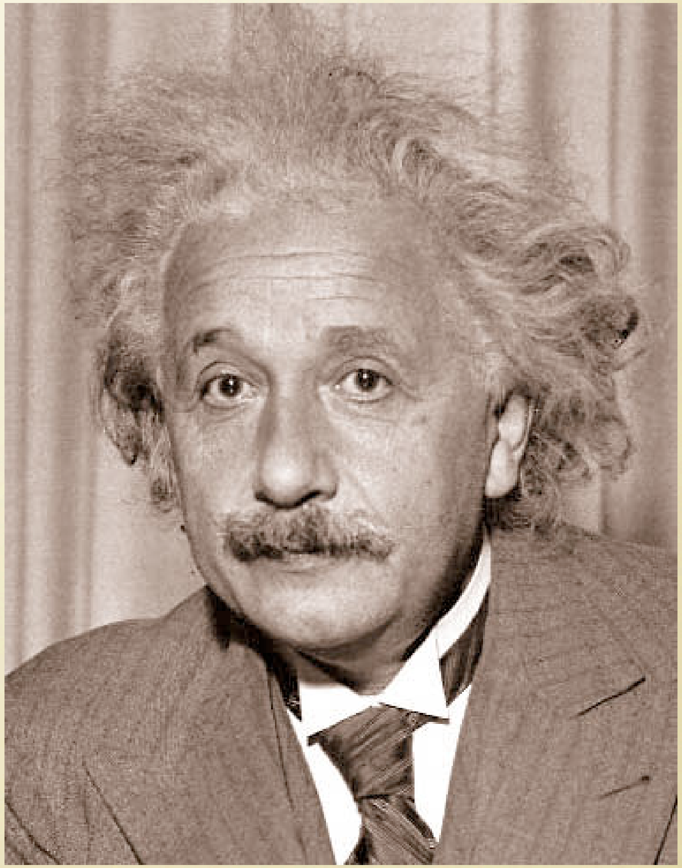
"...with an impatience and curiosity inspired by no other country" -Louis de Broglie

†Paul Hartman, "A Memoir on *The Physical Review*" (1994)

1936:

Einstein and *The Physical Review*

Referee



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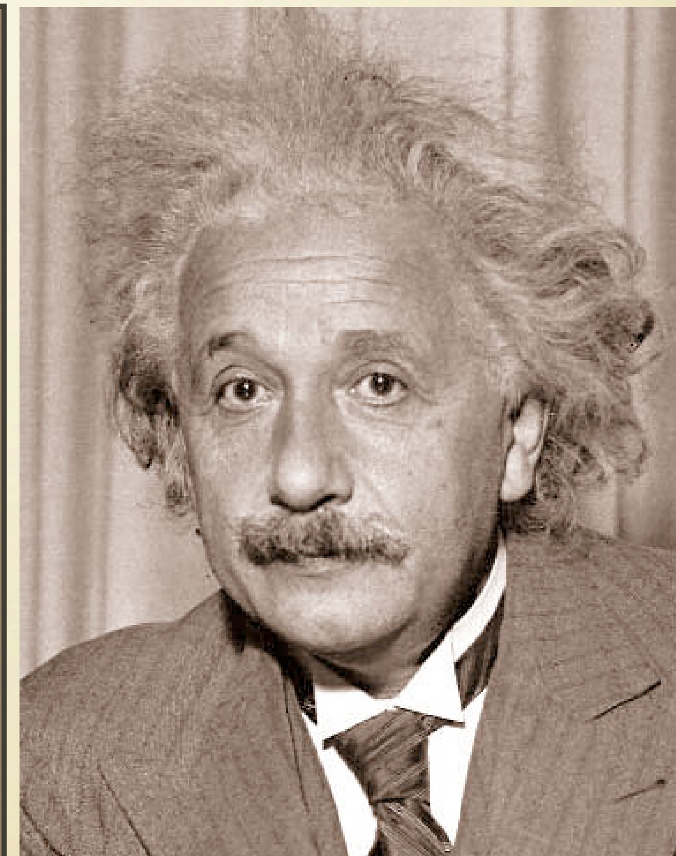
1936:

Einstein and *The Physical Review*

[based on the paper Daniel Kennefick, *Physics Today* **58**, 43 (2005) (and grqc/9704002)]

Referee



skip

In 1936 Einstein and Rosen submitted a paper to Physical Review titled “Do Gravitational Waves Exist?”, with the answer “no”. This was surprising, since gravitational waves were one of Einstein’s initial predictions of the general theory of relativity. The editor of Physical Review, Professor John T. Tate, sent a detailed ten page referee report (pointing out significant errors) to Einstein asking for his comments.

THE PHYSICAL REVIEW
REVIEWS OF MODERN PHYSICS
PHYSICS

Conducted by
THE AMERICAN PHYSICAL SOCIETY
JOHN T. TATE, *Managing Editor*

University of Minnesota, Minneapolis, Minn., U. S. A.

July 23, 1936

Professor A. Einstein
Saranac Lake, New York

Dear Professor Einstein:

I am taking the liberty of returning to you the paper by yourself and Dr. Rosen on gravitational waves together with some comments by the referee. Before publishing your paper I would be glad to have your reaction to the various comments and criticisms the referee has made.

Sincerely yours,

John T. Tate

John T. Tate,
Editor

JTT:B
Enc.

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Editor

JTT:B

Dear Sir:

We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists before it is printed. I see no reason to address the - by the way erroneous - comments of your anonymous expert. On the basis of this incident I prefer to publish the work elsewhere.

Sincerely,

[A. Einstein]

P.S. Mr. Rosen, who has left for Soviet-Russia, has authorized me to represent him in this matter.

THE PHYSICAL REVIEW
REVIEWS OF MODERN PHYSICS
PHYSICS

Conducted by
THE AMERICAN PHYSICAL SOCIETY
JOHN T. TATE, *Managing Editor*

University of Minnesota, Minneapolis, Minn., U. S. A.

July 30, 1936

Dr. A. Einstein
Glenwood
Saranac Lake, New York

Dear Dr. Einstein:

I regret the circumstances which led to your decision to publish elsewhere the paper by yourself and Dr. Rosen.

Perhaps I was personally at fault in that I assumed you were familiar with the publication policies of the American Physical Society and that you would receive the comments of our Editorial Board in the spirit in which they were written.

All papers submitted for publication in THE PHYSICAL REVIEW are subject to editorial supervision by a Board of Editors elected by the American Physical Society. I could not accept for publication in THE PHYSICAL REVIEW a paper which the author was unwilling I should show to our Editorial Board before publication. I assumed that you knew this or I would have returned your paper to you at once.

I regret that you found the editorial comments on your paper erroneous and unworthy of reply.

Sincerely yours,

John T. Tate

John T. Tate,
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Sincerely yours,
John T. Tate
Editor

The paper was submitted to the Journal of the Franklin Institute. Discussions with Professor H. P. Robertson of Princeton convinced Einstein and his new assistant, L. Infeld, that the referee was right and Einstein and Rosen wrong. The paper was modified in proof, and the conclusions reflect those of the referee!

Subsequently Einstein published only one brief note in Physical Review, but several papers in Reviews of Modern Physics.

ON GRAVITATIONAL WAVES.

BY

A. EINSTEIN and N. ROSEN.

ABSTRACT.

The rigorous solution for cylindrical gravitational waves is given. For the convenience of the reader the theory of gravitational waves and their production, already known in principle, is given in the first part of this paper. After encountering relationships which cast doubt on the existence of *rigorous* solutions for undulatory gravitational fields, we investigate rigorously the case of cylindrical gravitational waves. It turns out that rigorous solutions exist and that the problem reduces to the usual cylindrical waves in euclidean space.

I. APPROXIMATE SOLUTION OF THE PROBLEM OF PLANE WAVES AND THE PRODUCTION OF GRAVITATIONAL WAVES.

It is well known that the approximate method of integration of the gravitational equations of the general relativity theory leads to the existence of gravitational waves. The method used is as follows: We start with the equations

$$R_{\mu\nu} - \tfrac{1}{2}g_{\mu\nu}R = -T_{\mu\nu}. \tag{1}$$

We consider that the $g_{\mu\nu}$ are replaced by the expressions

$$g_{\mu\nu} = \delta_{\mu\nu} + \gamma_{\mu\nu}, \tag{2}$$

where

$$\begin{aligned} \delta_{\mu\nu} &= 1 \quad \text{if} \quad \mu = \nu, \\ &= 0 \quad \text{if} \quad \mu \neq \nu, \end{aligned}$$

provided we take the time coördinate imaginary, as was done by Minkowski. It is assumed that the $\gamma_{\mu\nu}$ are small, i.e. that the gravitational field is weak. In the equations the $\gamma_{\mu\nu}$ and their derivatives will occur in various powers. If the $\gamma_{\mu\nu}$ are everywhere sufficiently small compared to unity one obtains a first-approximation solution of the equations by neglecting in (1) the higher powers of the $\gamma_{\mu\nu}$ (and their derivatives) compared with the lower ones. If one introduces further the $\bar{\gamma}_{\mu\nu}$ instead of the $\gamma_{\mu\nu}$ by the relations

$$\bar{\gamma}_{\mu\nu} = \gamma_{\mu\nu} - \tfrac{1}{2}\delta_{\mu\nu}\gamma_{\alpha\alpha},$$

where T is the interval of time over which the integral is taken. This does not vanish, in general. At distances x_1 from $x_1 = 0$ great compared with the wave-lengths, a progressive wave can be represented with good approximation in a domain containing many waves by

$$\beta = X_0 + a \sin \omega(x_4 - x_1),$$

where a is a constant (which, to be sure, is a substitute for a function depending weakly on x_1). In this case $X_1 = a \cos \omega x_1$, $X_2 = - a \sin \omega x_1$, so that the integral can be (approximately) represented by $- \frac{1}{2} a \omega^2 T$, and thus cannot vanish and always has the same sign. Progressive waves therefore produce a secular change in the metric.

This is related to the fact that the waves transport energy, which is bound up with a systematic change in time of a gravitating mass localized in the axis $x = 0$.

Note.—The second part of this paper was considerably altered by me after the departure of Mr. Rosen for Russia since we had originally interpreted our formula results erroneously. I wish to thank my colleague Professor Robertson for his friendly assistance in the clarification of the original error. I thank also Mr. Hoffmann for kind assistance in translation.

A. EINSTEIN.

1936

NAME	DATE IN	REFEREE	DATE IN	TO AUTHOR	TO N. Y.	ISSUE	RE-JECTED
[illegible]	5/29	Tarpton 6/4	6/8				6/12
Einstein & Rosen	6/1	Robertson 7/6	7/17	7/23			
[illegible]	[illegible]				4/14	MAY 15, 1936	
[illegible]	3/28		4/16	4/8	4/17/36	JUNE 15, 1936	
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1936

NAME	DATE IN	REFEREE
Chargaff	5/24	Tangton 6/4
Einstein & Rosen	6/1	Robertson 7/6
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Gamow & Teller	3/28	
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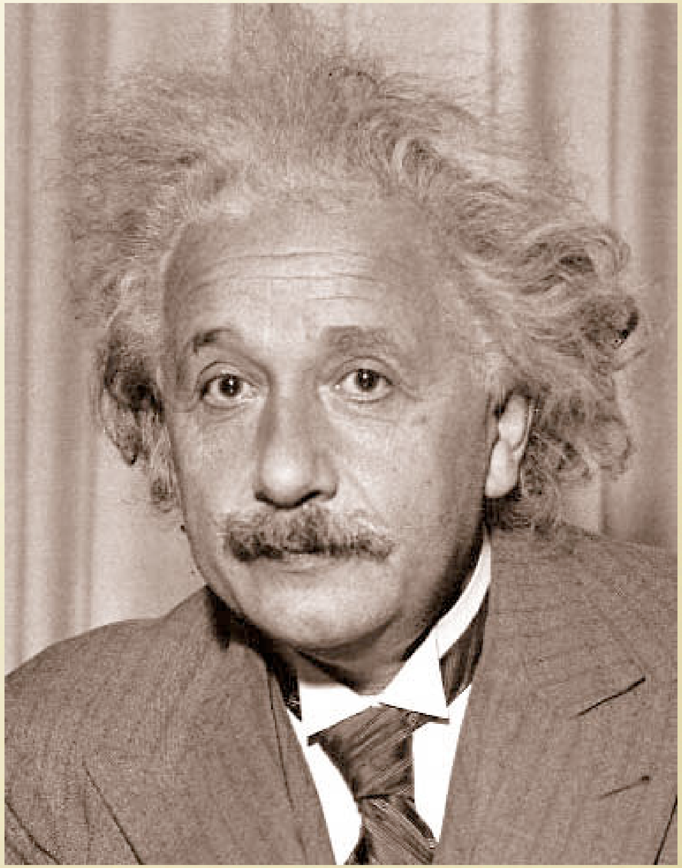
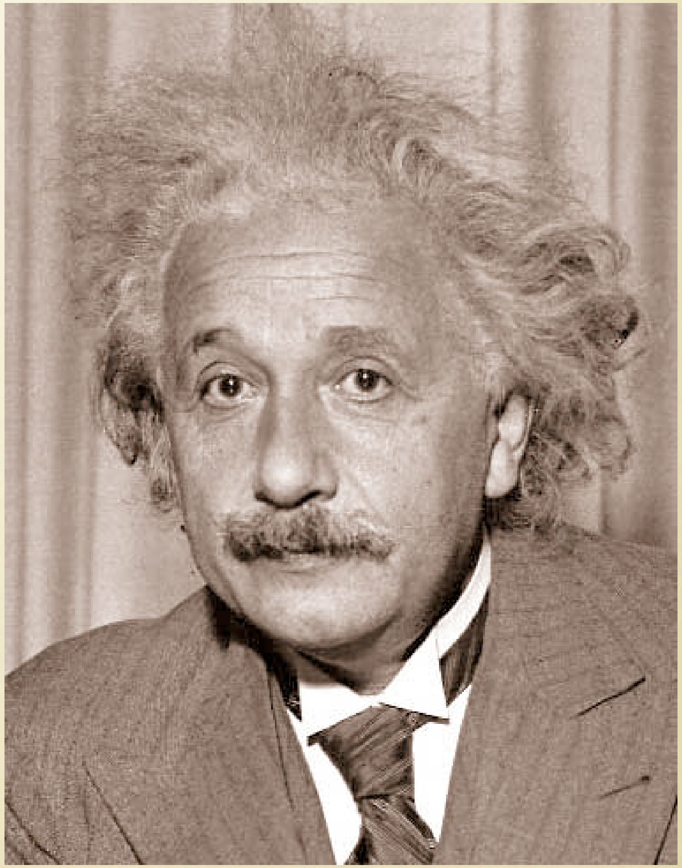
Referee







The Mechanism of Nuclear Fission

NIELS BOHR
University of Copenhagen, Copenhagen, Denmark, and The Institute for Advanced Study, Princeton, New Jersey

AND

JOHN ARCHIBALD WHEELER
Princeton University, Princeton, New Jersey

(Received June 28, 1939)

On the basis of the liquid drop model of atomic nuclei, an account is given of the mechanism of nuclear fission. In particular, conclusions are drawn regarding the variation from nucleus to nucleus of the critical energy required for fission, and regarding the dependence of fission cross section for a given nucleus on energy of the exciting agency. A detailed discussion of the observations is presented on the basis of the theoretical considerations. Theory and experiment fit together in a reasonable way to give a satisfactory picture of nuclear fission.

INTRODUCTION

THE discovery by Fermi and his collaborators that neutrons can be captured by heavy nuclei to form new radioactive isotopes led especially in the case of uranium to the interesting finding of nuclei of higher mass and charge number than hitherto known. The pursuit of these investigations, particularly through the work of Meitner, Hahn, and Strassmann as well as Curie and Savitch, brought to light a number

Just the enormous energy release in the fission process has, as is well known, made it possible to observe these processes directly, partly by the great ionizing power of the nuclear fragments, first observed by Frisch[3] and shortly afterwards independently by a number of others, partly by the penetrating power of these fragments which allows in the most efficient way the separation from the uranium of the new nuclei formed by the fission.[4] These products are above all character-

University of Copenh ... inceton, New Jersey

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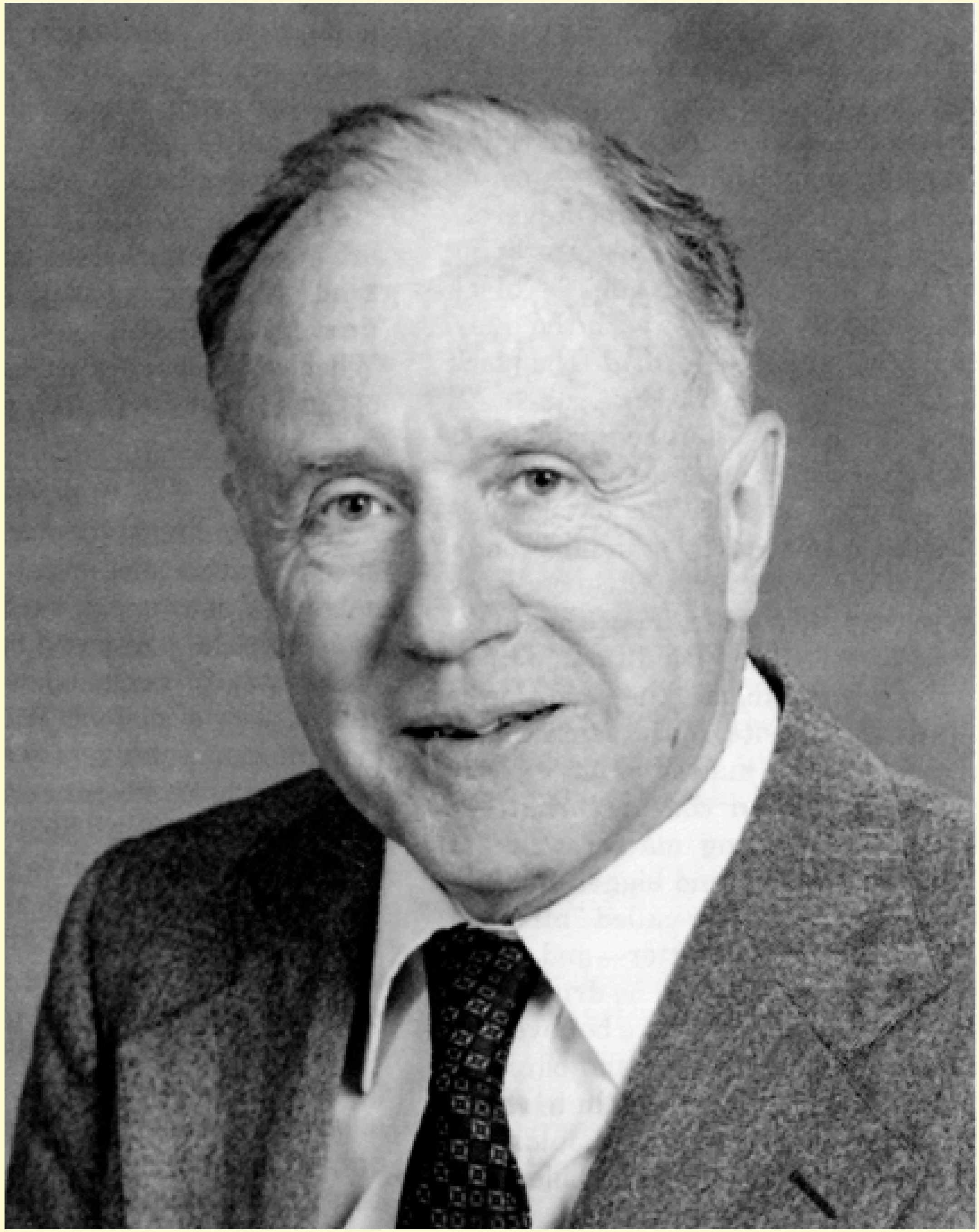

John Archibald Wheeler
1911-2008

The Mechanism of Nuclear Fission

NIELS BOHR
University of Copenhagen, Copenhagen, Denmark, and The Institute for Advanced Study, Princeton, New Jersey

AND

JOHN ARCHIBALD WHEELER
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Letters to the Editor

PUBLICATION of brief reports of important discoveries in physics may be secured by addressing them to this department. The closing date for this department is five weeks prior to the date of issue. No proof will be sent to the authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents. Communications should not exceed 600 words in length.

The Origin of Chemical Elements

R. A. ALPHER* α
Applied Physics Laboratory, The Johns Hopkins University, Silver Spring, Maryland
AND
H. BETHE β
Cornell University, Ithaca, New York
AND
G. GAMOW γ
The George Washington University, Washington, D. C.
February 18, 1948

AS pointed out by one of us,[1] various nuclear species must have originated not as the result of an equilibrium corresponding to a certain temperature and density, but rather as a consequence of a continuous building-up process arrested by a rapid expansion and cooling of the primordial matter. According to this picture, we must imagine the early stage of matter as a highly compressed

We may remark at first that the building-up process was apparently completed when the temperature of the neutron gas was still rather high, since otherwise the observed abundances would have been strongly affected by the resonances in the region of the slow neutrons. According to Hughes,[2] the neutron capture cross sections of various elements (for neutron energies of about 1 Mev) increase exponentially with atomic number halfway up the periodic system, remaining approximately constant for heavier elements.

Using these cross sections, one finds by integrating Eqs. (1) as shown in Fig. 1 that the relative abundances of various nuclear species decrease rapidly for the lighter elements and remain approximately constant for the elements heavier than silver. In order to fit the calculated curve with the observed abundances[3] it is necessary to assume the integral of $\rho_n dt$ during the building-up period is equal to 5×10^4 g sec./cm³.

On the other hand, according to the relativistic theory of the expanding universe[4] the density dependence on time is given by $\rho \cong 10^6/t^2$. Since the integral of this expression diverges at $t=0$, it is necessary to assume that the building-up process began at a certain time t_0, satisfying the relation:

$$\int_{t_0}^{\infty} (10^6/t^2)dt \cong 5\times10^4, \tag{2}$$

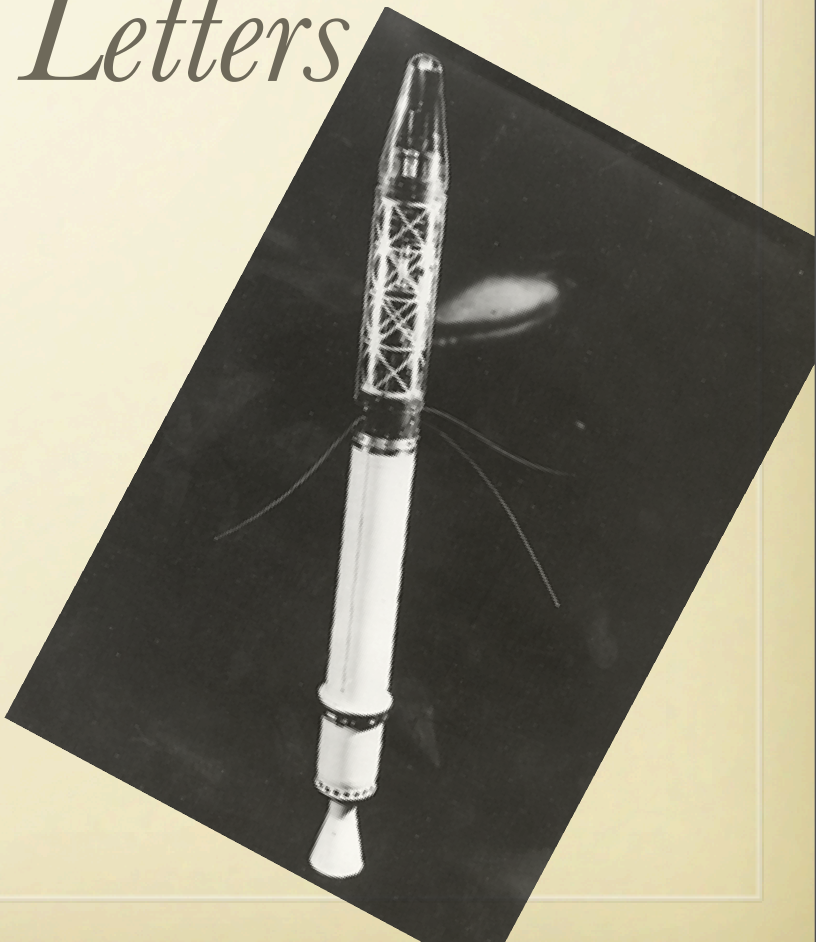
which gives us $t_0 \cong 20$ sec. and $\rho_0 \cong 2.5\times10^5$ g sec./cm³. This result may have two meanings: (a) for the higher densities existing prior to that time the temperature of the neutron gas was so high that no aggregation was taking place, (b)

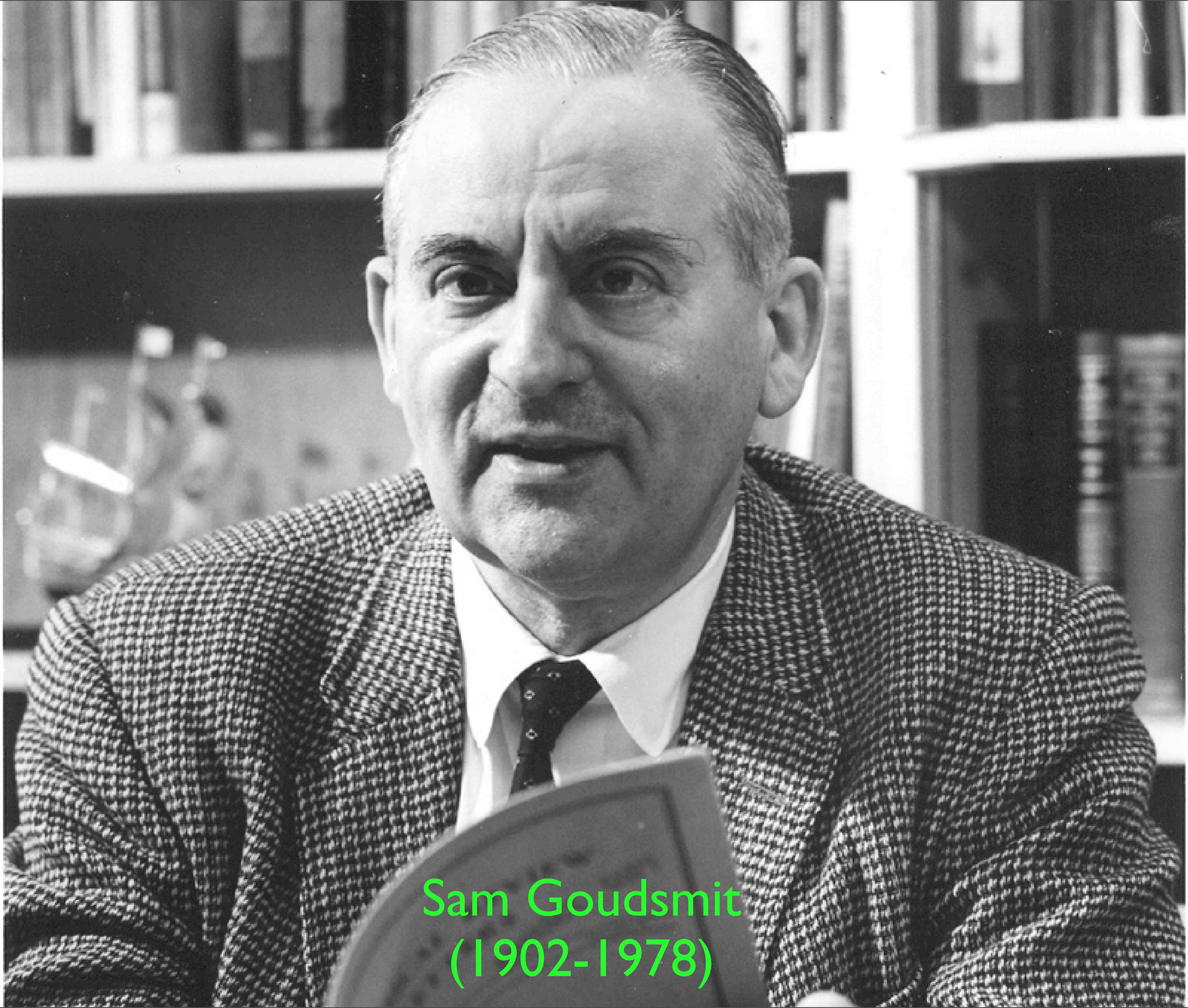
1951: *The Physical Review* MOVES TO BNL

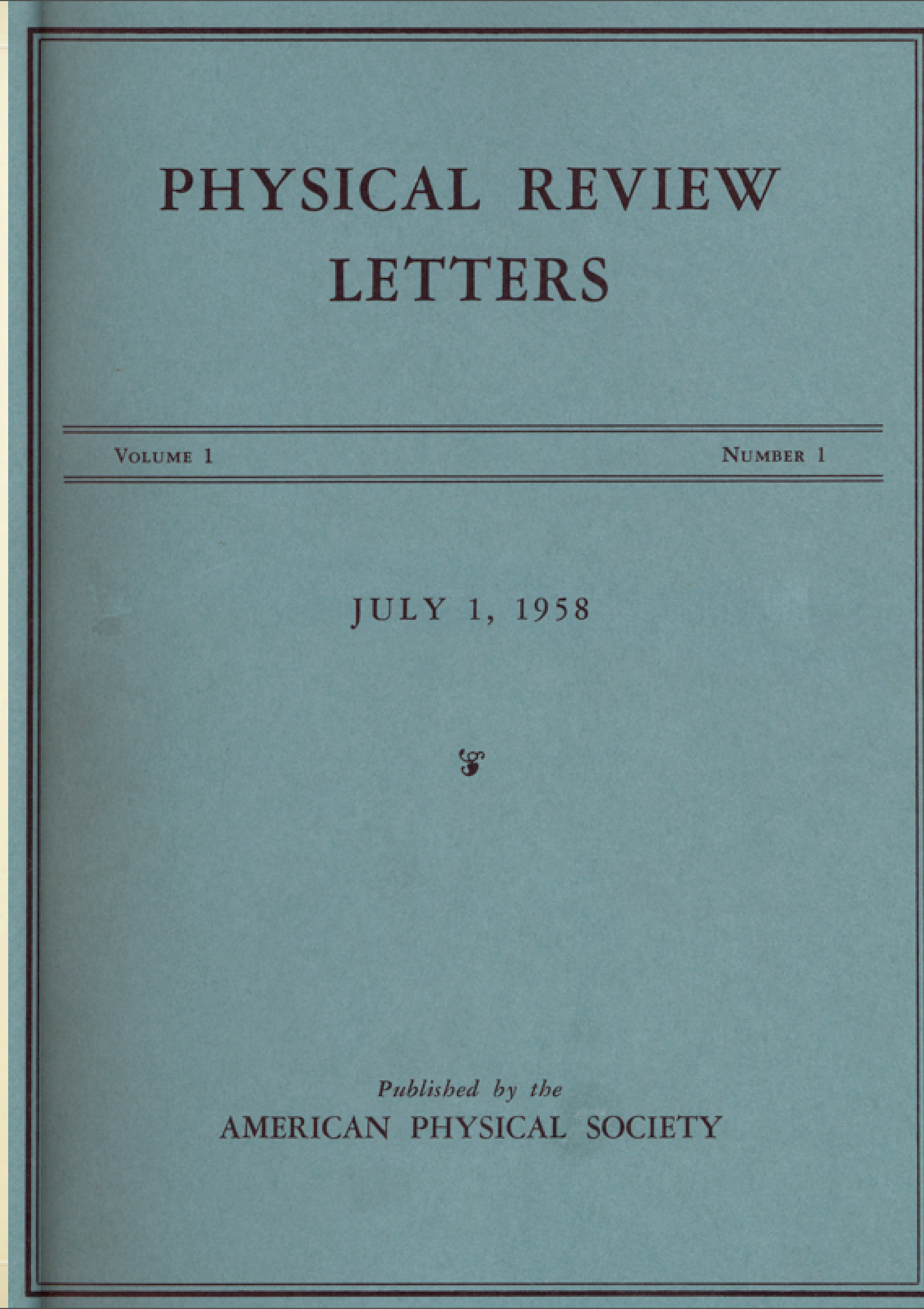
…occupying two offices in the Physics Department
Editors: Samuel A. Goudsmit and Simon Pasternack

$$P(E_e)dE_e \sim \rho(E_e)\left(1 + \frac{\lambda m_e m_\nu}{E_e(E_e^{max} - E_e + m_\nu)}\right)dE_e$$

1958: Launch of *Physical Review Letters*




Sam Goudsmit
(1902-1978)



PHYSICAL REVIEW LETTERS

VOLUME 1 NUMBER 1

JULY 1, 1958

Published by the
AMERICAN PHYSICAL SOCIETY

EDITORIAL

Here is the first issue of Physical Review Letters. We hope that it will gain the approval of authors and readers. Speed of publication is achieved at the expense of printing elegance. We believe, however, that this does not reduce the clarity and ease of reading, even though the number of symbols available in this type of reproduction is much more limited than in letterpress printing.

To maintain the high speed and high standards, only Letters which really deserve rapid publication should be submitted. Since there is little time or none at all for refereeing, most of the decisions for acceptance and for minor alterations will have to be made in the Editor's office. We shall do our best to make as few mistakes as possible but for this we require the cooperation of authors and an understanding on their part of the many problems facing a journal of this type.

Physical Review Letters is an experiment. This first issue is triple size; it contains the Letters which formerly would have appeared in three consecutive issues of The Physical Review. We intend to make changes and improvements in the course of time. But if we fail we can return to the old "Letters to the Editor" column in The Physical Review.

S. A. Goudsmit

Reason: Speed

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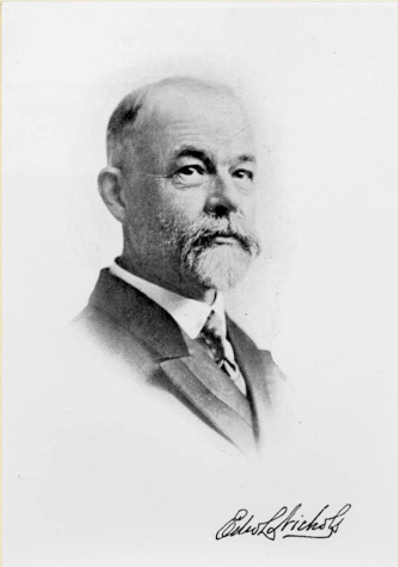


Edward Nichols

Ernest Merritt

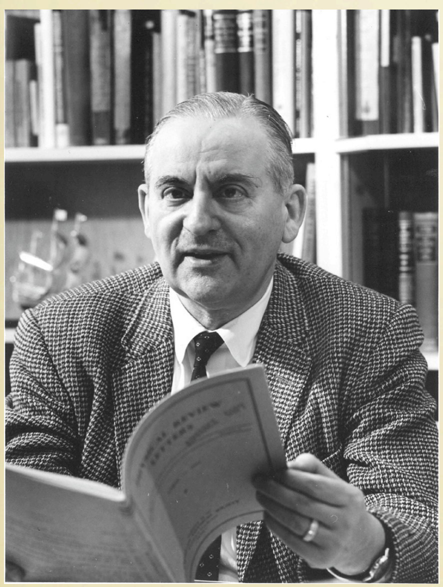
1893

Fredrick Bedell

1913

John Tate

1926



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1951, 1958

Bob Adair

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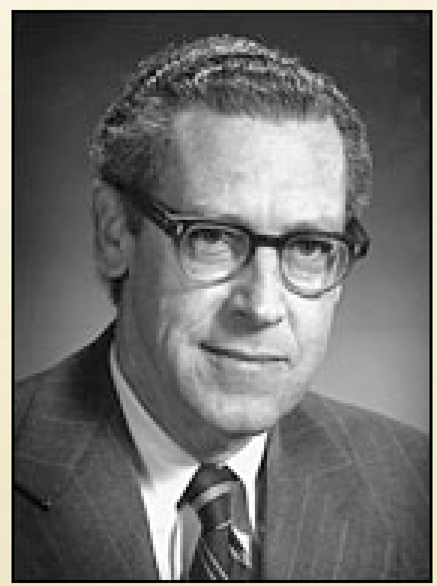


George Vinyard

1983

Jack Sandweiss

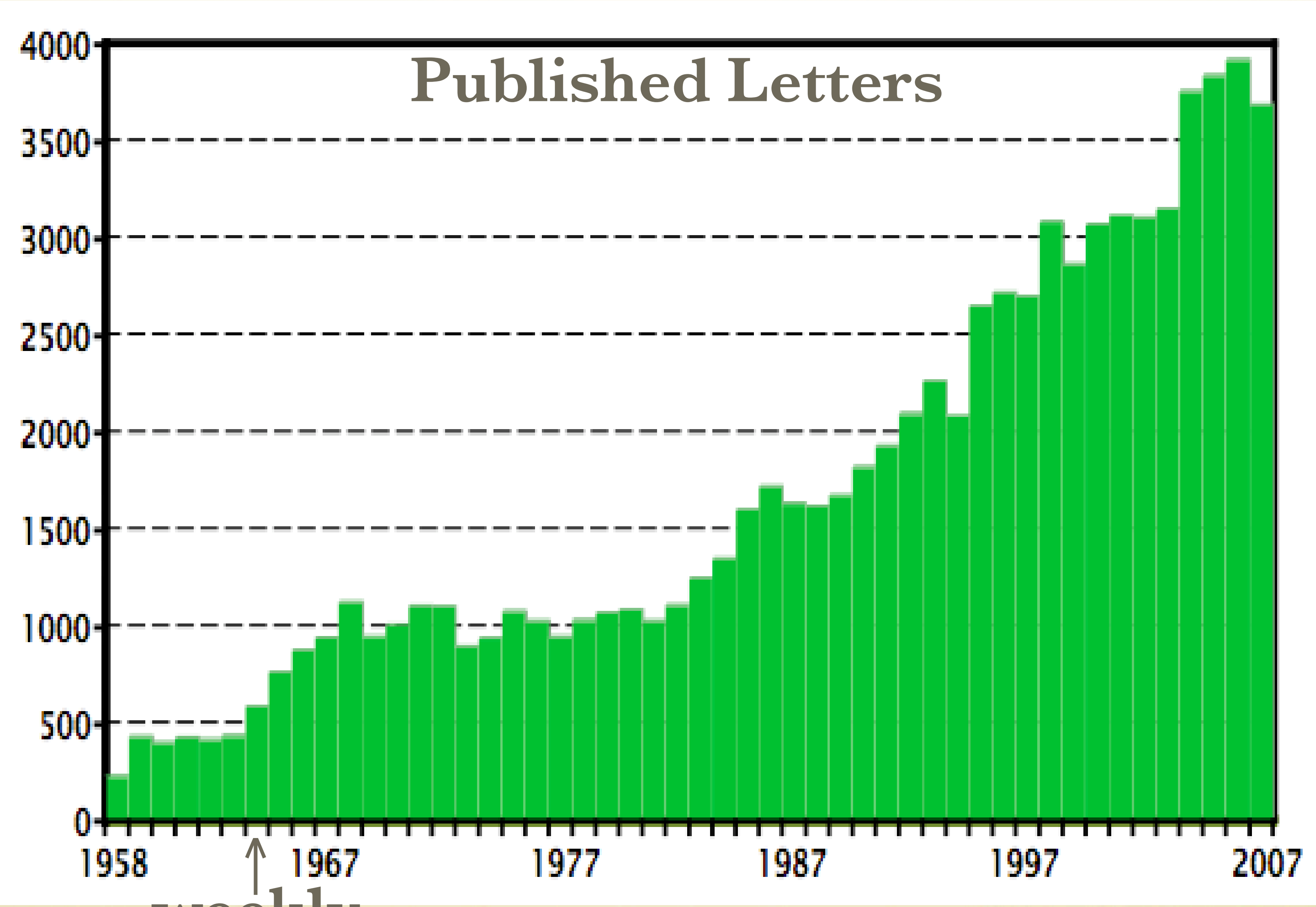
1987

PRL's First Fifty Years

- 1958: Launch of *Physical Review Letters*
- 1964: *PRL* changes from biweekly to weekly
- 1968: Abstracts required for Letters
- 1972: Generally send papers to two referees
- 1974: Comments initiated; Editorial Board formed
- 1980: Move from BNL to Ridge office
- 1982: *PRL* criteria of Importance & Broad Interest
- 1990: *PRL* becomes a truly international journal
- 1995: *PRL* Online
- 1998: *PR Focus*
- 2001: Cover figures
- 2007: *PRL Editors' Suggestions*


PHYSICAL REVIEW LETTERS
Articles published week ending
3 AUGUST 2007
Volume 99, Number 5
APS physics
Published by The American Physical Society
Volume 73

Growth of PRL



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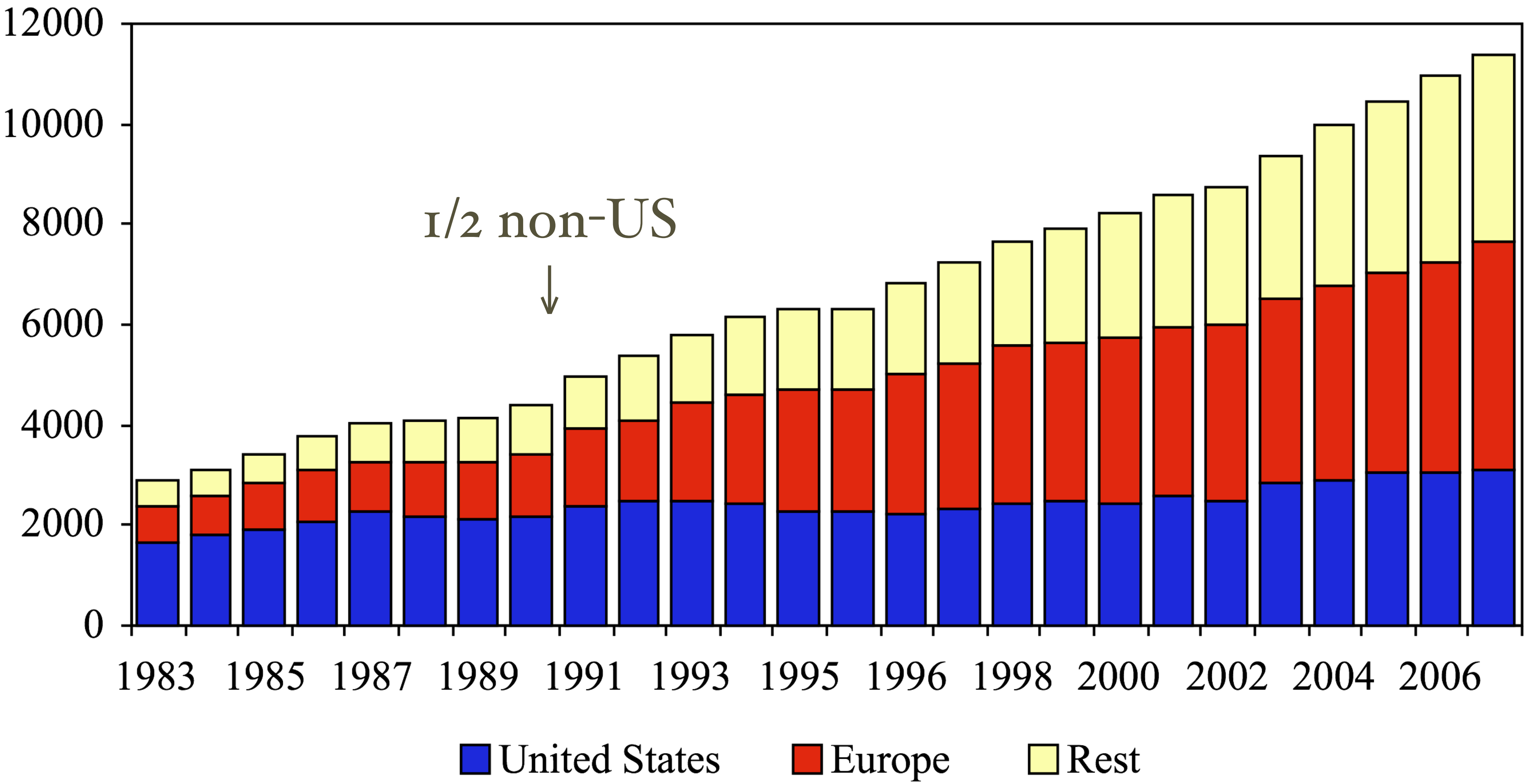
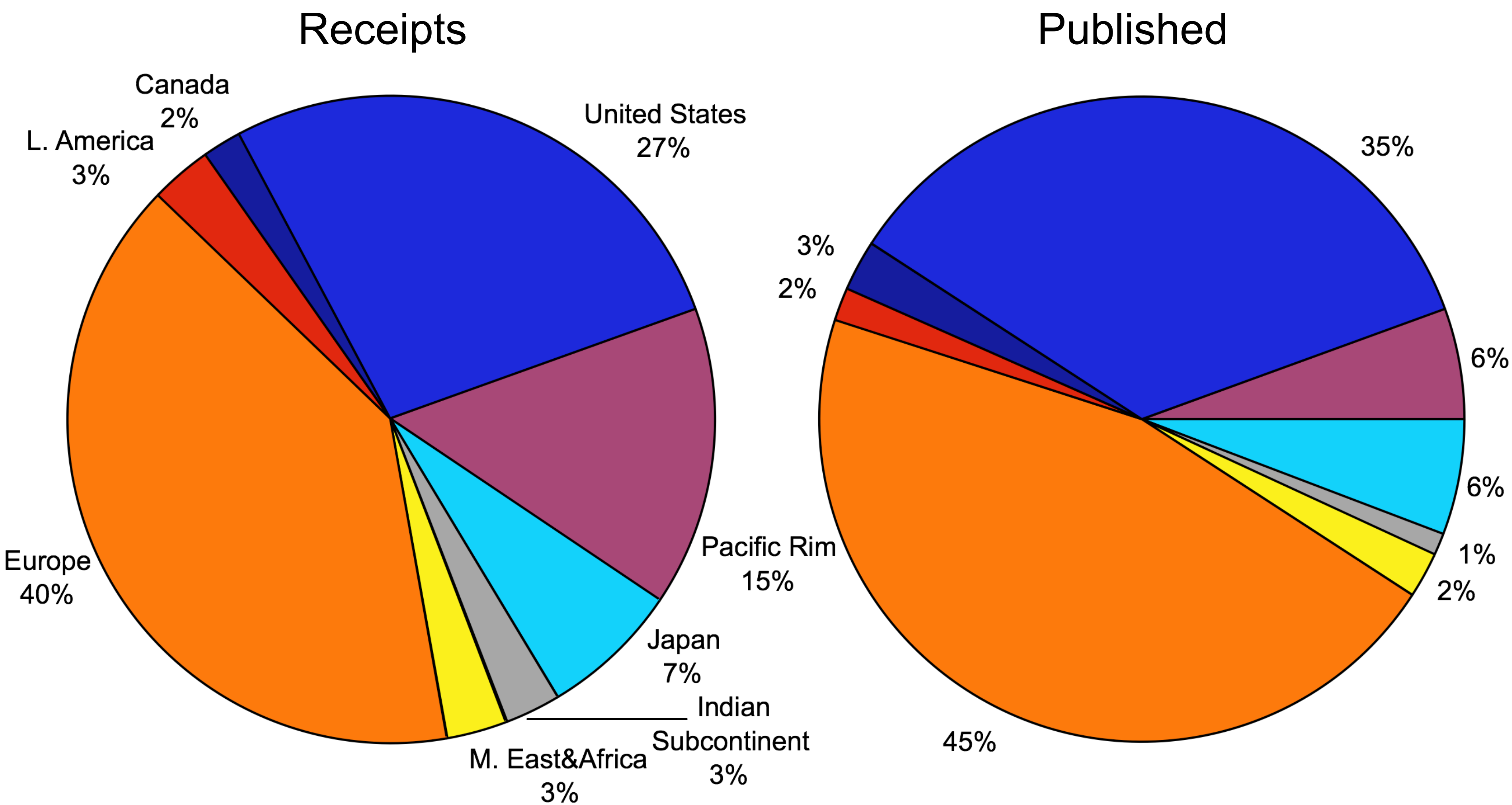
Internationalization

Physical Review Letters Submissions
1983 - 2007



Physical Review Letters

January 1 - December 31, 2007



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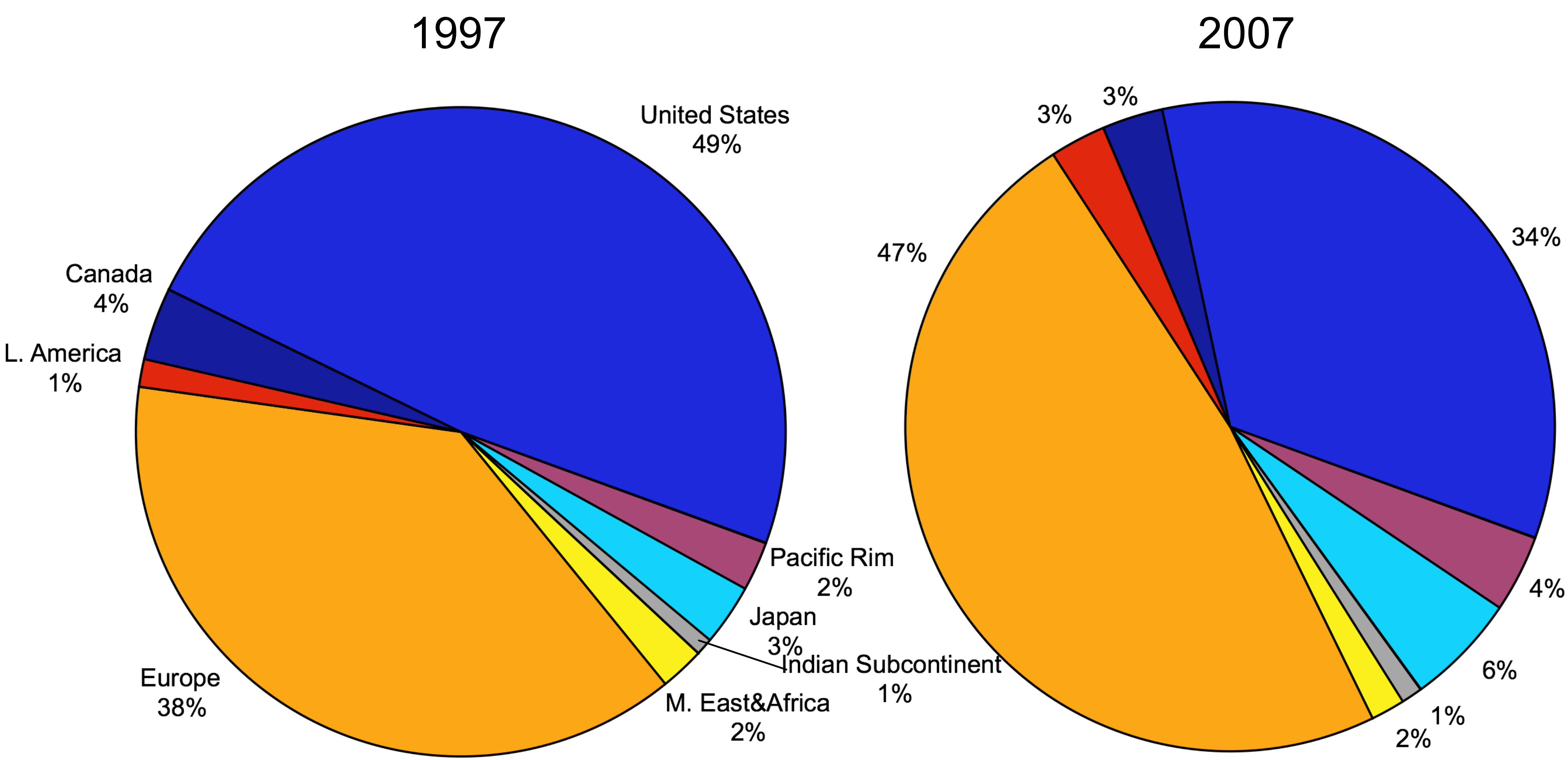
Physical Review and Physical Review Letters Referees Used for Published Articles



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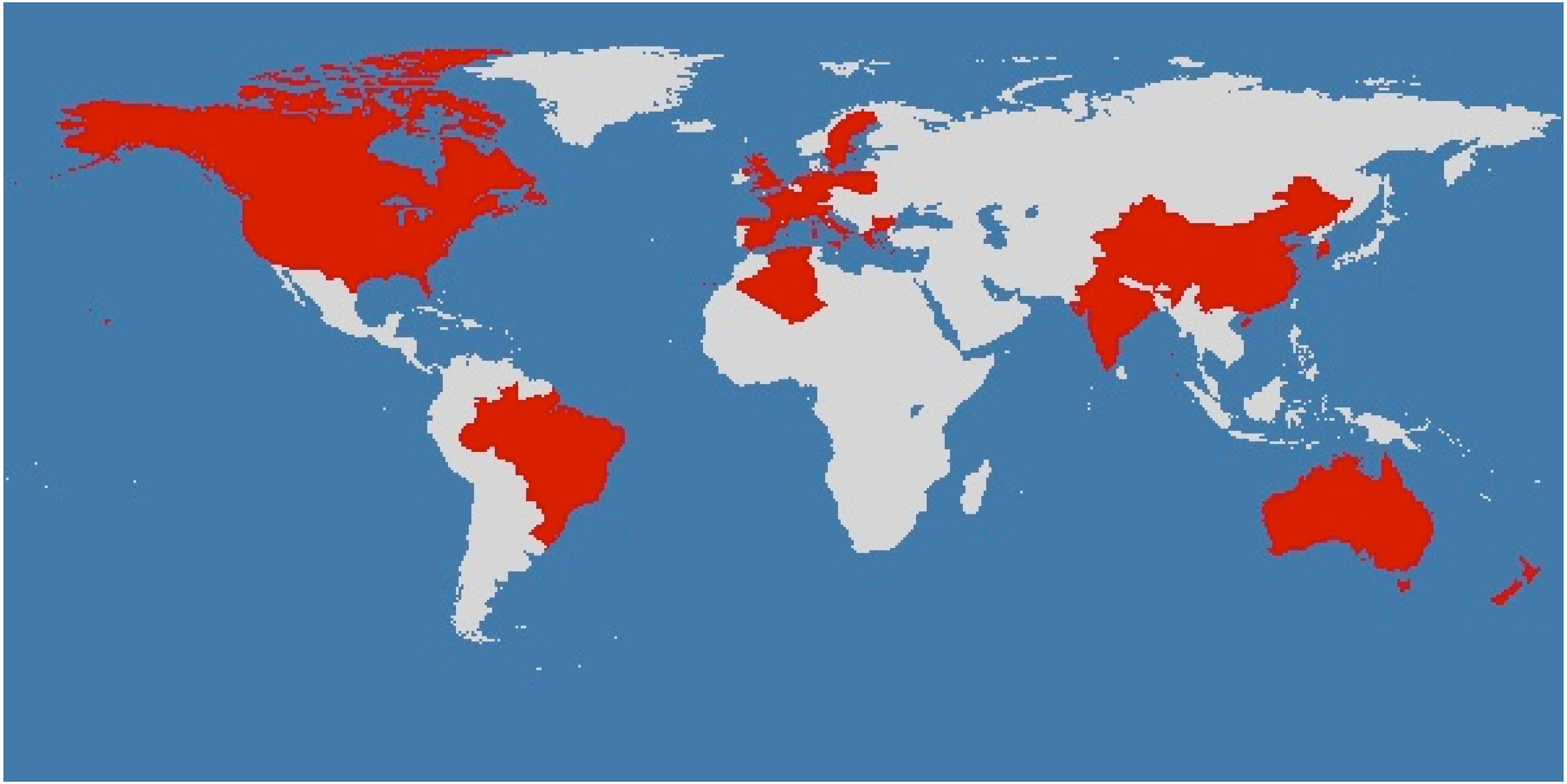

Aspects of *Letters*

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EDITORIAL

The Letters are getting out of hand again. This journal can fulfill its function only if each issue does not contain more than about a dozen Letters. Fifteen should be the maximum. But we receive over three times as many manuscripts and publish twice as many Letters as we believe to be right. Moreover, "Letters" have grown longer, which would not be objectionable if the increase had resulted in greater clarity.

The following are some of our pet peeves: an author who gets an interesting "Letter" published and now believes that all subsequent results of his work must be published in a series of "Letters"; another author arriving at a later result in the same subject who demands the right to have his work also published as a "Letter"; an author who uses the "Letters" merely to announce a later paper and whose Letter is incomprehensible by itself; • • •

S. A. Goudsmit

EDITORIAL

Criticism, Acceptance Criteria, and Refereeing

Critique.—We, the Editors, hear many complaints about Physical Review Letters, both directly and secondhand. We hear that young physicists believe that our referees accept papers only from well-established research experts at prestigious institutions; on the other hand, distinguished colleagues claim that we select only young referees who cannot possibly appreciate the great significance of their work. Often a complainant does not object so much to the rejection of his Letter as he does to the publication of someone else's which he thinks is inferior (and he is sometimes right). Obviously, when we reject or refer to another journal about fifty percent of the submitted manuscripts, it is not surprising if about half of our contributors are disgruntled. We believe, however, that much of the basis for these complaints is inherent in the nature of a Letters journal. The high rejection rate gives these journals an undeserved prestige value. Acceptance of a Letter is somewhat similar to selection to an Academy: For every one selected there are always a few equally qualified candidates who lost by a couple of votes.

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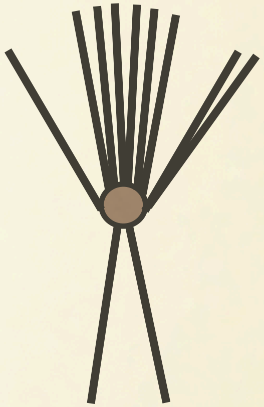
S. A. Goudsmit

Kinds of Letters

http://prl.aps.org/50years/milestones

Kinds of Letters



Discovery:
Christenson, Cronin, Fitch, Turlay:
CP violation in K^0 mesons

http://prl.aps.org/50years/milestones

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EVIDENCE FOR THE 2π DECAY OF THE K_2^0 MESON*†

J. H. Christenson, J. W. Cronin,‡ V. L. Fitch,‡ and R. Turlay§
Princeton University, Princeton, New Jersey
(Received 10 July 1964)

This Letter reports the results of experimental studies designed to search for the 2π decay of the K_2^0 meson. Several previous experiments have served[1,2] to set an upper limit of 1/300 for the fraction of K_2^0's which decay into two charged pions. The present experiment, using spark chamber techniques, proposed to extend this limit.

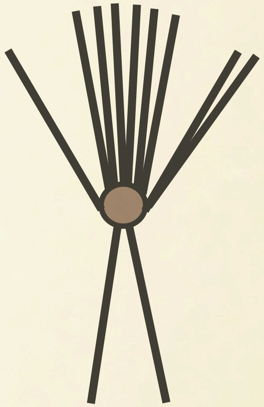
In this measurement, K_2^0 mesons were produced at the Brookhaven AGS in an internal Be target bombarded by 30-BeV protons. A neutral beam was defined at 30 degrees relative to the circulating protons by a $1\frac{1}{2}$-in.$\times 1\frac{1}{2}$-in.$\times$48-in. collimator at an average distance of 14.5 ft. from the internal target. This collimator was followed by a sweeping magnet of 512 kG-in. at ~20 ft. and a 6-in.$\times$6-in.$\times$48-in. collimator at 55 ft. A $1\frac{1}{2}$-in. thickness of Pb was placed in front of the first collimator to attenuate the gamma rays in the beam.

The experimental layout is shown in relation to the beam in Fig. 1. The detector for the decay products consisted of two spectrometers each composed of two spark chambers for track delineation separated by a magnetic field of 178 kG-in.

The analysis program computed the vector momentum of each charged particle observed in the decay and the invariant mass, m^*, assuming each charged particle had the mass of the charged pion. In this detector the K_{e3} decay leads to a distribution in m^* ranging from 280 MeV to ~536 MeV; the $K_{\mu 3}$, from 280 to ~516; and the $K_{\pi 3}$, from 280 to 363 MeV. We emphasize that m^* equal to the K^0 mass is not a preferred result when the three-body decays are analyzed in this way. In addition, the vector sum of the two momenta and the angle, θ, between it and the direction of the K_2^0 beam were determined. This angle should be zero for two-body decay and is, in general, different from zero for three-body decays.

An important calibration of the apparatus and data reduction system was afforded by observing the decays of K_1^0 mesons produced by coherent regeneration in 43 gm/cm^2 of tungsten. Since the K_1^0 mesons produced by coherent regeneration have the same momentum and direction as the K_2^0 beam, the K_1^0 decay simulates the direct decay of the K_2^0 into two pions. The regenerator

Kinds of Letters



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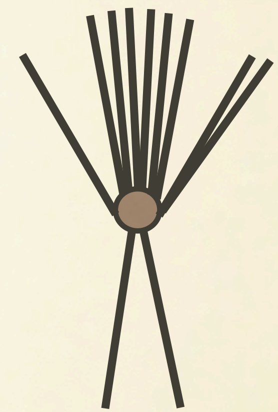

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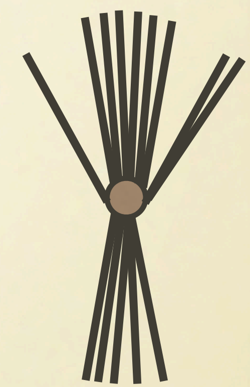


Important advances within field:
Steven Weinberg: Electroweak gauge theory
Gross & Wilczek; Politzer: Asymptotic Freedom

http://prl.aps.org/50years/milestones

skip

[11] In obtaining the expression (11) the mass difference between the charged and neutral has been ignored.

[12] M. Ademollo and R. Gatto, Nuovo Cimento 44A, 282 (1966); see also J. Pasupathy and R. E. Marshak, Phys. Rev. Letters 17, 888 (1966).

[13] The predicted ratio [eq. (12)] from the current algebra is slightly larger than that (0.23%) obtained from the ρ-dominance model of Ref. 2. This seems to be true also in the other case of the ratio $\Gamma(\eta \to \pi^+\pi^-\gamma)/\Gamma(\gamma\gamma)$ calculated in Refs. 12 and 14.

[14] L. M. Brown and P. Singer, Phys. Rev. Letters 8, 460 (1962).

A MODEL OF LEPTONS*

Steven Weinberg†
Laboratory for Nuclear Science and Physics Department,
Massachusetts Institute of Technology, Cambridge, Massachusetts

(Received 17 October 1967)

Leptons interact only with photons, and with the intermediate bosons that presumably mediate weak interactions. What could be more natural than to unite[1] these spin-one bosons into a multiplet of gauge fields? Standing in the way of this synthesis are the obvious differences in the masses of the photon and intermediate meson, and in their couplings. We might hope to understand these differences by imagining that the symmetries relating the weak and electromagnetic interactions are exact symmetries of the Lagrangian but are broken by the vacuum. However, this raises the specter of unwanted massless Goldstone bosons.[2] This note will describe a model in which the

and on a right-handed singlet

$$R \equiv [\tfrac{1}{2}(1-\gamma_5)]e. \qquad (2)$$

The largest group that leaves invariant the kinematic terms $-\bar{L}\gamma^\mu\partial_\mu L - \bar{R}\gamma^\mu\partial_\mu R$ of the Lagrangian consists of the electronic isospin $\vec{T}$ acting on L, plus the numbers N_L, N_R of left- and right-handed electron-type leptons. As far as we know, two of these symmetries are entirely unbroken: the charge $Q = T_3 - N_R - \frac{1}{2}N_L$, and the electron number $N = N_R + N_L$. But the gauge field corresponding to an unbroken symmetry will have zero mass,[4] and there is no

Ultraviolet Behavior of Non-Abelian Gauge Theories*

David J. Gross† and Frank Wilczek
Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540
(Received 27 April 1973)

It is shown that a wide class of non-Abelian gauge theories have, up to calculable logarithmic corrections, free-field-theory asymptotic behavior. It is suggested that Bjorken scaling may be obtained from strong-interaction dynamics based on non-Abelian gauge symmetry.

Non-Abelian gauge theories have received much attention recently as a means of constructing unified and renormalizable theories of the weak and electromagnetic interactions.[1] In this note we report on an investigation of the ultraviolet (UV) asymptotic behavior of such theories. We have found that they possess the remarkable feature, perhaps unique among renormalizable theories, of asymptotically approaching free-field theory. Such asymptotically free theories will exhibit, for matrix elements of currents between on-mass-shell states, Bjorken scaling. We therefore suggest that one should look to a non-Abelian gauge theory of the strong interactions to provide the explanation for Bjorken scaling, which has so far eluded field-theoretic understanding.

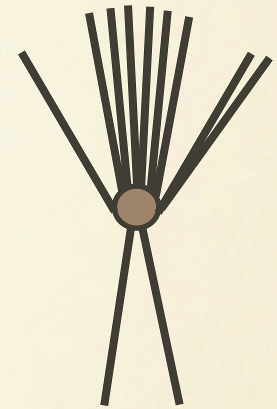
The UV behavior of renormalizable field theories can be discussed using the renormalization-group equations,[2,3] which for a theory involving one field (say $g\varphi^4$) are

$$[m\partial/\partial m + \beta(g)\,\partial/\partial g - n\gamma(g)]\,\Gamma_{\text{asy}}^{(n)}(g; P_1, \dots, P_n) = 0. \tag{1}$$

$\Gamma_{\text{asy}}^{(n)}$ is the asymptotic part of the one-particle-irreducible renormalized n-particle Green's function, $\beta(g)$ and $\gamma(g)$ are finite functions of the renormalized coupling constant g, and m is either the renormalized mass or, in the case of massless particles, the Euclidean momentum at which the theory is renormalized.[4] If we set $P_i = \lambda q_i^0$, where q_i^0 are (nonexceptional) Euclidean momenta, then (1) determines the λ dependence of $\Gamma^{(n)}$:

$$\Gamma^{(n)}(g; P_i) = \lambda^D \Gamma^{(n)}(\bar{g}(g, t); q_i) \exp\left[-n\int_0^t \gamma(\bar{g}(g, t'))\,dt'\right], \tag{2}$$

Kinds of Letters



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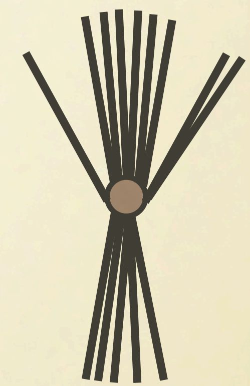
CP violation in K^0 mesons



Important advances within field:
Steven Weinberg: Electroweak gauge theory
Gross & Wilczek; Politzer: Asymptotic Freedom

http://prl.aps.org/50years/milestones

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Kinds of Letters

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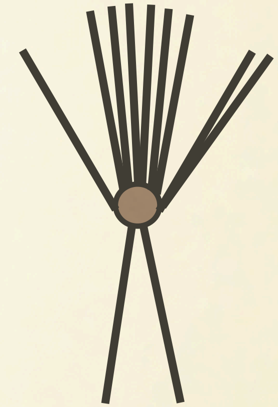

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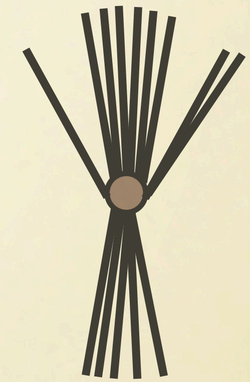
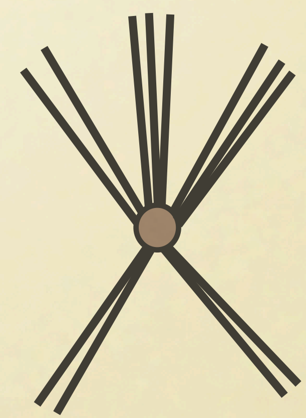


Cross-field fertilization:
Alpher, Bethe, Gamow: Nucleosynthesis
Téramond & Brodsky: Holographic QCD



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Hadronic Spectrum of a Holographic Dual of QCD

Guy F. de Téramond[1] and Stanley J. Brodsky[2]
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(Received 18 January 2005; published 23 May 2005)

We compute the spectrum of light hadrons in a holographic dual of QCD defined on $AdS_5 \times S^5$ which has conformal behavior at short distances and confinement at large interquark separation. Specific hadrons are identified by the correspondence of string modes with the dimension of the interpolating operator of the hadron's valence Fock state. Higher orbital excitations are matched quanta to quanta with fluctuations about the AdS background. Since only one parameter, the QCD scale Λ_{QCD}, is used, the agreement with the pattern of physical states is remarkable. In particular, the ratio of delta to nucleon trajectories is determined by the ratio of zeros of Bessel functions.

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The correspondence [1] between ten-dimensional string theory defined on anti–de Sitter ($AdS_5 \times S^5$) and Yang-Mills theories at its conformal 3 + 1 space-time boundary [2] has led to important insights into the properties of QCD at strong coupling. As shown by Polchinski and Strassler [3], one can give a nonperturbative derivation of dimensional counting rules [4] for the leading power-law falloff of hard exclusive glueball scattering in gauge theories with a mass gap dual to supergravity in warped space-times. The resulting theories have the hard behavior expected from QCD at short distances, rather than the soft behavior characteristic of string theory. Another important application is the description of deep inelastic scattering structure functions at small x [5]. One can also derive the falloff of hadronic light-front wave functions in QCD at large transverse momentum by matching their short-distance properties to the behavior of the string solutions in the large-r counting rules for exclusive processes can be understood if QCD resembles a strongly coupled conformal theory at moderate but not asymptotic momentum transfer. QCD is also a confining gauge theory in the infrared with a mass gap Λ_{QCD} and a well-defined spectrum of color-singlet hadronic states.

The isomorphism of the group $SO(2,4)$ of conformal QCD in the limit of massless quarks and vanishing β function with the isometries of AdS space, $x^\mu \to \lambda x^\mu$, $r \to r/\lambda$, maps scale transformations into the holographic coordinate r: the string mode in r is the extension of the hadron wave function into the fifth dimension. Different values of r correspond to different energy scales at which the hadron is examined, and determines the scale of the invariant separation between quarks $x_\mu x^\mu \to \lambda^2 x_\mu x^\mu$. In particular, the $r \to \infty$ boundary corresponds to the $Q \to \infty$, zero separation limit. Conversely, color confinement im-

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“Our results suggest that basic features of the QCD hadron spectrum can be understood in terms of a higher dimensional dual theory.”

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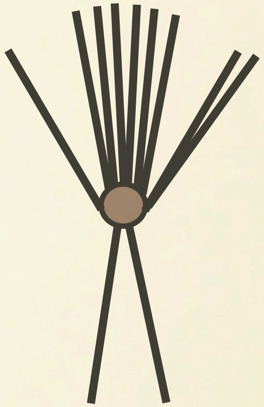
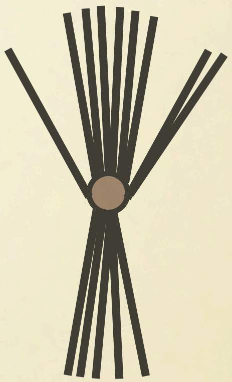
Kinds of Letters

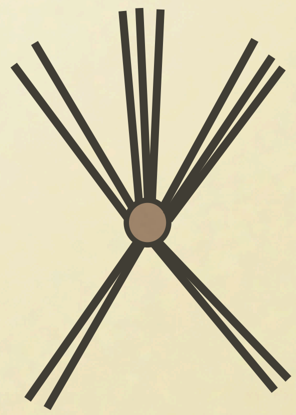
Discovery:
Christenson, Cronin, Fitch, Turlay:
CP violation in K^0 mesons



Important advances within field:
Steven Weinberg: Electroweak gauge theory
Gross & Wilczek; Politzer: Asymptotic Freedom



Cross-field fertilization:
Alpher, Bethe, Gamow: Nucleosynthesis
Téramond & Brodsky: Holographic QCD



http://prl.aps.org/50years/milestones

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Technology

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Technology

- 1958: Typewriter Composition

skip

VOLUME 1, NUMBER 1 PHYSICAL REVIEW LETTERS JULY 1, 1958

As the Managing Editor has noted, the rapid publication schedule of Physical Review Letters reduces to a minimum the time available for editing. In the past, it has been possible to make in galley minor changes of errors noticed either by the author or in the editorial offices, the latter frequently after consultation with the author. With the method of reproduc ... ever, such a luxury is not possible. Material leaves the editorial of ... appear in print. Thus it becomes imperative for authors to exercise ... of manu-scripts. For guidance in this respect, ... lex and

In fact, the method is a sword which cuts both ways, as t ... symbols therefore less flexible instrument than a Monotype machine. ... me and not in that font can be inserted, but only by means of processes ... triction more or less unsatisfactory. Developments are in progress wh ... condi-somewhat in the near future, but for the present we are boun ... al sub-tions are imposed: (1) Numerical subscripts and superscript ... scripts scripts and superscripts will already look a bit awkward, and ... sional) and superscripts should be avoided. (2) Boldface characters ... phabets vector quantities, as they will be denoted by arrows; boldface ... other than Latin and Greek should be avoided.

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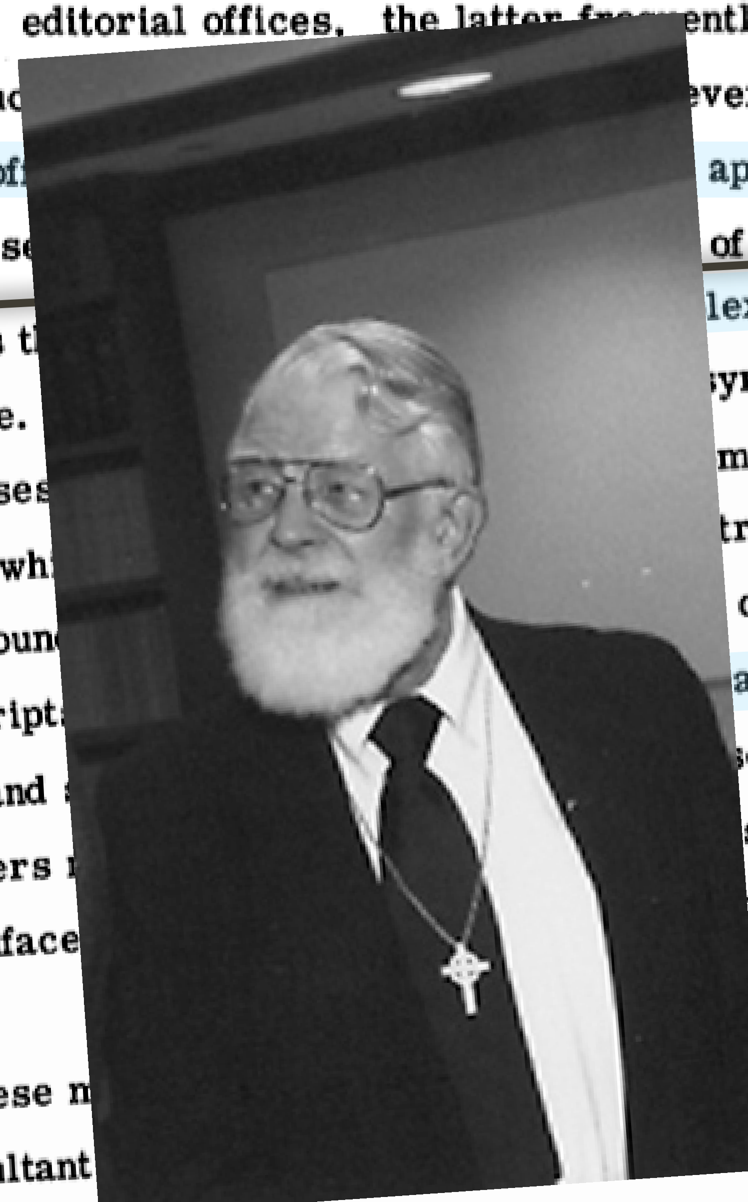

George L. Trigg

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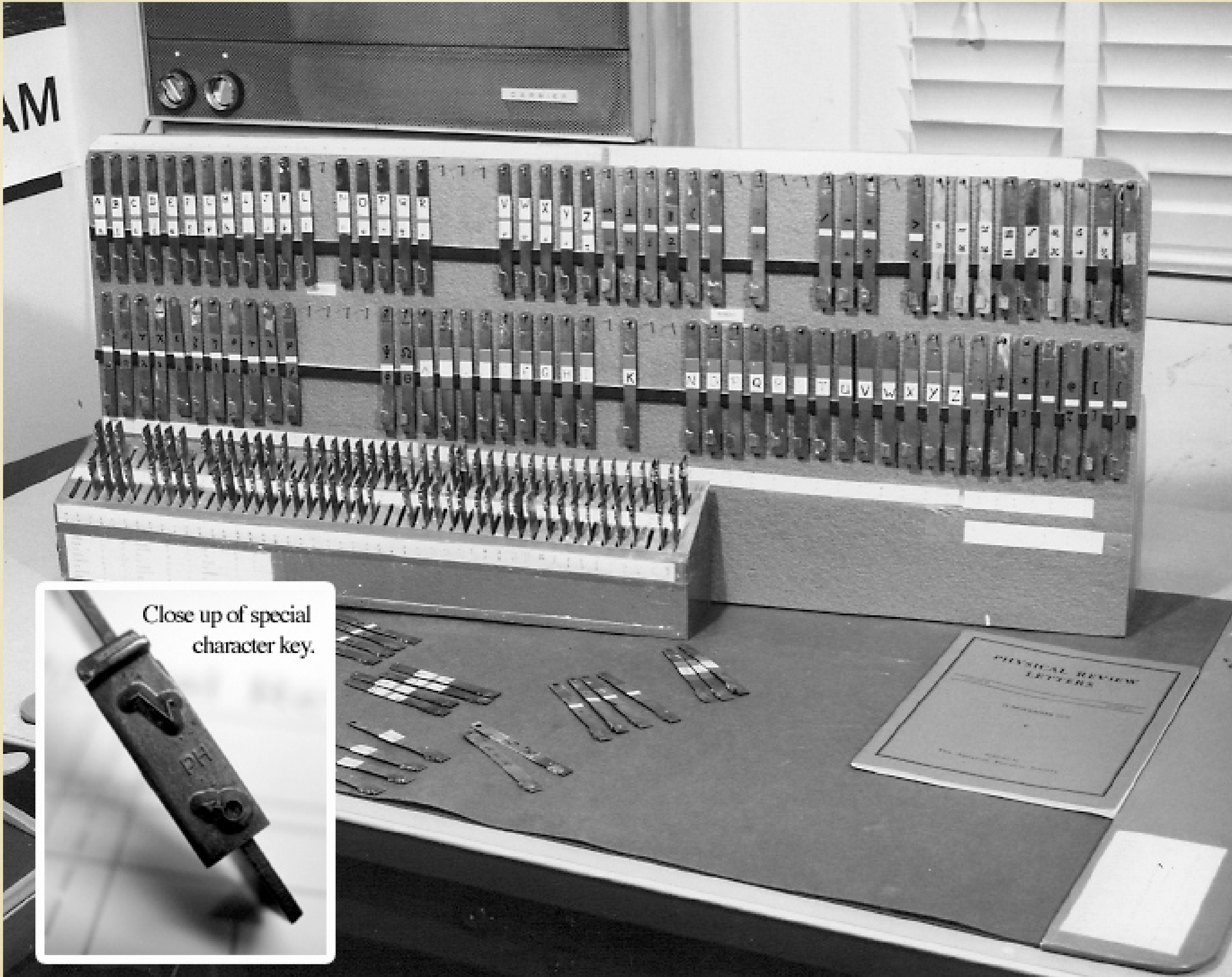
In fact, the method is a sword which cuts both ways, as the typewriter is a much less complex and therefore less flexible instrument than a Monotype machine. Essentially, it has only one font; symbols not in that font can be inserted, but only by means of processes which are more or less cumbersome and more or less unsatisfactory. Developments are in progress which are expected to loosen this restriction somewhat in the near future, but for the present we are bound by it. Specifically, the following conditions are imposed: (1) Numerical subscripts and superscripts will cause no difficulty, but literal subscripts and superscripts will already look a bit awkward, and subscripts and superscripts of subscripts and superscripts should be avoided. (2) Boldface characters must be reserved for (three-dimensional) vector quantities, as they will be denoted by arrows; boldface italic will not be available. (3) Alphabets other than Latin and Greek should be avoided.

Authors who fail to use judgment and/or ingenuity in these matters *before* submitting a paper may be required to do so *after* acceptance of the paper, with resultant delay.

George L. Trigg


IBM



Close up of special character key.

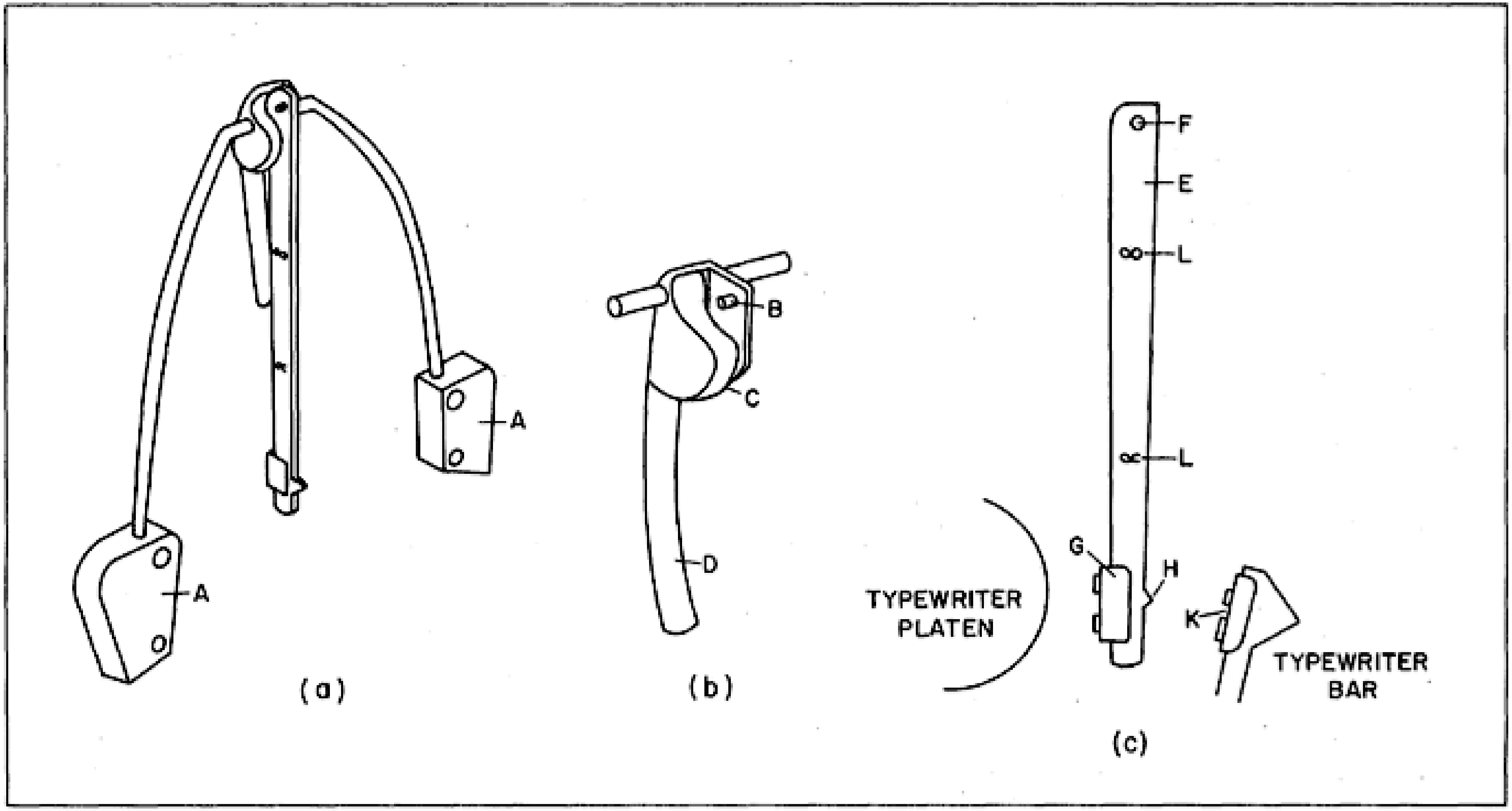


FIG. 2. Diagram of typewriter attachment showing (a) complete assembly with type arm in position, (b) detail of bracket, and (c) detail of arm. A - plates for attaching the assembly to the typewriter without altering the latter; B - pin on which the type arm hangs; C - slot into which the arm slips, providing horizontal alignment; D - spring to hold arm slightly out of the way of the typewriter ribbon; E - thin metal strip; F - hole to engage pin A; G - typewriter bar with special symbols, soldered on to E; H - projection on metal strip such that it is struck by a regular typewriter bar at K, in between the upper and lower case symbols, so as not to damage the regular typewriter characters; L - upper and lower case

Technology

- 1958: Typewriter Composition

skip

Technology

- 1958: Typewriter Composition (proper subscripts 1969)

skip

Technology

- 1958: Typewriter Composition (proper subscripts 1969)

30 June 1969

al energy,

$$\exp(x_i - x_j)\frac{\Gamma(0.55, x_i)}{\Gamma(0.55, x_j)}, \qquad (7)$$

$^5/(1230R_i)$. Figure 1(a)
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m (CNO) nuclei. Clearly
pend strongly on energy.
MeV/nucleon the increase is
f $\chi_{He^4 j}$ at 50 MeV/nucleon
column of Table I for other

7 July 1969

he other energy bands are
the conduction and valence
l calculations[9,10] indicate that
the order of 1-3 eV which
e above observations.
T_1 we can obtain directly the
$g_c + g_v) \simeq 35$, where m_r^* is
e mass of the valence and
en by $1/m_r^* = 1/m_c^* + 1/m_v^*$
and g_c are the $\langle 100 \rangle$ band-

Technology

- 1958: Typewriter Composition (proper subscripts 1969)

skip

Technology

- 1958: Typewriter Composition (proper subscripts 1969)
- 1984: Computer-controlled Photo Composition

skip

EDITORIAL

New Typography—and a New Production Method

The formation of *Physical Review Letters* was an innovation. Sam Goudsmit not only was aware of that; he also rather took pride in it, especially when it turned out to be a successful innovation. It was his thought that the journal could and should continue to be innovative, to be willing to try new developments in publishing. Consequently, when the decision was made for The American Physical Society to purchase a computer system for the purpose of managing the information demands of the editorial office, Sam, aware of early developments in computer-controlled photocomposition, saw to it that the system purchased was one that could easily be adapted to that purpose as well. The original idea was that the composition of *Physical Review Letters*, a small journal, could be a parasitic operation on the system while it handled the editorial processing.

For a number of reasons, things did not work out quite as originally intended. A discussion of most of those reasons would be out of place here; one crucial one, however, was that our weekly schedule demanded that there be adequate backup for both the computer itself and the typesetting equipment. Acquisition of the necessary hardware took a substantial amount of time. The result was that our older sisters, the *Physical Review* journals, shifted over to computer-controlled composition some time ago, while we continued with the same method that we have used from the start: typewriters, equipped with a special gadget to permit insertion of many of the special symbols that characterize the literature of the sciences. For some time, now, we have been holding our breaths in fear that the machines we have would fail. They

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Thus it is with a combination of pride and relief that we offer herewith the first issue produced by the new method. It is not yet all we would like, even though we have spent several weeks in practice. The most troublesome feature is that the typesetting machines themselves have limitations in terms of the fonts available. Actually, apart from the fact that we now justify both margins rather than having a "ragged right," the ordinary reader will probably notice little difference. We do, however, have slightly more characters per line. On the other hand, it appears that displayed equations may require slightly more space in

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition

27 February 1984

ided by a Yukawa coup-
ge-singlet left-handed
fied with s_L and s_L';
supersymmetry.[13] Thus
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or the singlet ones. For
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ggs fields are needed:
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id Σ—the singlet[13] re-
kawa interaction is giv-

5 March 1984

expected if the pion
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we have corrected for

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by a fast timing out-
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the last one, i.e., the
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cepted only events for
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; 1 μsec after a pion

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition
- 1986: First outgoing email correspondence

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition
- 1986: First outgoing email correspondence
- 1991: First incoming email correspondence

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition
- 1986: First outgoing email correspondence
- 1991: First incoming email correspondence
- 1995: *PRL* goes online

skip

Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition
- 1986: First
- 1991: First
- 1995: *PRL* goes online

skip

Technology

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- 1991: First incoming email correspondence
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skip

Technology

- 1958: Typewriter Composition
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- 1986: First outgoing email correspondence
- 1991: First incoming email correspondence
- 1995: *PRL* goes online
- 1995: First email referrals

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Technology

- 1958: Typewriter Composition
- 1984: Computer-controlled Photo Composition
- 1986: First outgoing email correspondence
- 1991: First incoming email correspondence
- 1995: *PRL* goes online
- 1995: First email referrals
- 2004: All electronic office

skip


Please Note That Pending Area Has Been Reorganized Alphabetically, By Journal.
A - L

$$Q_{\rm ann} = \langle\sigma v\rangle\rho_\chi^2/m_\chi$$
$$\simeq 1.2\times10^{-29}\ {\rm erg/cm^3/s}[\langle\sigma v\rangle/(3\times10^{-26}\ {\rm cm^3/s})]$$
$$\times (n/{\rm cm^{-3}})^{1.62}[m_\chi/(100\ {\rm GeV})]^{-1}.$$

Present and Future

PRL Staff






How PRL Works

Not all authors understand the process

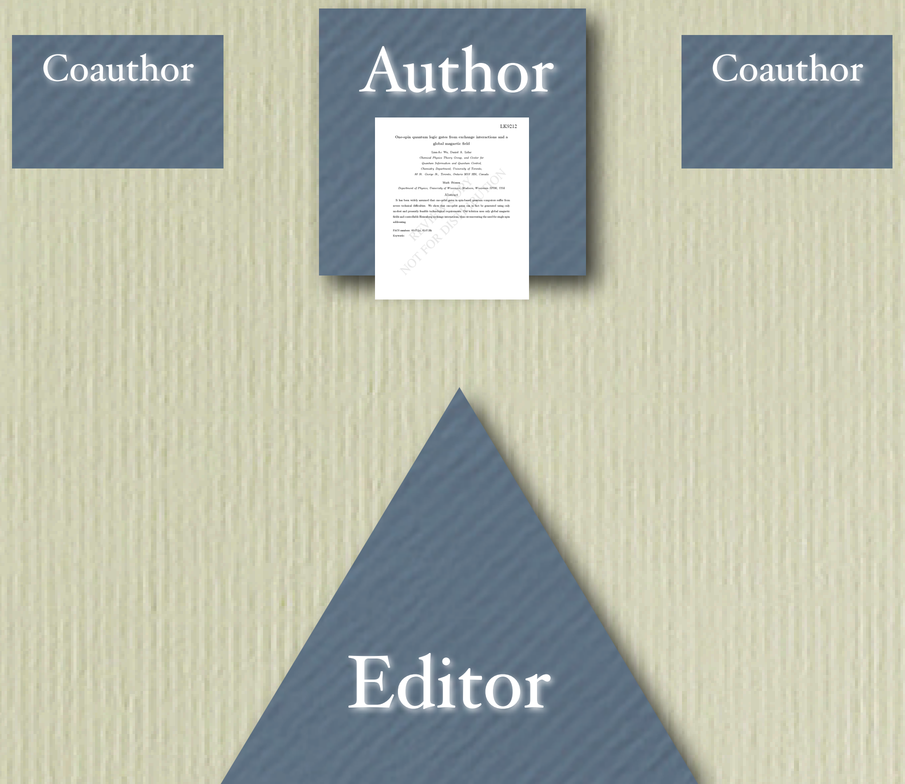
Authors: ***********
Corresponding author: No

Dear Editor,
I don't know what "Corresponding Author" means, so I have filled in "No".

Roles in the Review Process

Roles in the Review Process

Roles in the Review Process



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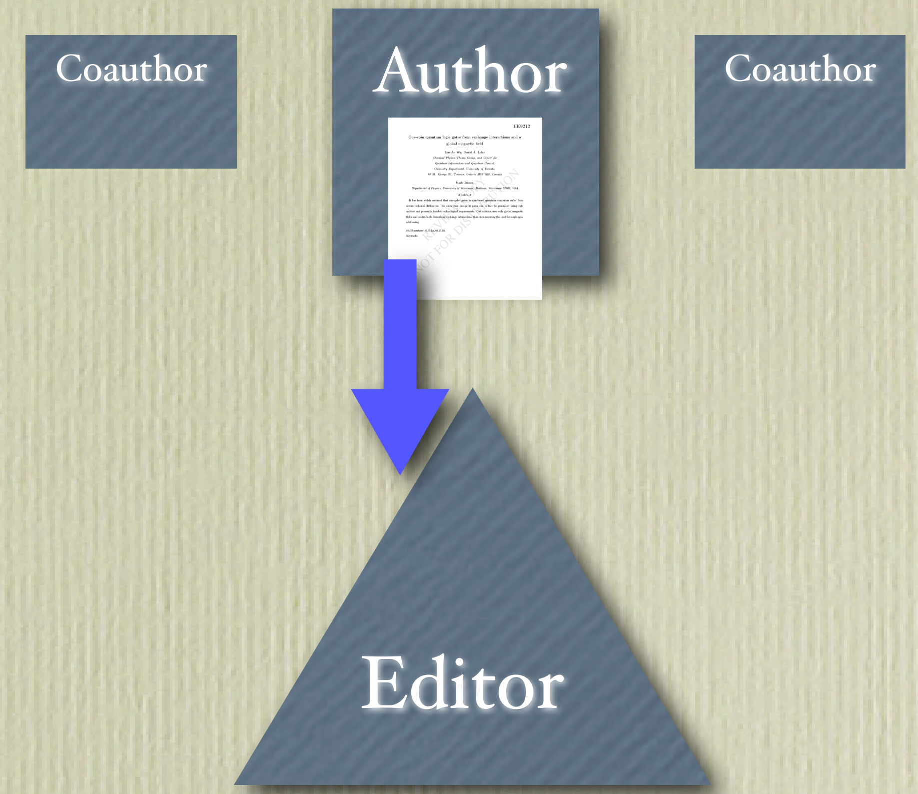

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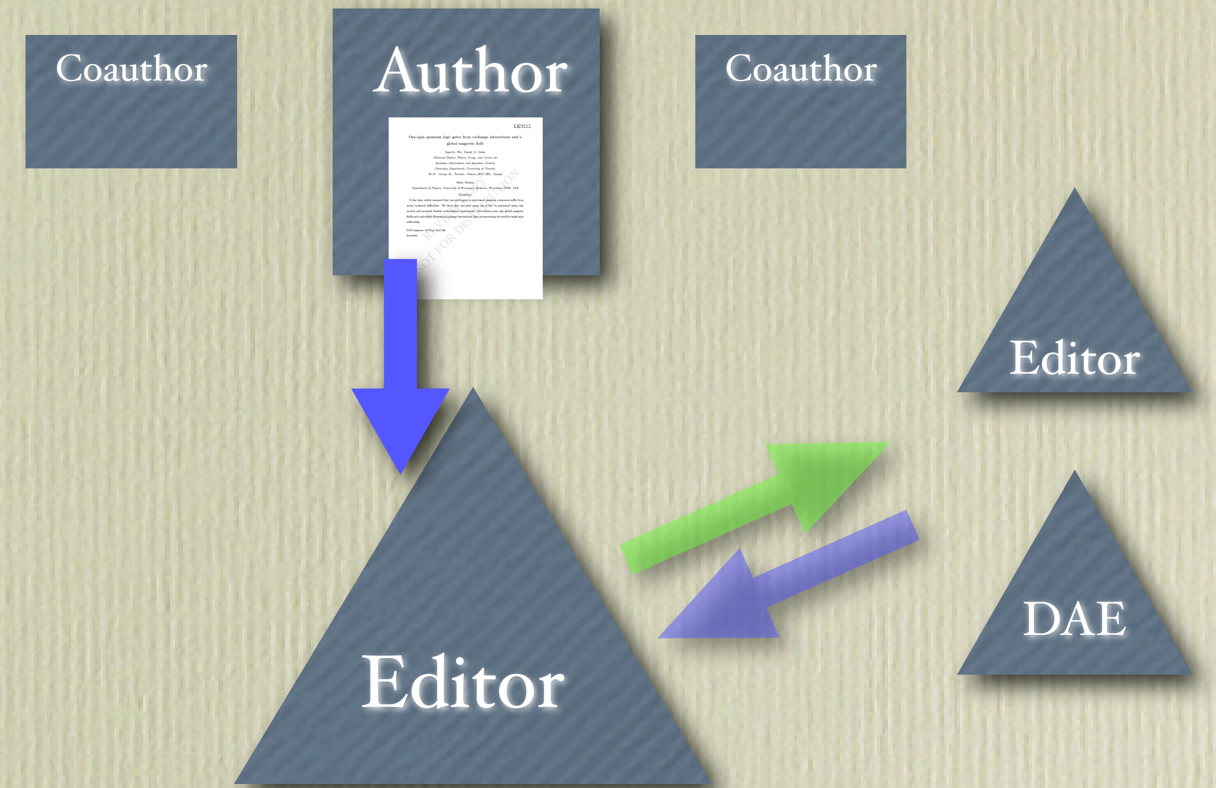

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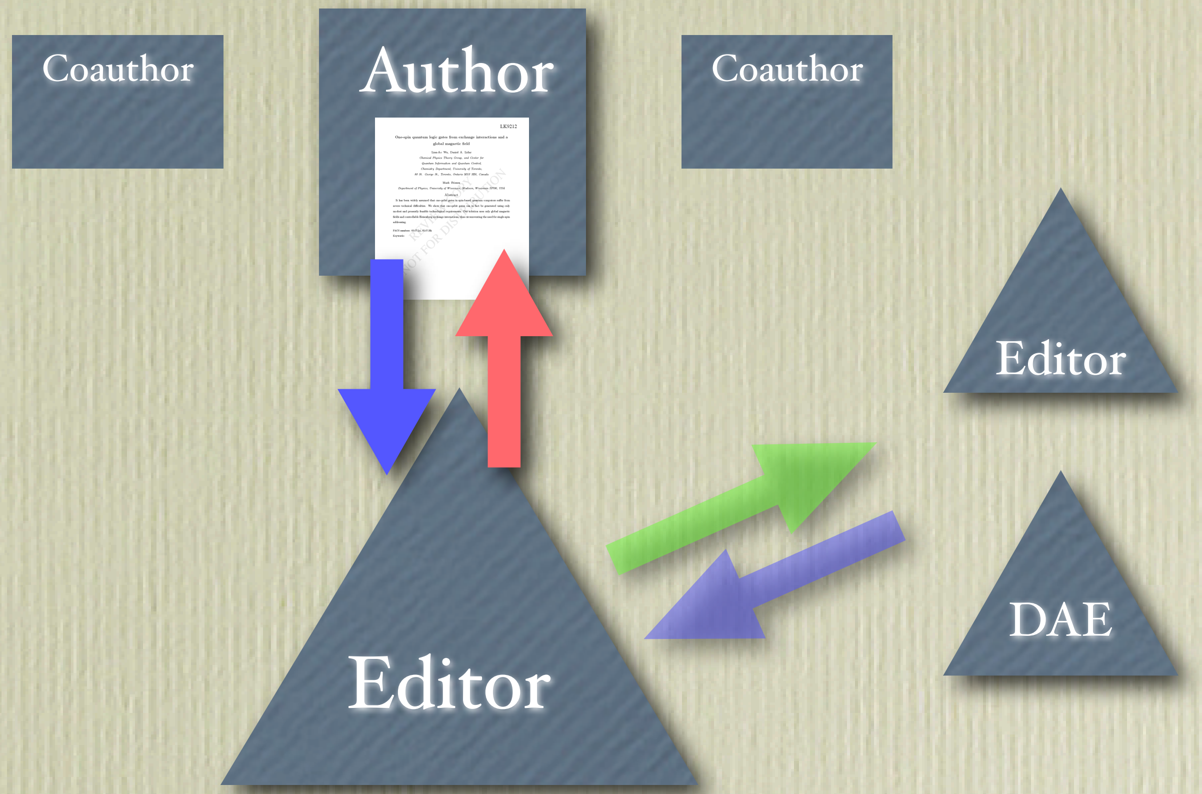

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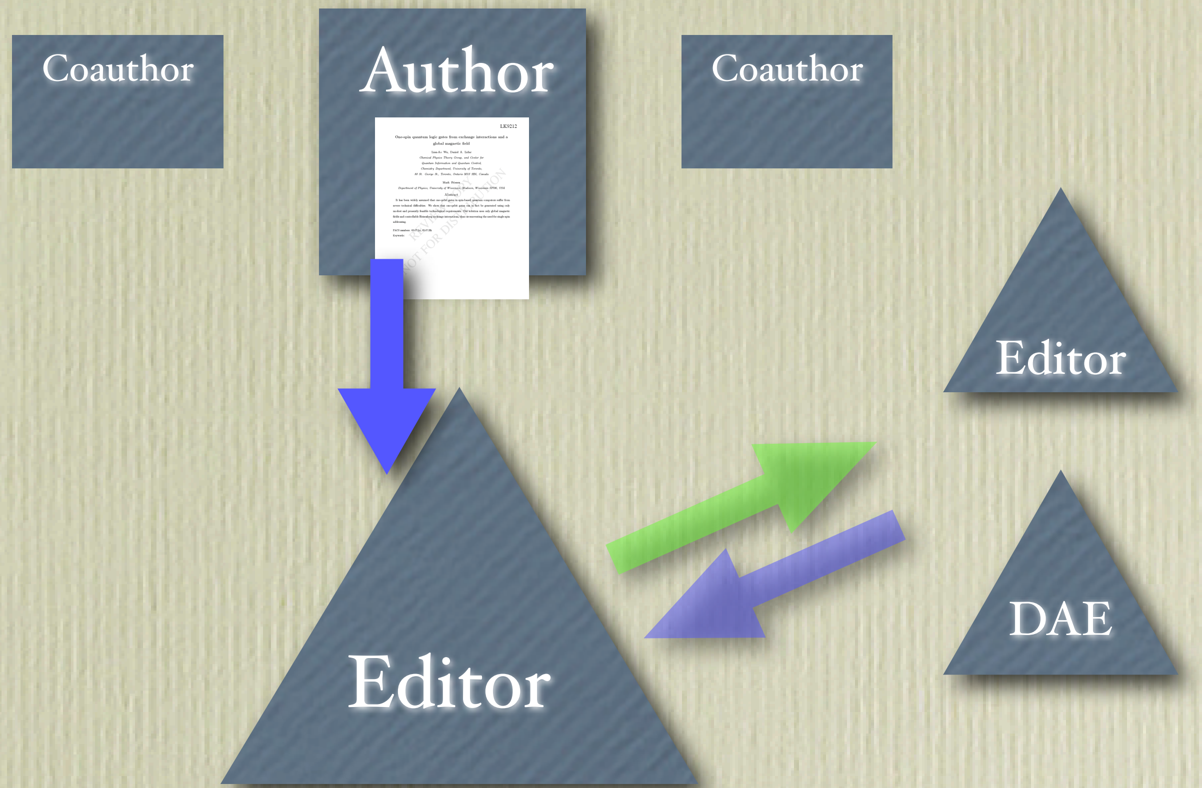

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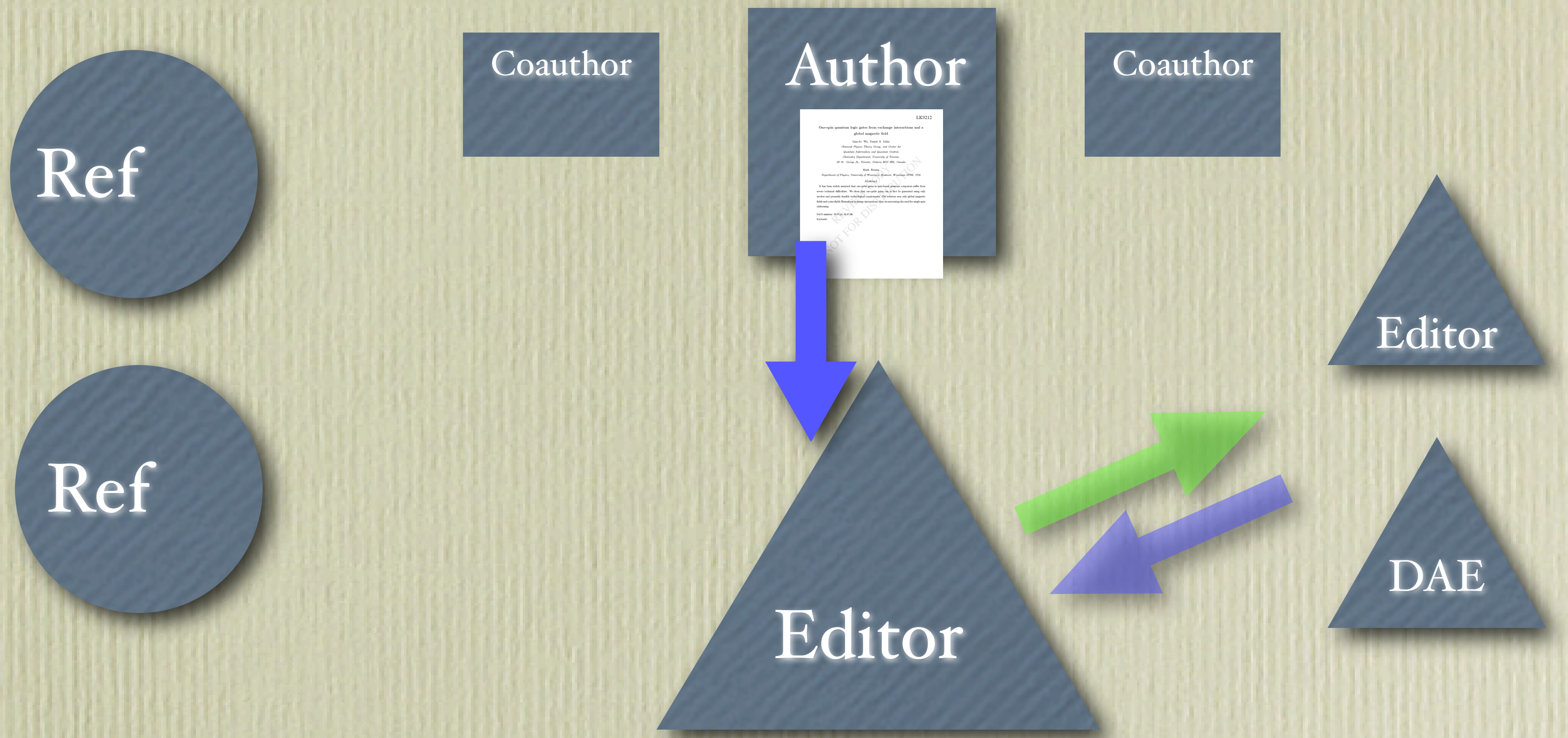

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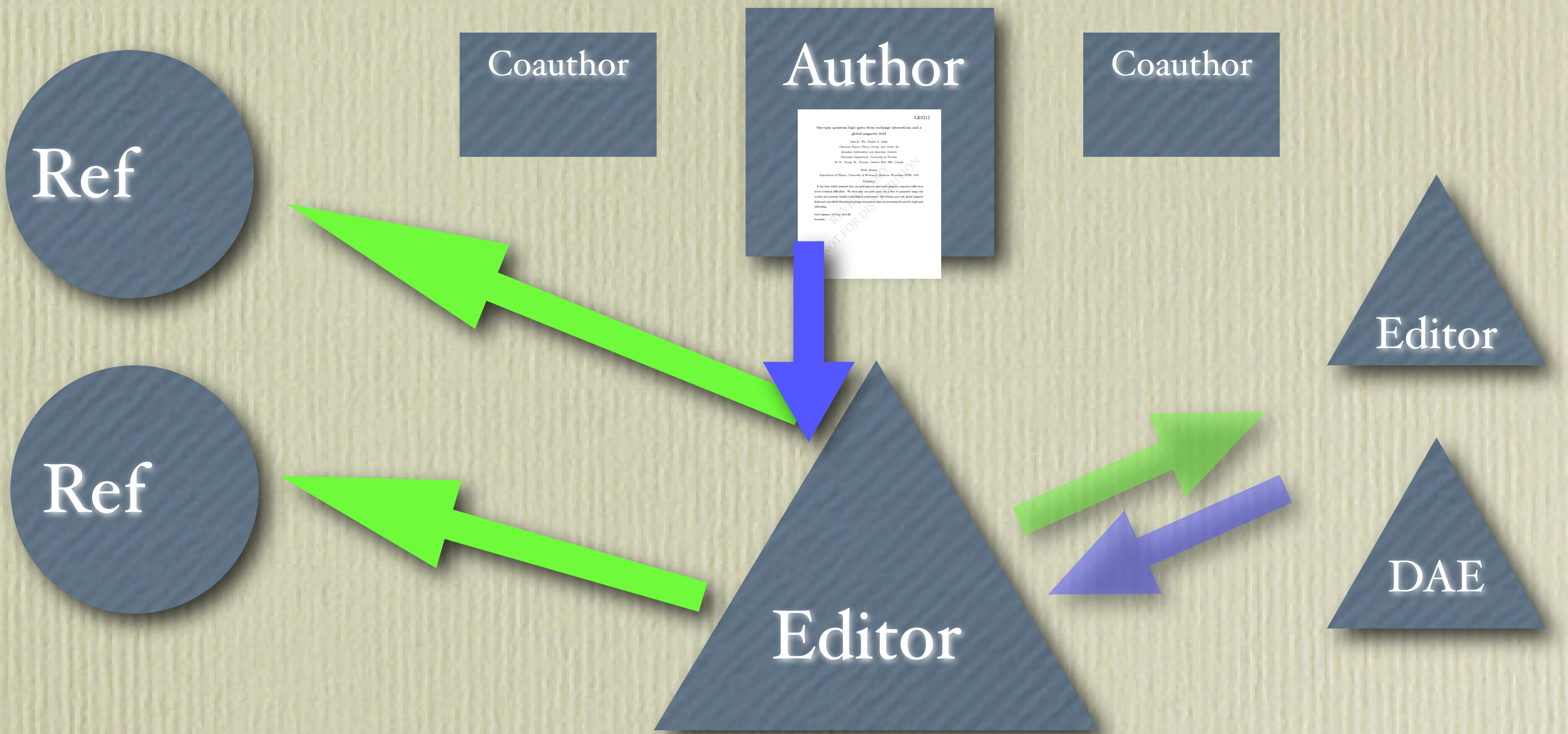

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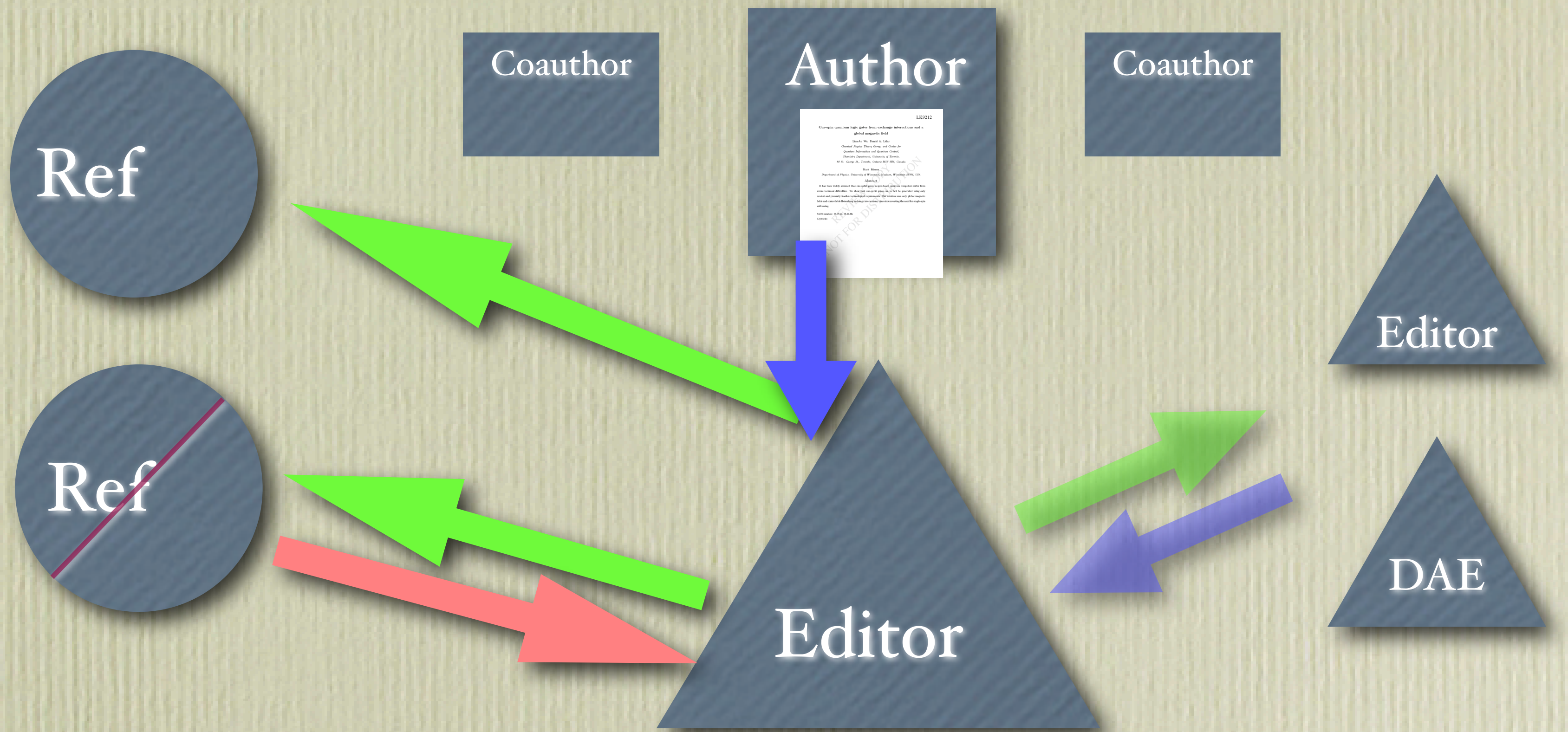

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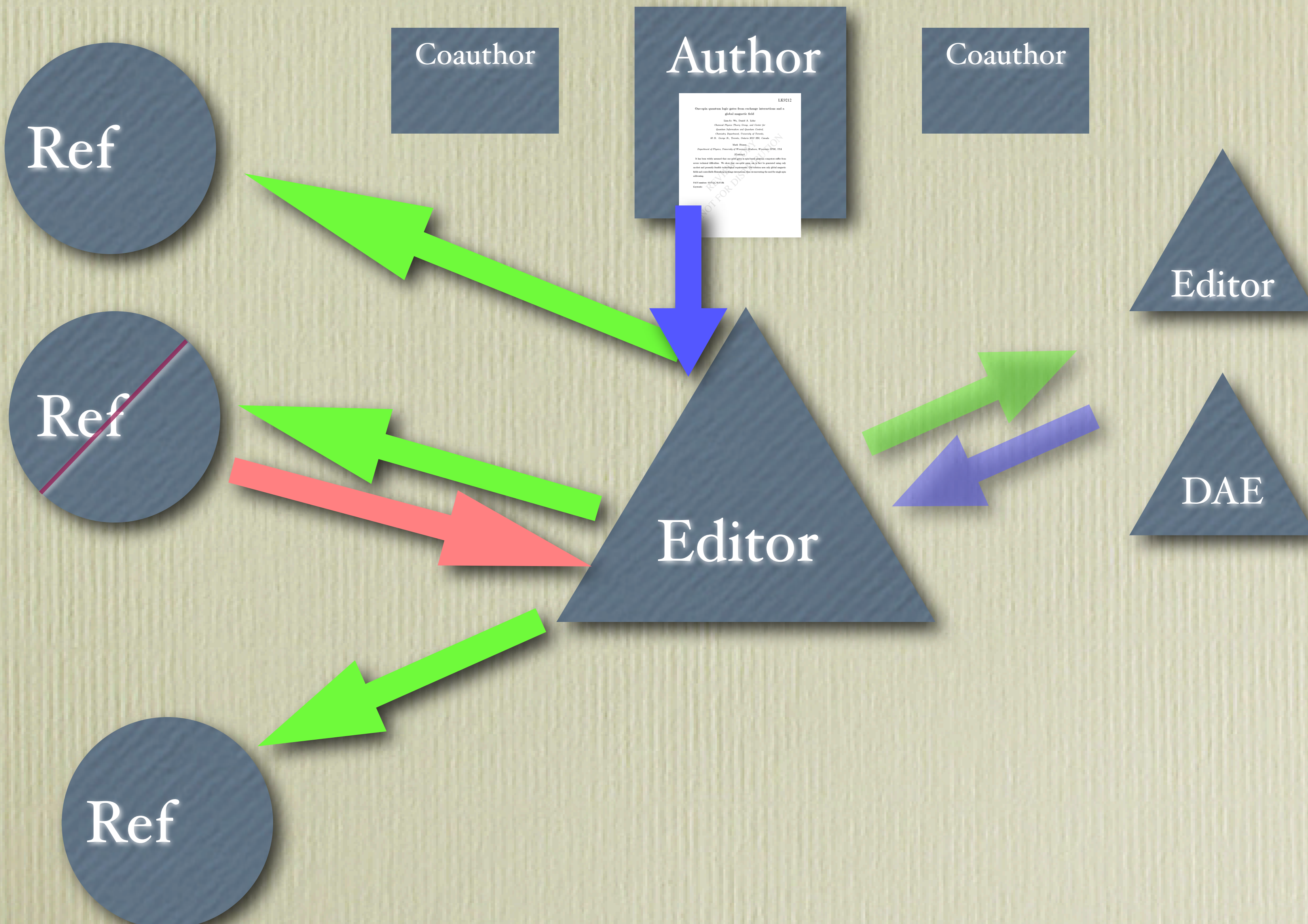

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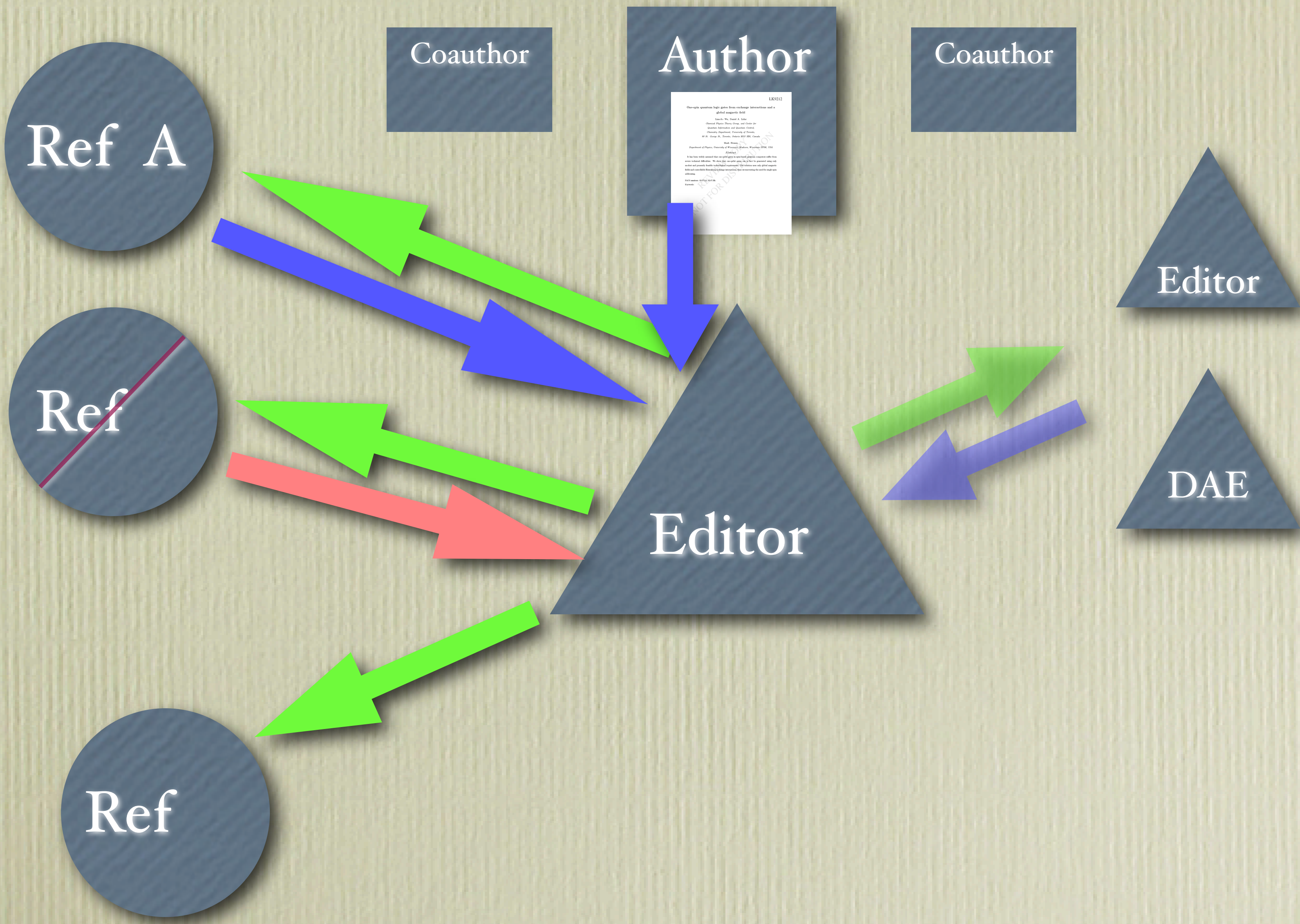

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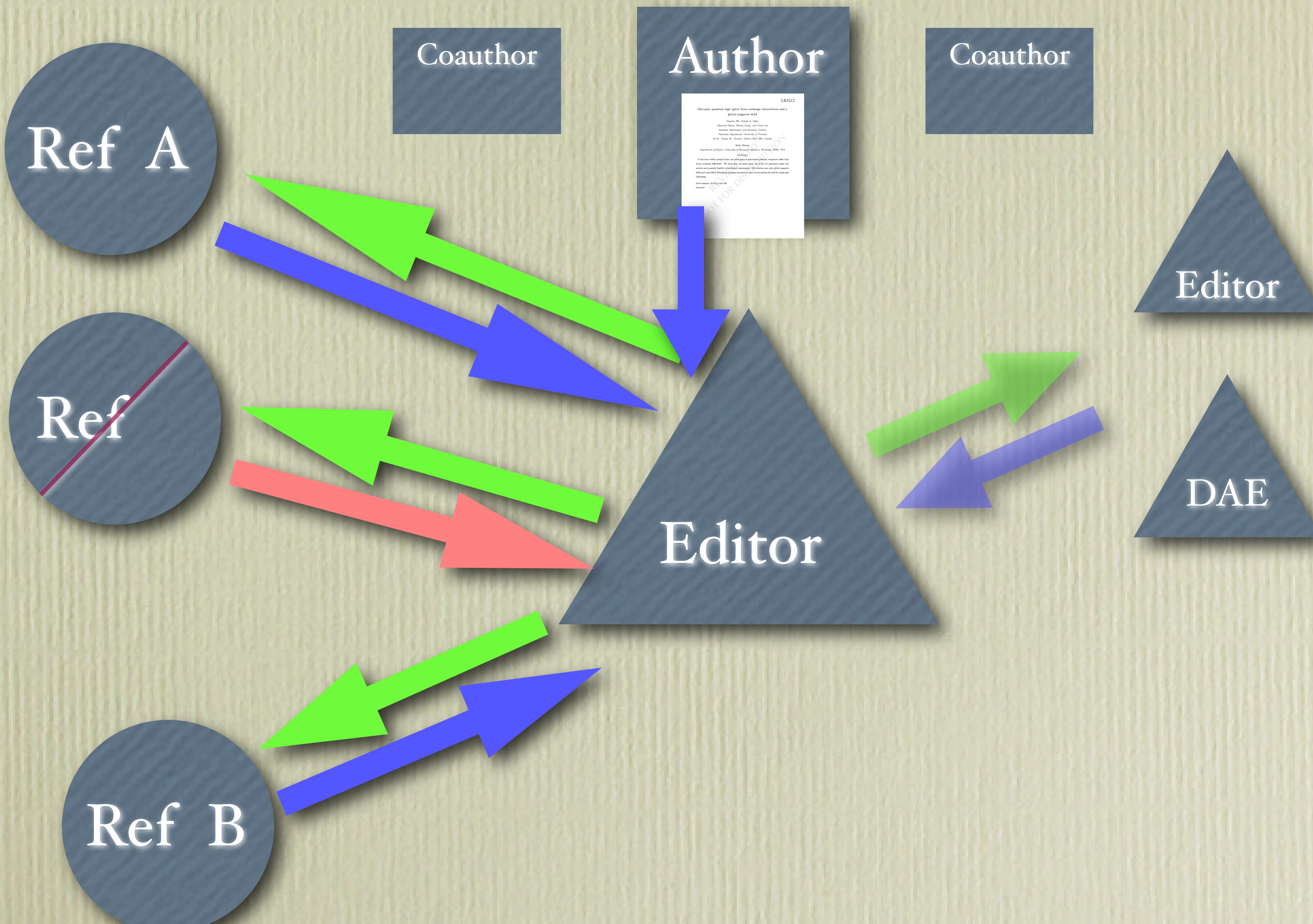

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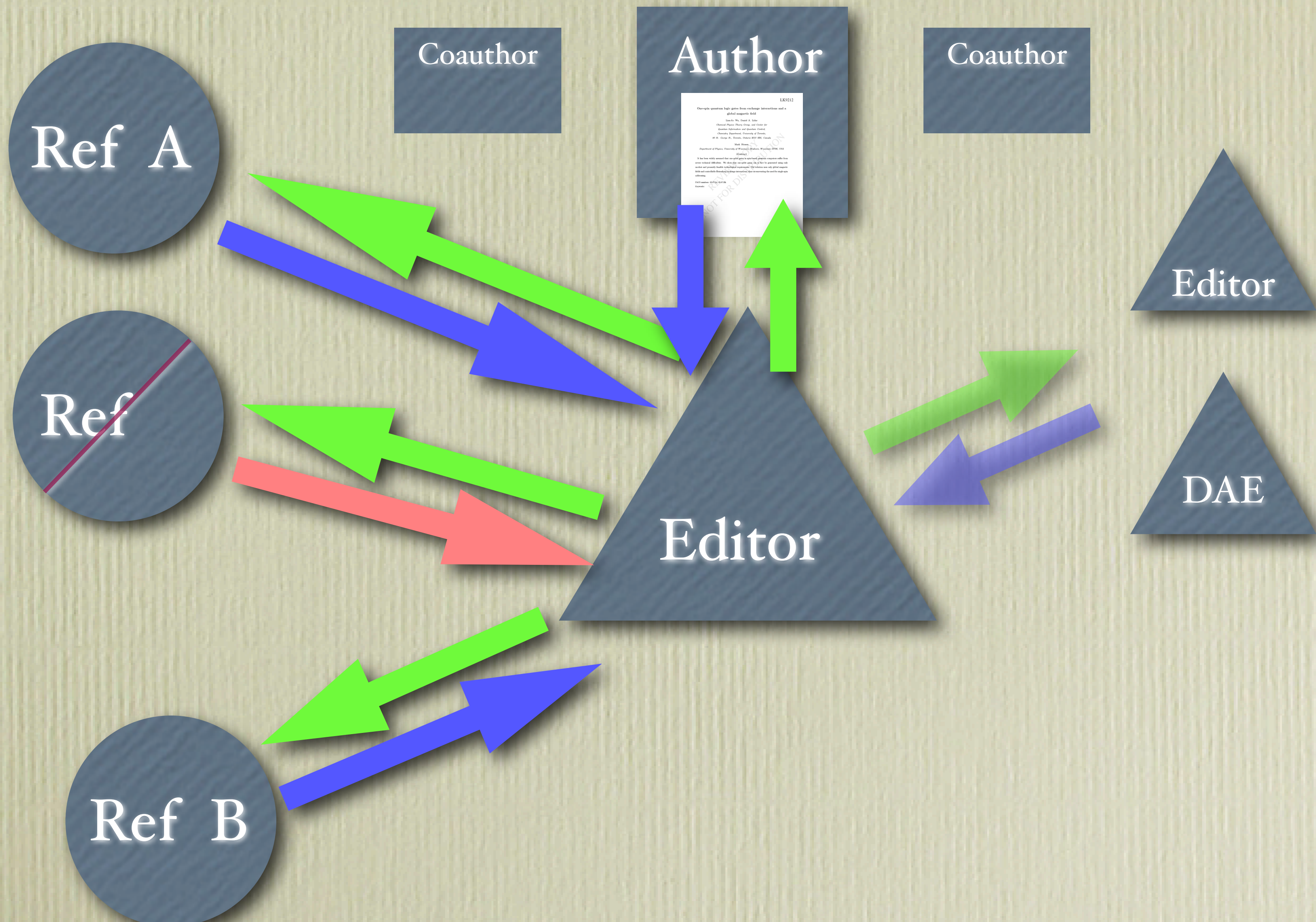

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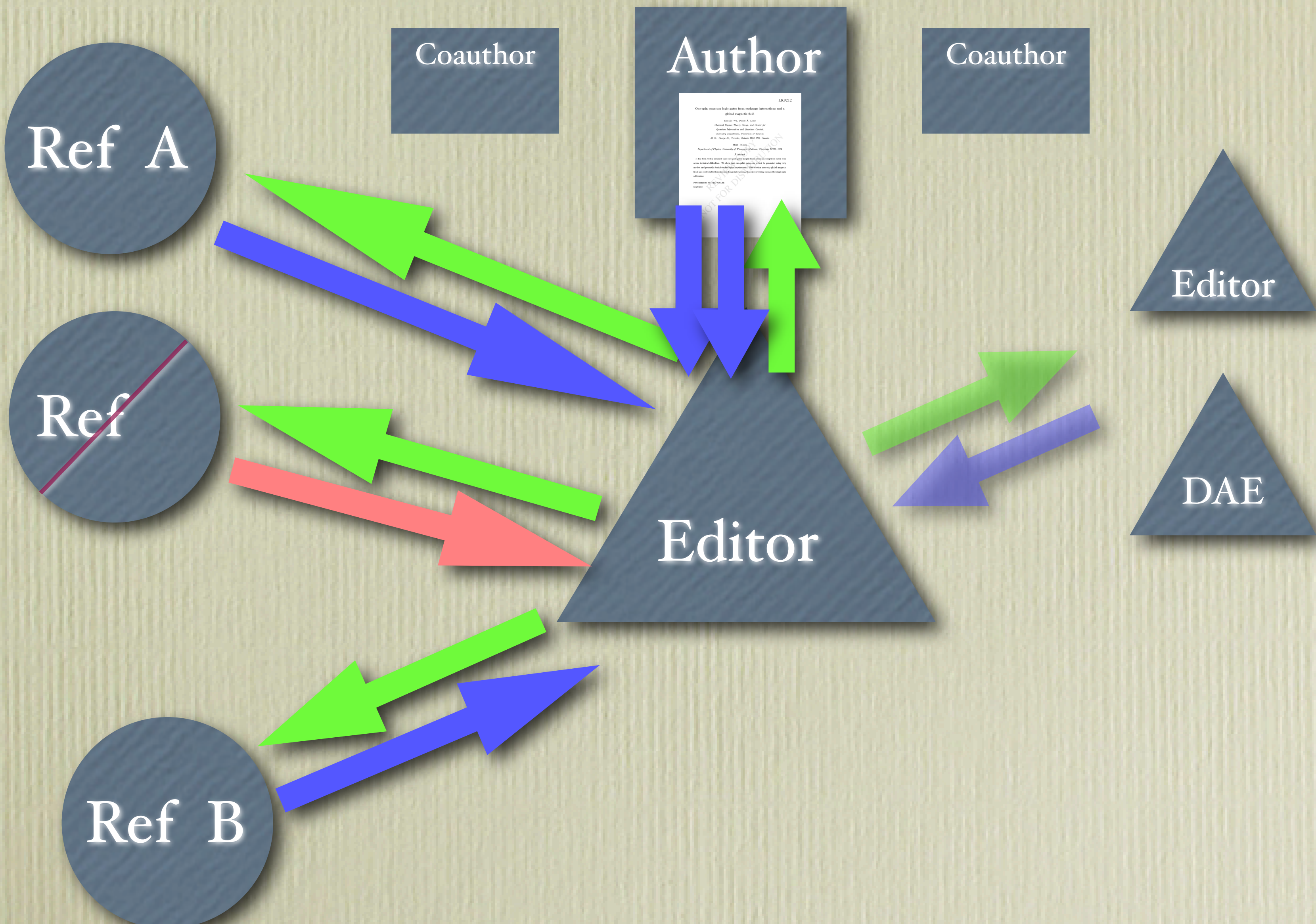

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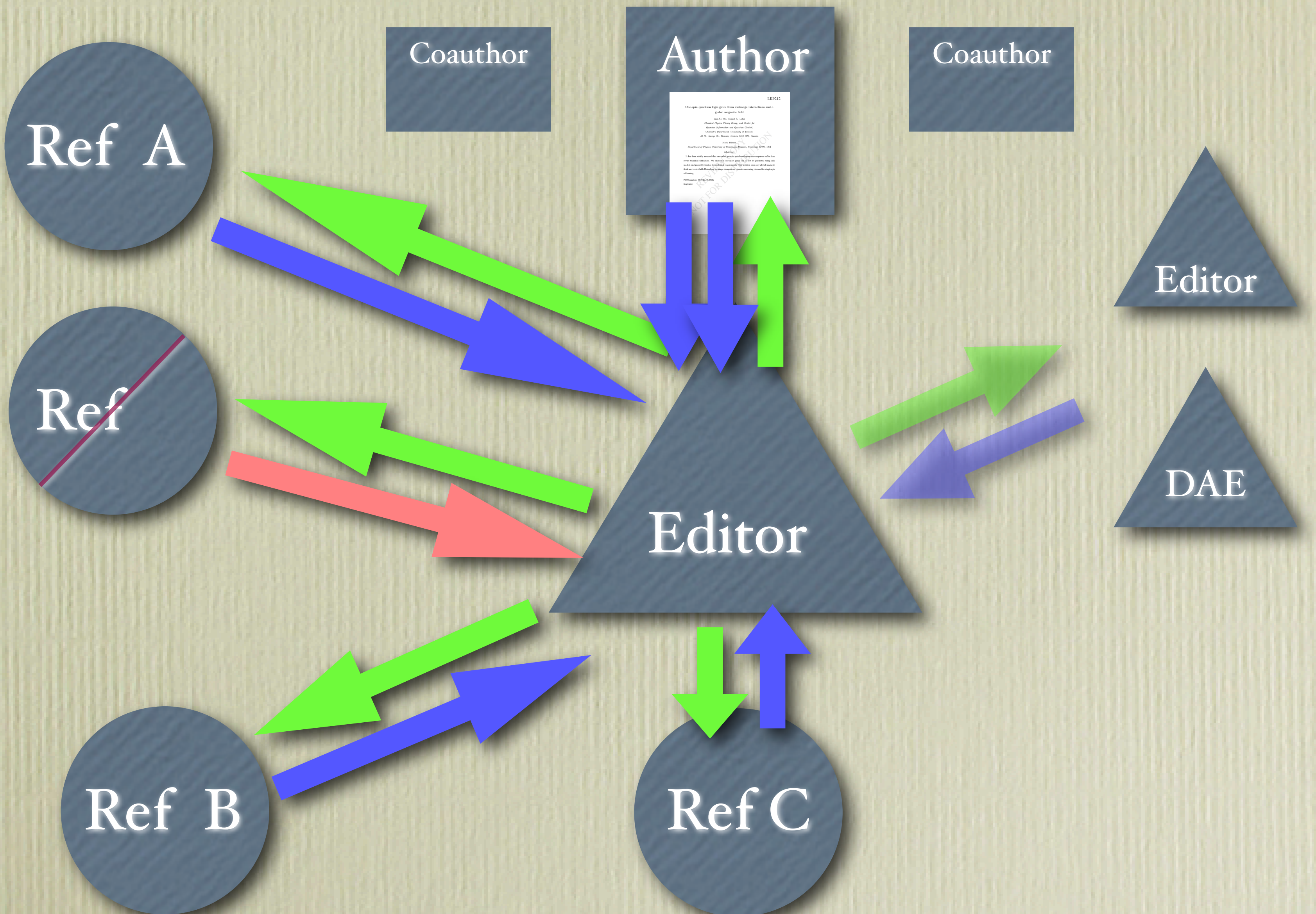

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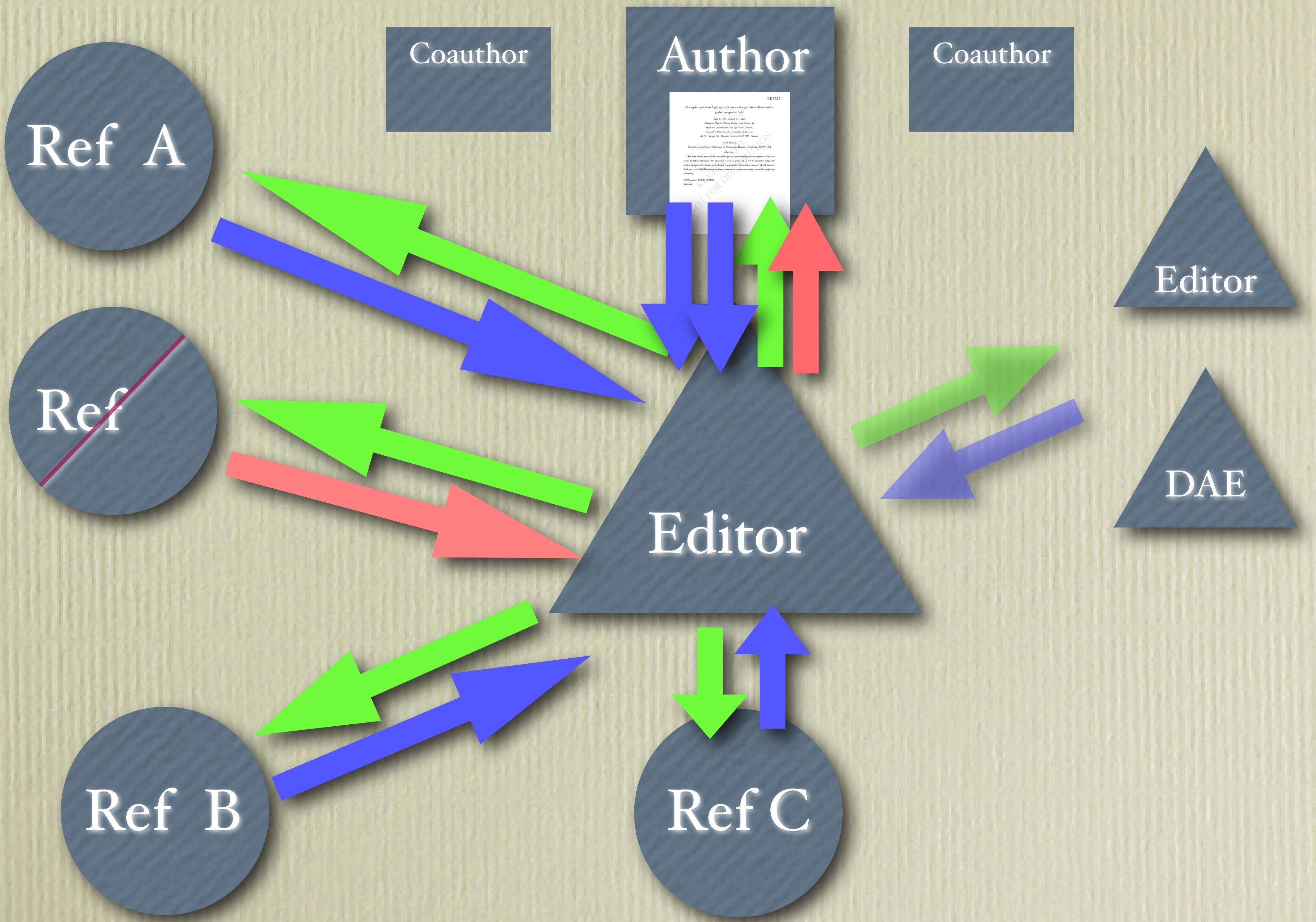

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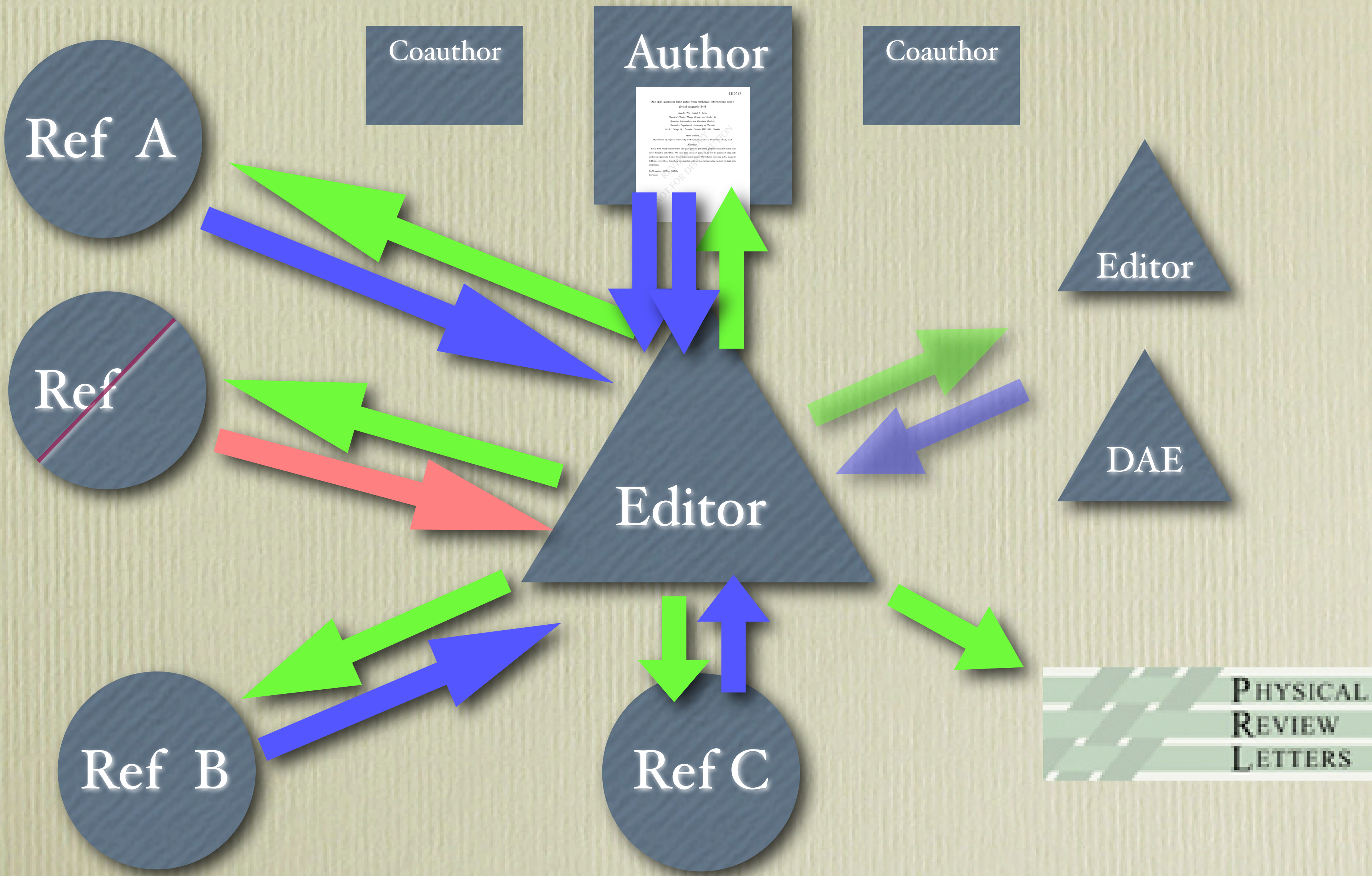

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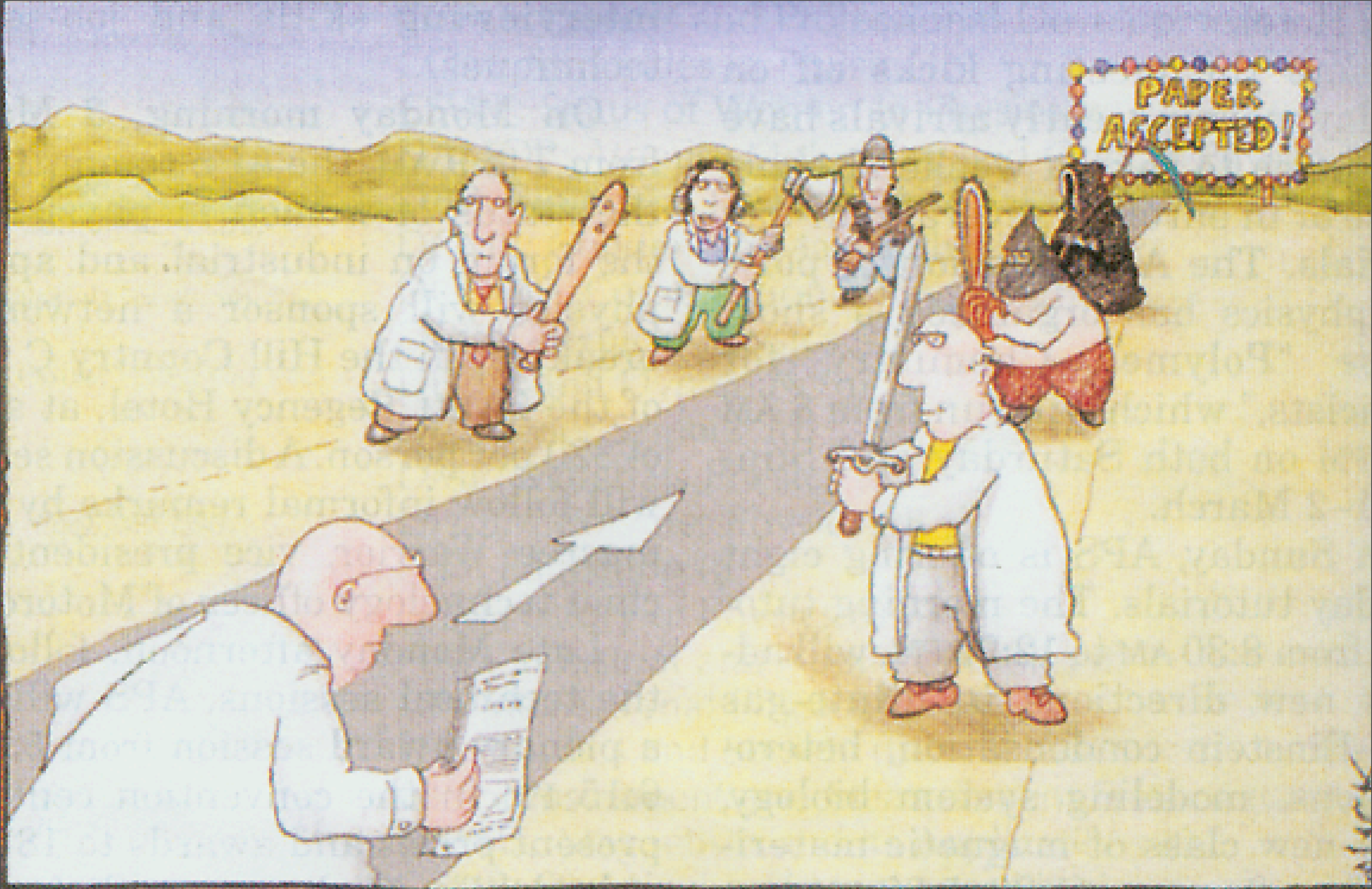

Most scientists regarded the new streamlined peer-review process as 'quite an improvement.'

Innovations:

Editors' Suggestions

&

Physics

end

The Problem

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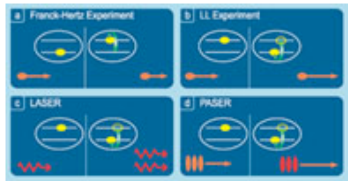

Schematic of Particle Acceleration by Stimulated Emission of Radiation (PASER) compared to analogous processes. In PASER, bound electrons in excited atoms (yellow) are stimulated by a bunched beam of electrons (orange bars) and transfer energy into accelerating the electron motion (red bars). See also Physics News Update story at http://www.aip.org/pnu/2006/split/792-1.html.

Enlarge the Image | Read the Article

Physical Review Letters

29 September 2006

Volume 97, Number 13, Articles (13xxxx)

Articles published 23 September - 29 September 2006

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Condensed Matter: Electronic Properties, etc.

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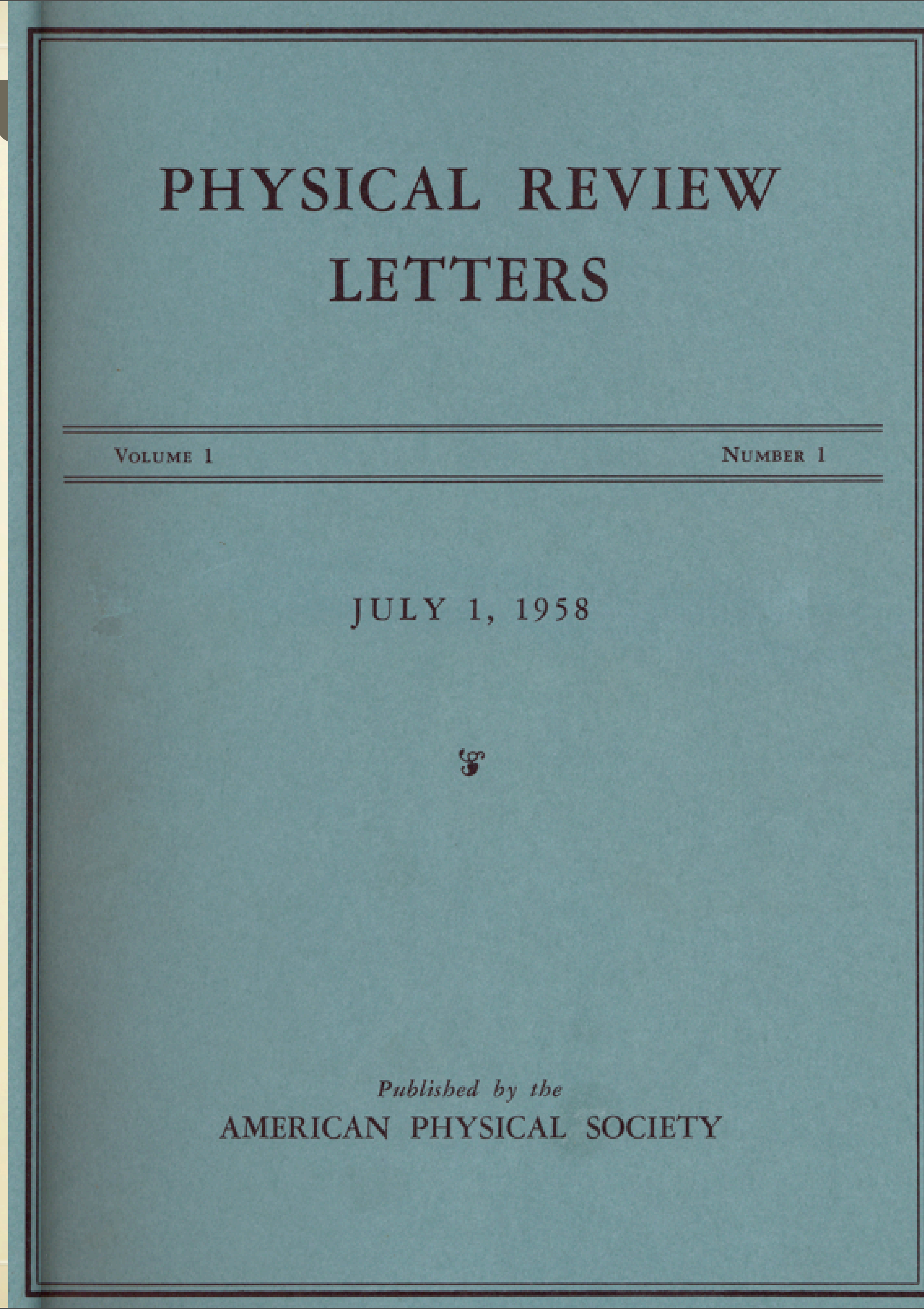
Unified Physics



PHYSICAL REVIEW LETTERS

VOLUME 1 NUMBER 1

JULY 1, 1958

Published by the
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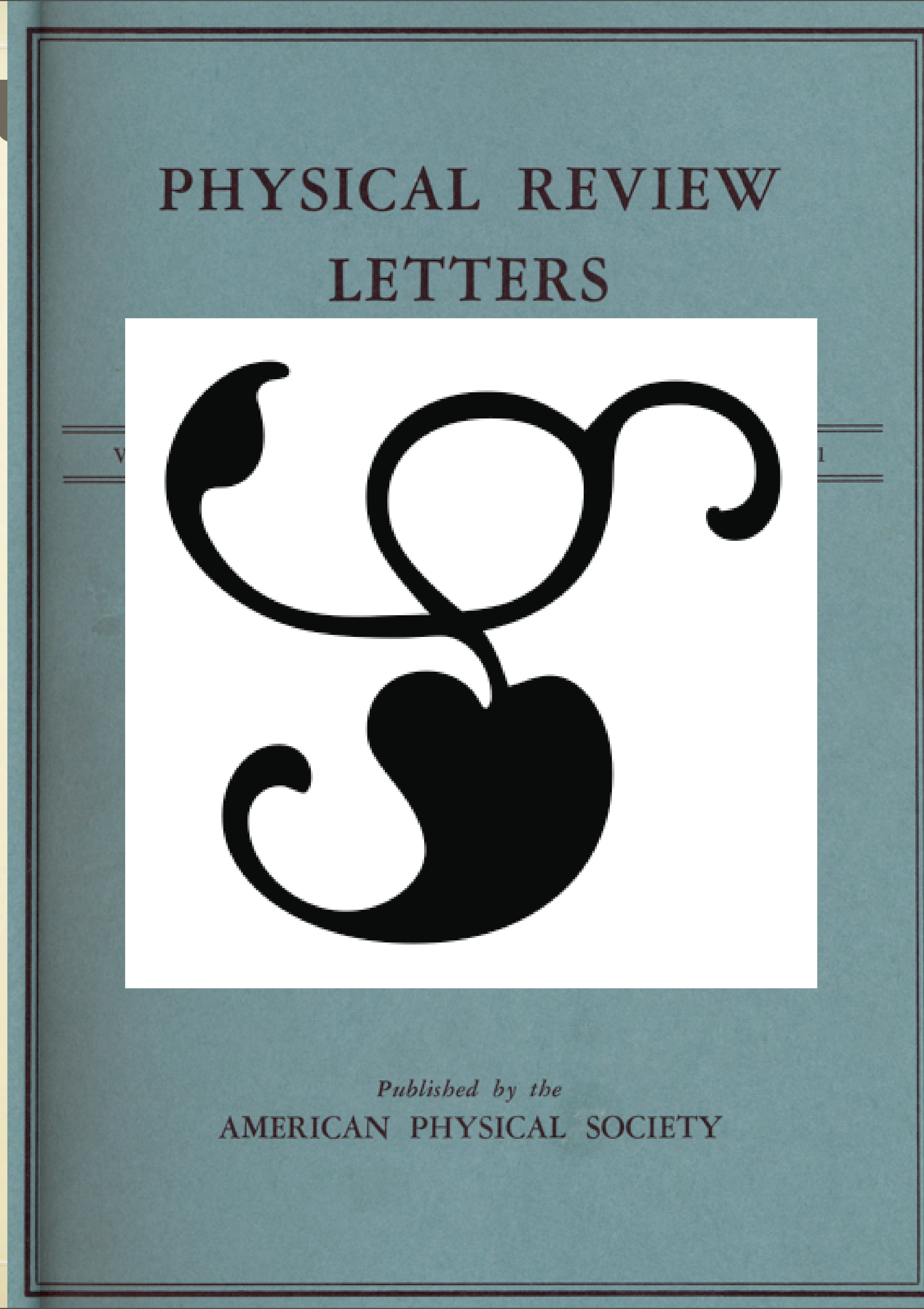
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Gravitation and Astrophysics
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Demonstration of Displacement- and Frequency-Noise-Free Laser Interferometry Using Bidirectional Mach-Zehnder Interferometers
Shuichi Sato, Keiko Kokeyama, Robert L. Ward, Seiji Kawamura, Yanbei Chen, Archana Pai, and Kentaro Somiya
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Probing the Temperature Profile of Energy Production in the Sun
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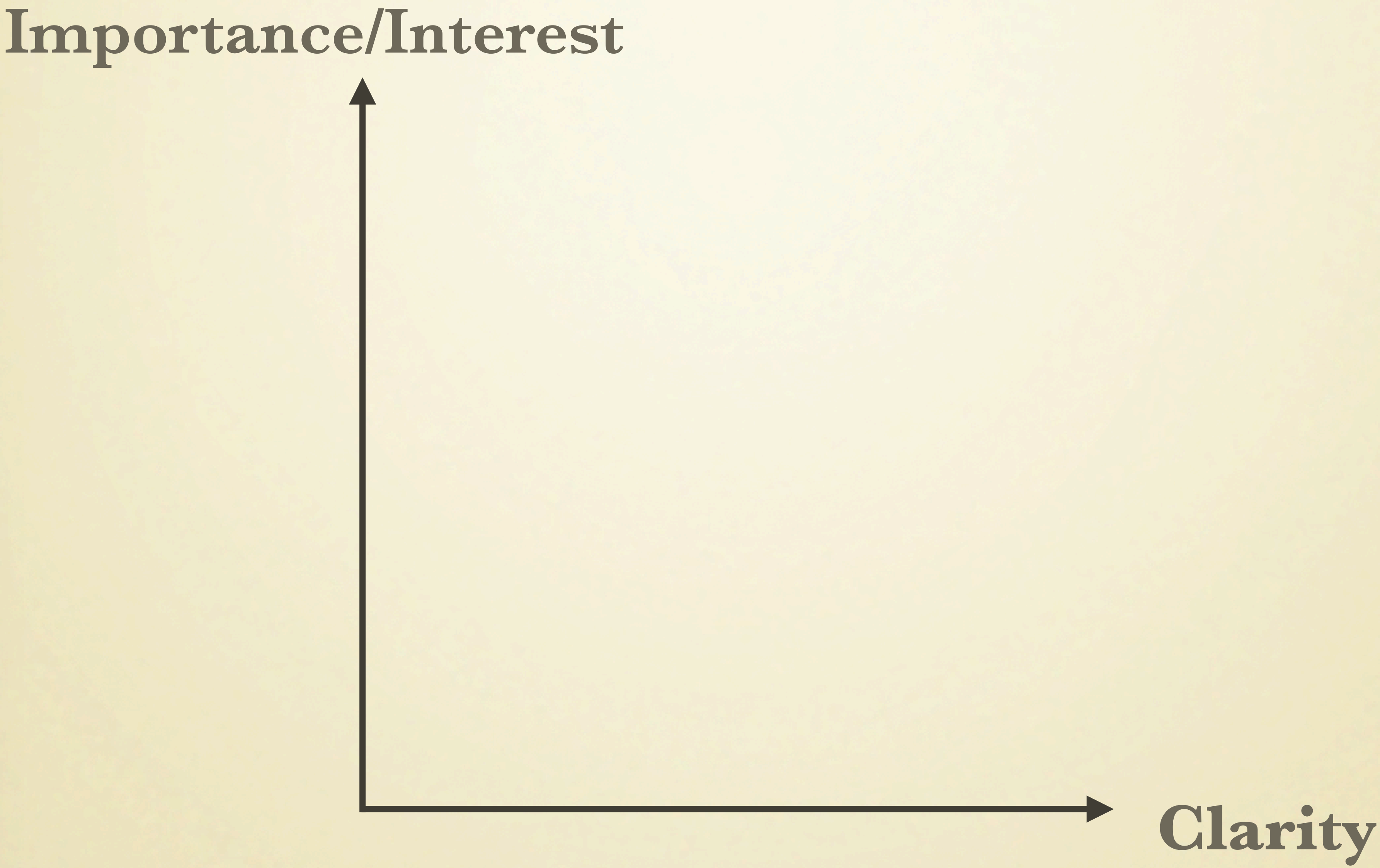

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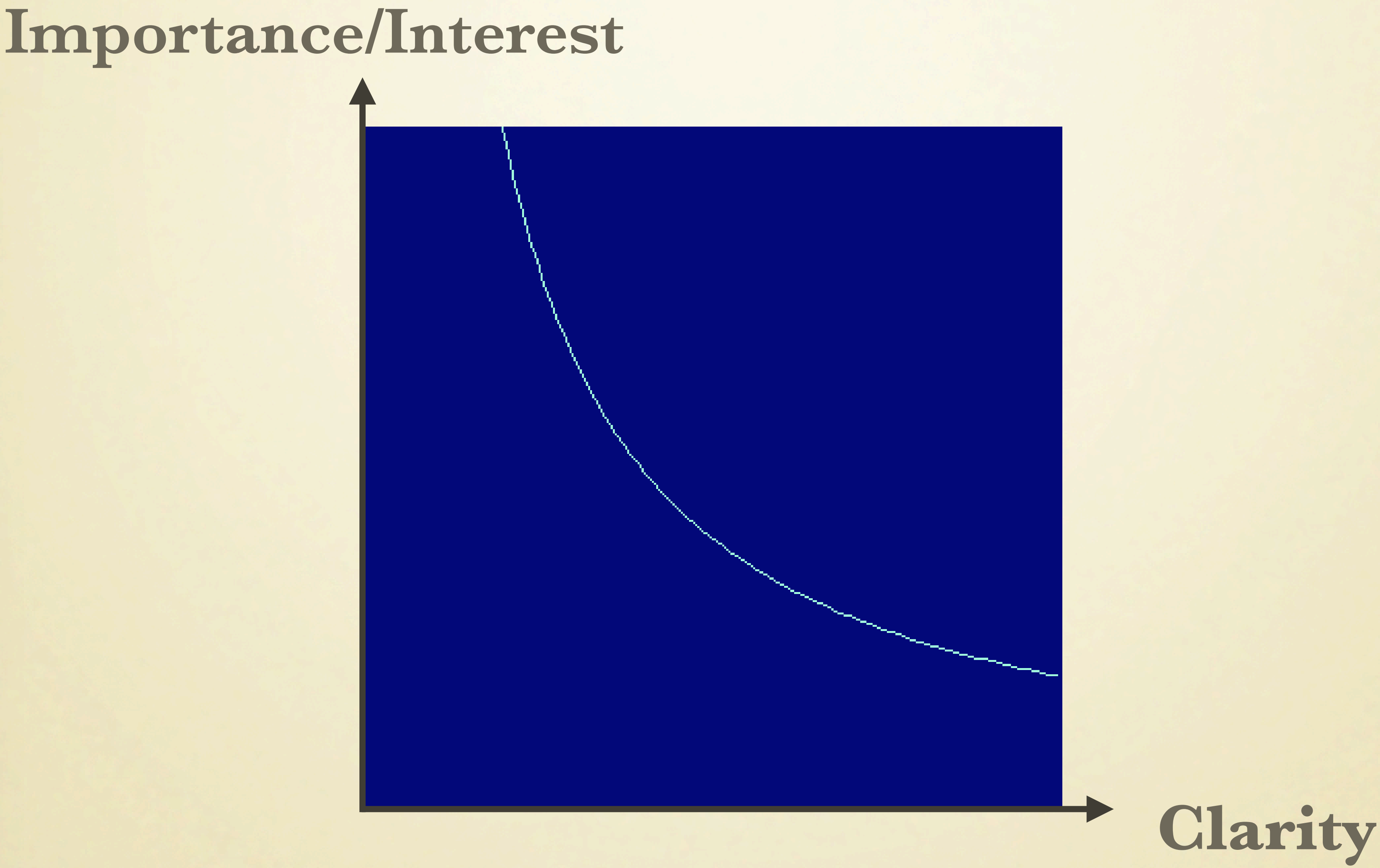

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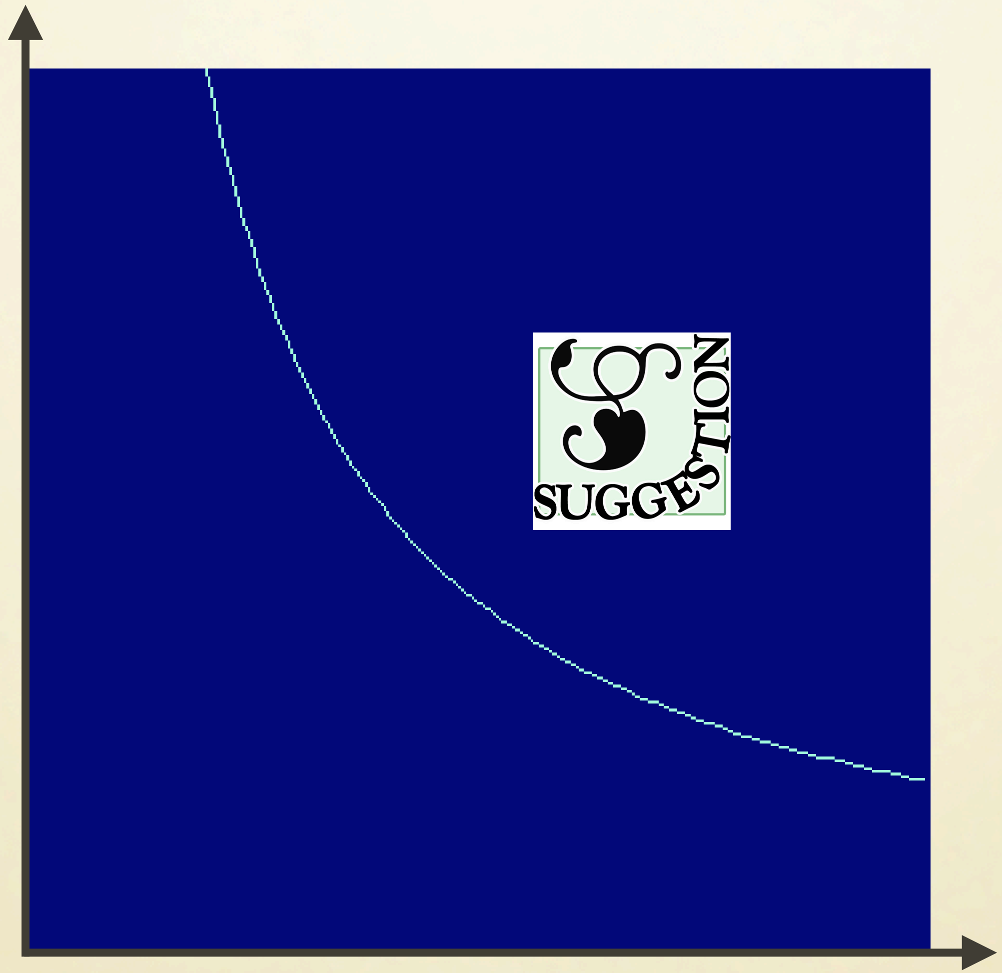

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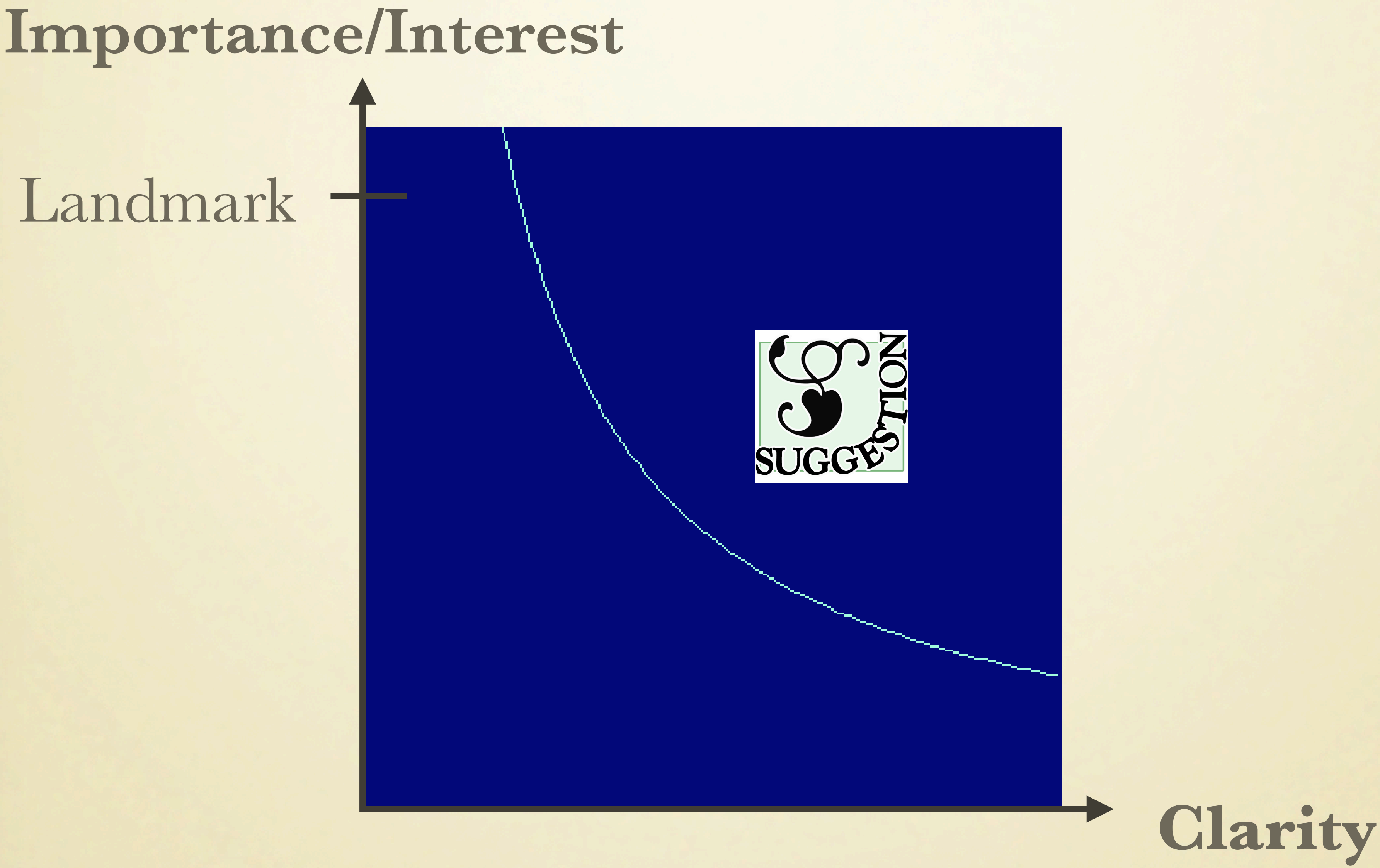

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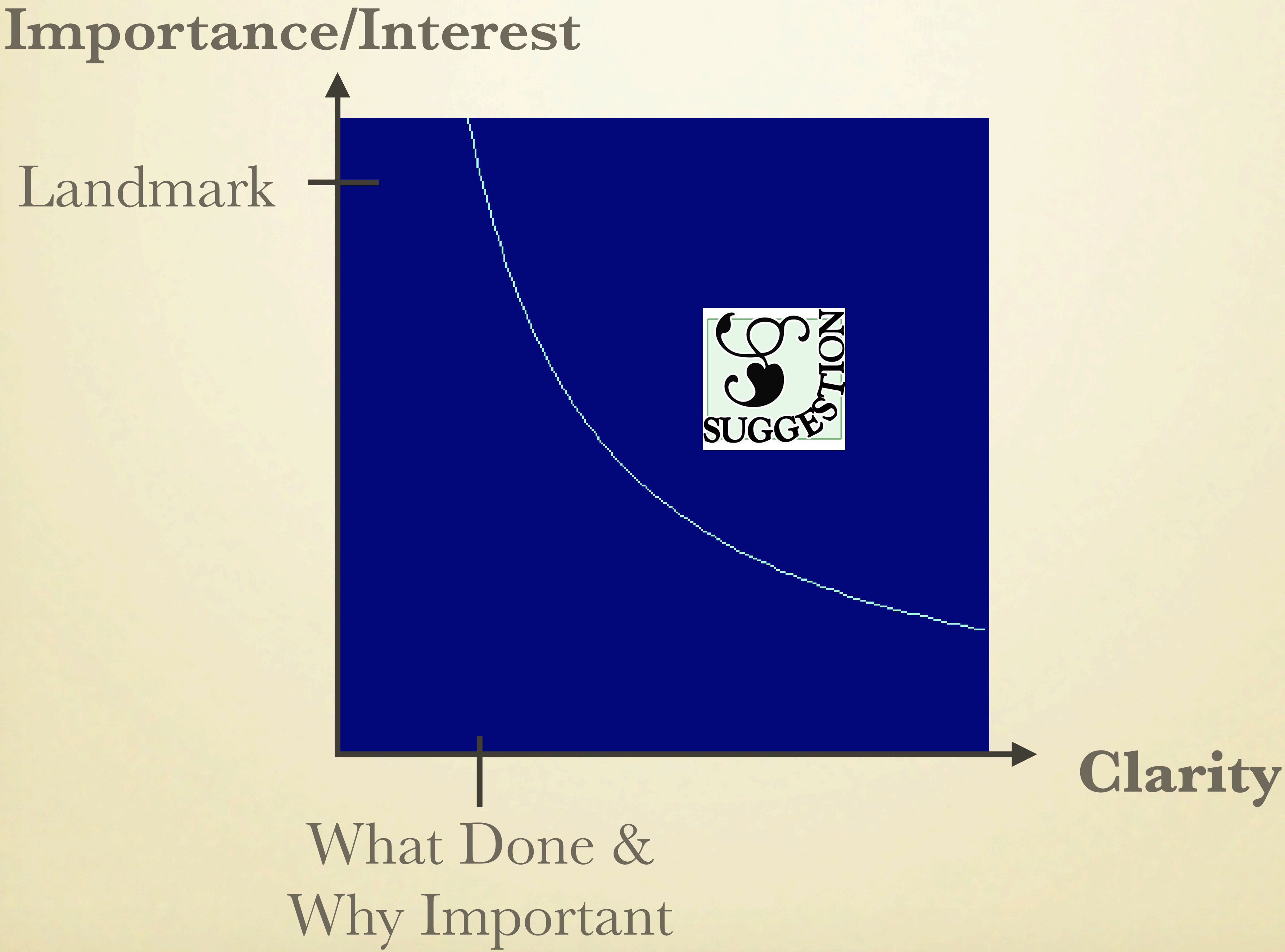

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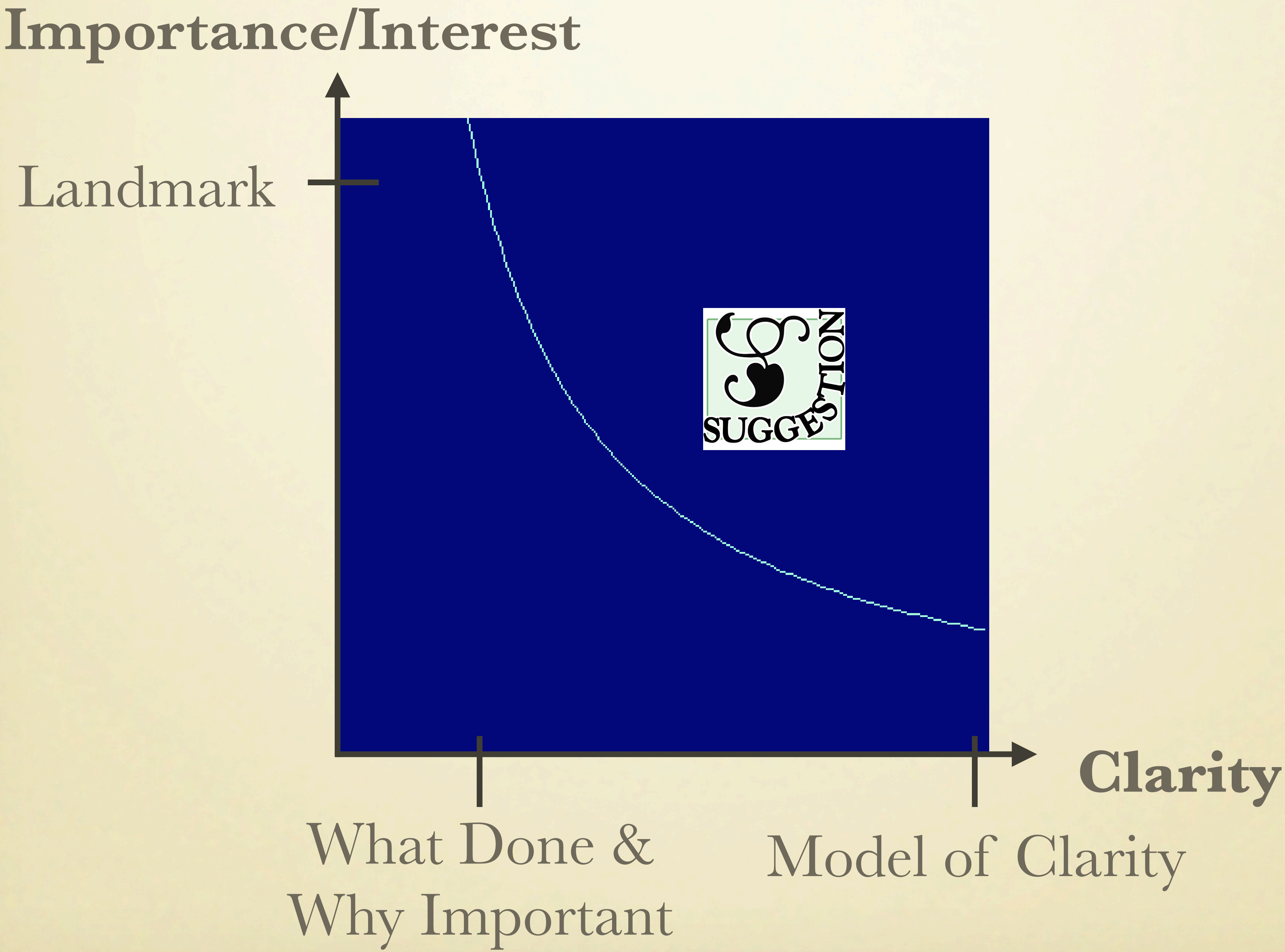

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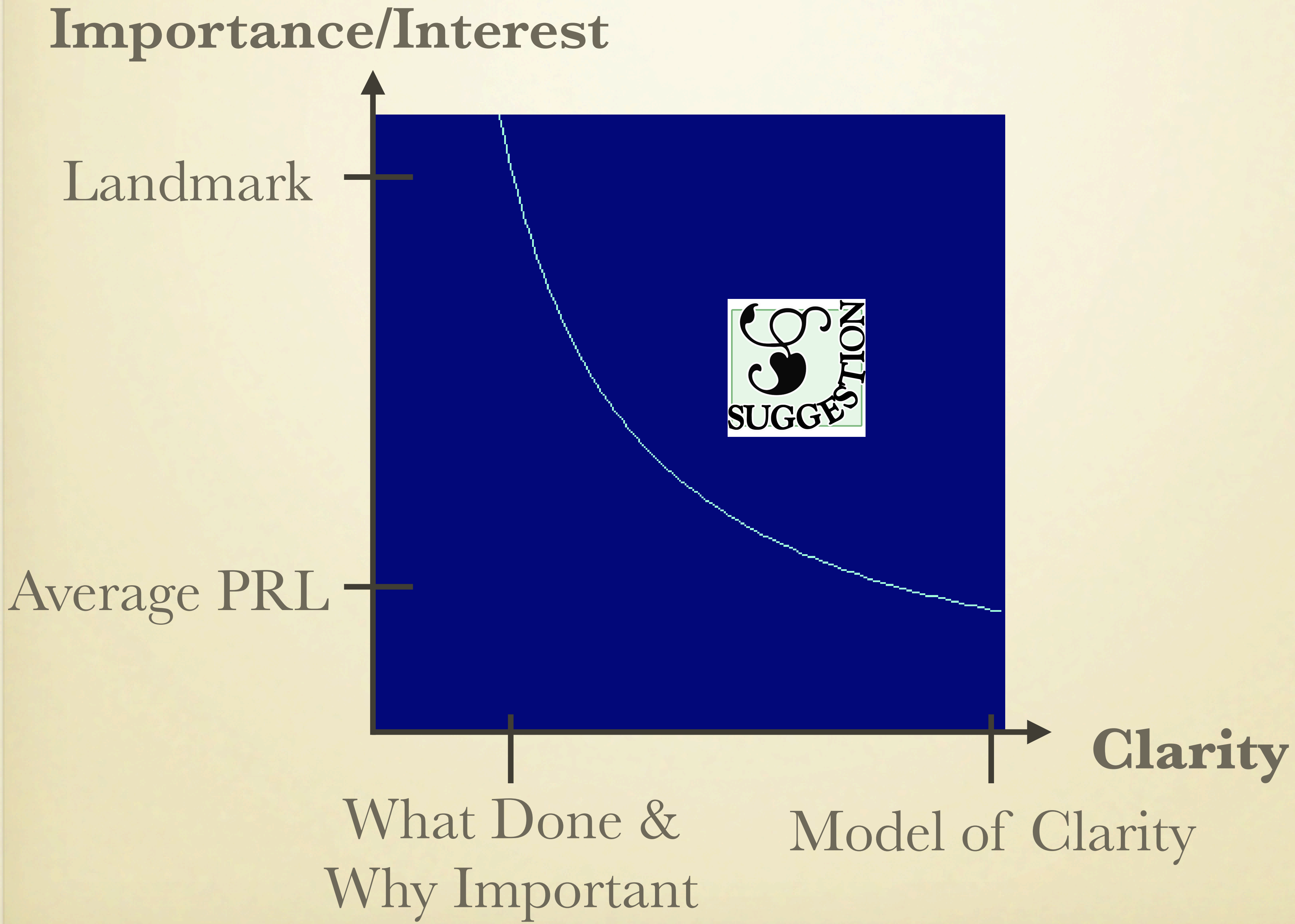

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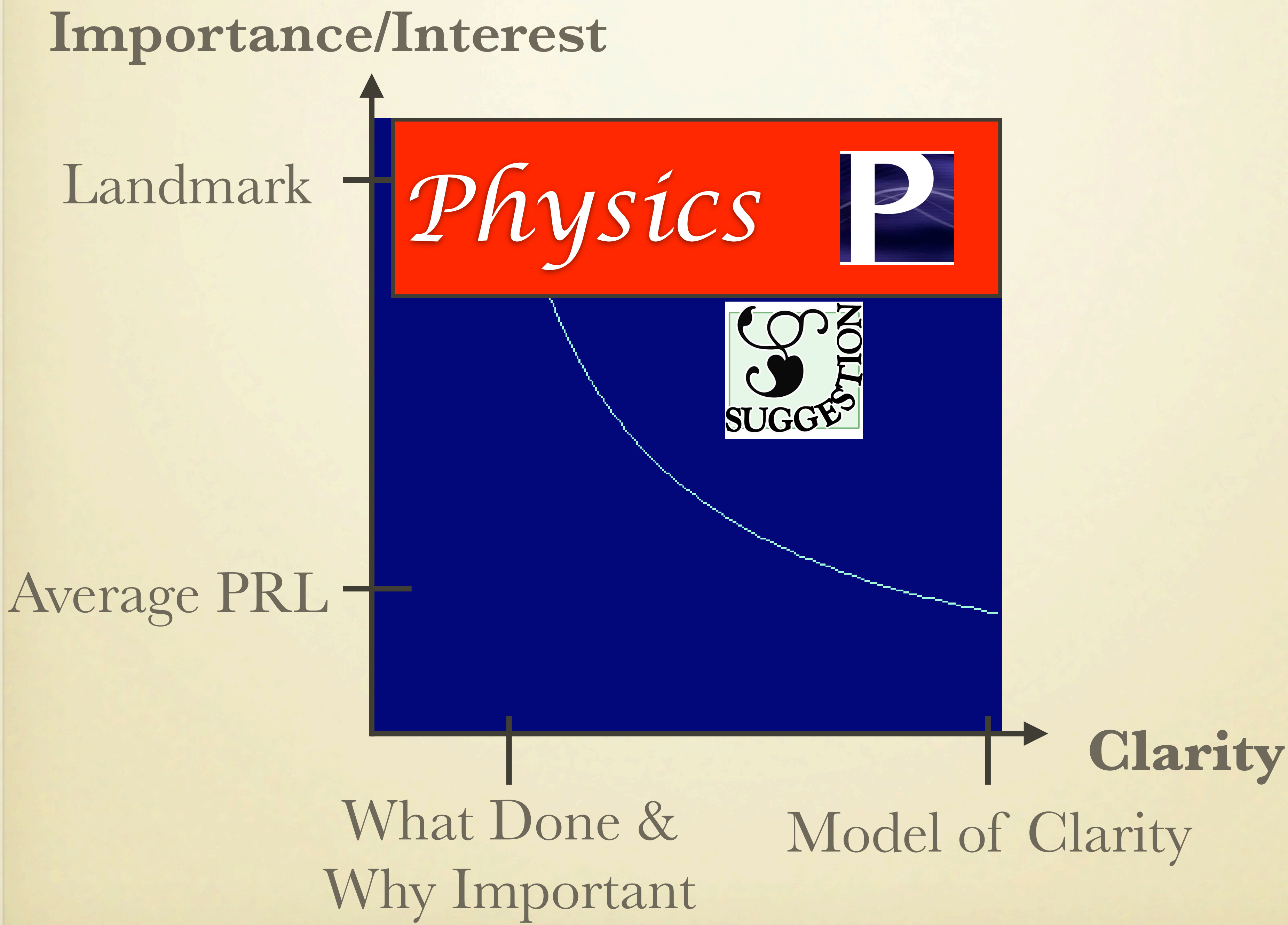

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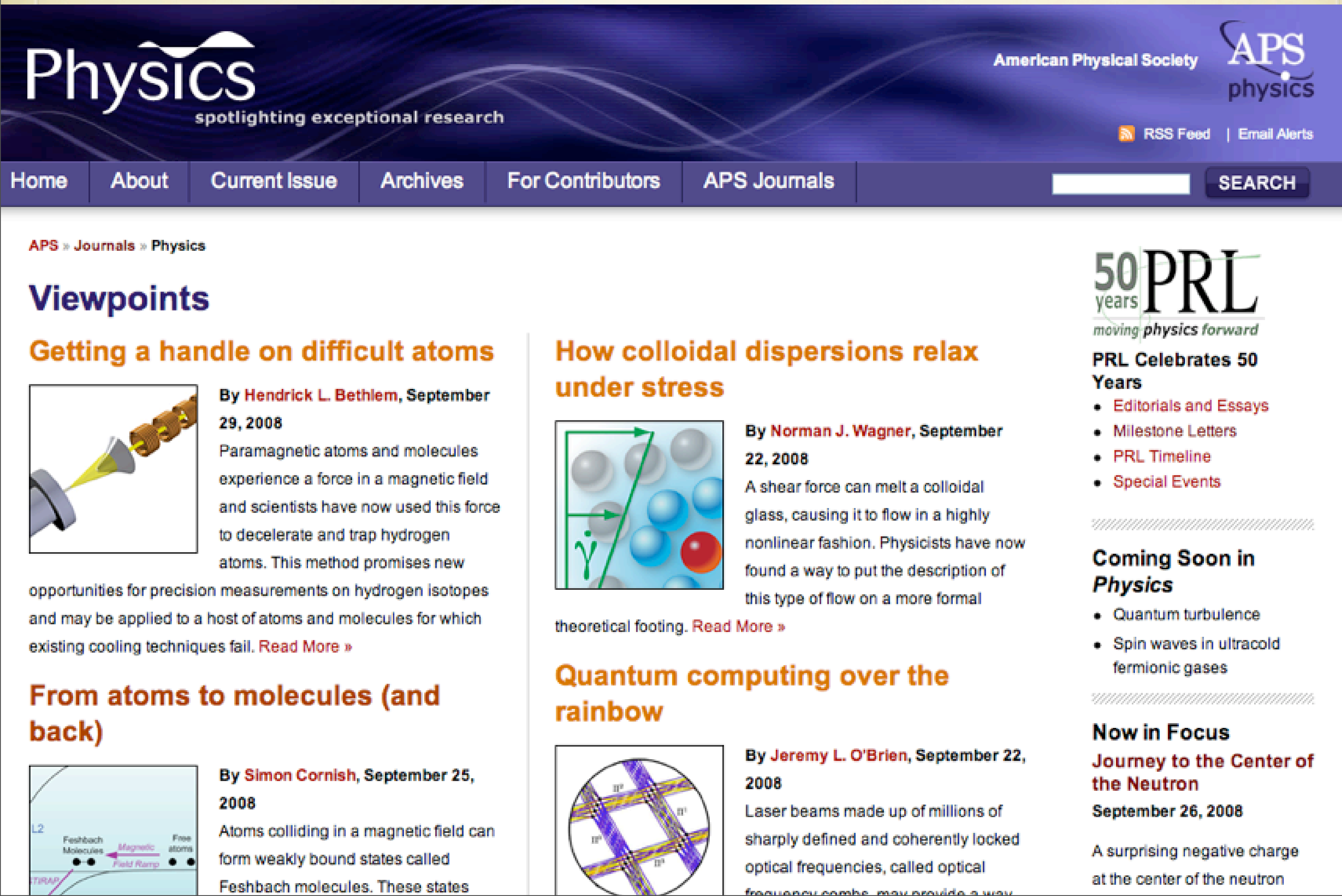

Searching high and low for bottomonium

By Stephen Godfrey
Ottawa-Carleton Institute for Physics, Department of Physics, Carleton University, Ottawa, Canada K1S 5B6
Published August 11, 2008

The BABAR collaboration at SLAC has observed the radiative decay of an excited state of bottomonium (the bound state of a bottom quark and its antiparticle) to its ground state η_b. Observing this long-sought ground state should enable better tests of quantum chromodynamic calculations of quark interactions and the computational approach called lattice quantum chromodynamics.

A Viewpoint on:

Observation of the Bottomonium Ground State in the Decay $\Upsilon(3S)\rightarrow\gamma\eta_b$

B. Aubert et al. BABAR Collaboration

Phys. Rev. Lett. 101, 071801 (2008) – Published August 11, 2008

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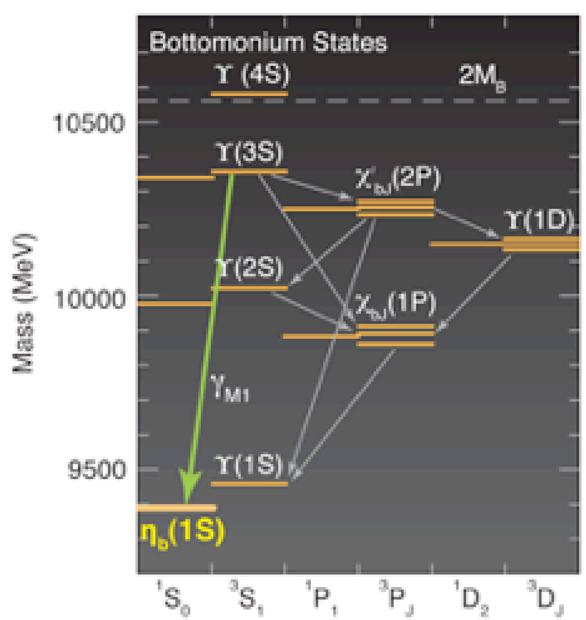

Just over thirty years ago, a new generation of quarks was discovered when Fermilab announced they had found the bottom quark [1], adding to the known up, down, strange, and charm quarks. The discovery was indirect—the actual detection involved finding bottom-antibottom quark pairs ($b\bar{b}$) that form bound states via strong interactions and have a rich spectroscopy analogous to that of the hydrogen atom [2]. These composite particles are called bottomonium, an analogy to the well-known electron-positron pairs called positronium. The first two $b\bar{b}$ states that were discovered are named upsilon particles (ϒ and ϒ′) and were found in 1977 during experiments with collisions of 400-GeV protons on nuclear targets at Fermilab [1].

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$$ds^2 = e^{-2kr_c\phi}\eta_{\mu\nu}dx^\mu dx^\nu + r_c^2 d\phi^2$$

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VOLUME 87, NUMBER 9 PHYSICAL REVIEW LETTERS 27 AUGUST 2001

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We present an updated measurement of time-dependent *CP*-violating asymmetries in neutral *B* decays with the *BABAR* detector at the PEP-II asymmetric *B* Factory at SLAC. This result uses an additional sample of $\Upsilon(4S)$ decays collected in 2001, bringing the data available to 32×10^6 $B\bar{B}$ pairs. We select events in which one neutral *B* meson is fully reconstructed in a final state containing charmonium and the flavor of the other neutral *B* meson is determined from its decay products. The amplitude of the *CP*-violating asymmetry, which in the standard model is proportional to $\sin 2\beta$, is derived from the decay time distributions in such events. The result $\sin 2\beta = 0.59 \pm 0.14(\text{stat}) \pm 0.05(\text{syst})$ establishes *CP*

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Observation of Large *CP* Violation in the Neutral *B* Meson System

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We present a measurement of the standard model *CP* violation parameter $\sin 2\phi_1$ based on a 29.1 fb^{-1} data sample collected at the $\Upsilon(4S)$ resonance with the Belle detector at the KEKB asymmetric-energy e^+e^- collider. One neutral *B* meson is fully reconstructed as a $J/\psi K_S$, $\psi(2S)K_S$, $\chi_{c1}K_S$, $\eta_c K_S$, $J/\psi K_L$, or $J/\psi K^{*0}$ decay and the flavor of the accompanying *B* meson is identified from its decay products. From the asymmetry in the distribution of the time intervals between the two *B* meson decay points, we determine $\sin 2\phi_1 = 0.99 \pm 0.14(\text{stat}) \pm 0.06(\text{syst})$. We conclude that we have observed *CP* violation in the neutral *B* meson system.

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Kobayashi and Maskawa (KM) proposed, in 1973, a model where *CP* violation is incorporated as an irreducible complex phase in the weak-interaction quark mixing matrix [1]. The idea, which was presented at a time when only the *u*, *d*, and *s* quarks were known to exist, was remarkable because it required the existence of six quarks. The subsequent discoveries of the *c*, *b*, and *t* quarks, and the compatibility of the model with the *CP* violation observed in the neutral *K* meson system led to the incorporation of the KM mechanism into the standard model, even though it had not been conclusively tested experimentally.

In 1981, Sanda, Bigi, and Carter [2] pointed out that the KM model predicted large *CP* violation in certain decays of *B* mesons for a range of quark mixing parameters. Subsequent measurements of the *B* meson lifetime [3] and the discovery of $B^0\bar{B}^0$ mixing [4] indicated that the parameters lie within such a range. Thus, measurements of *CP* violation in *B* meson decays provide important tests of the

The model predicts a *CP* violating asymmetry in the time-dependent rates for initial B^0 and $\bar{B}^0$ decays to a common *CP* eigenstate, f_{CP} [2]. In the case where $f_{CP} = (c\bar{c})K^0$, the asymmetry is given by

$$A(t) \equiv \frac{\Gamma(\bar{B}^0 \to f_{CP}) - \Gamma(B^0 \to f_{CP})}{\Gamma(\bar{B}^0 \to f_{CP}) + \Gamma(B^0 \to f_{CP})} = -\xi_f \sin 2\phi_1 \sin \Delta m_d t,$$

where $\Gamma[\bar{B}^0(B^0) \to f_{CP}]$ is the decay rate for $\bar{B}^0(B^0)$ to f_{CP} at a proper time t after production, ξ_f is the *CP* eigenvalue of f_{CP}, Δm_d is the mass difference between the two B^0 mass eigenstates, and ϕ_1 is one of the three internal angles of the unitarity triangle, defined as $\phi_1 \equiv \pi - \arg(\frac{-V_{tb}^* V_{td}}{-V_{cb}^* V_{cd}})$ [5]. For the $(c\bar{c})K^0$ decays, both the ambiguity due to strong interactions and the contribution from direct *CP* violation are expected to be small [5].

Our previous determination, using a data sample taken

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Combination of CDF and D0 results on the *W* boson mass and width

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  - Con: Many submissions, credit mainly for speed.

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The odd case of PAMELA

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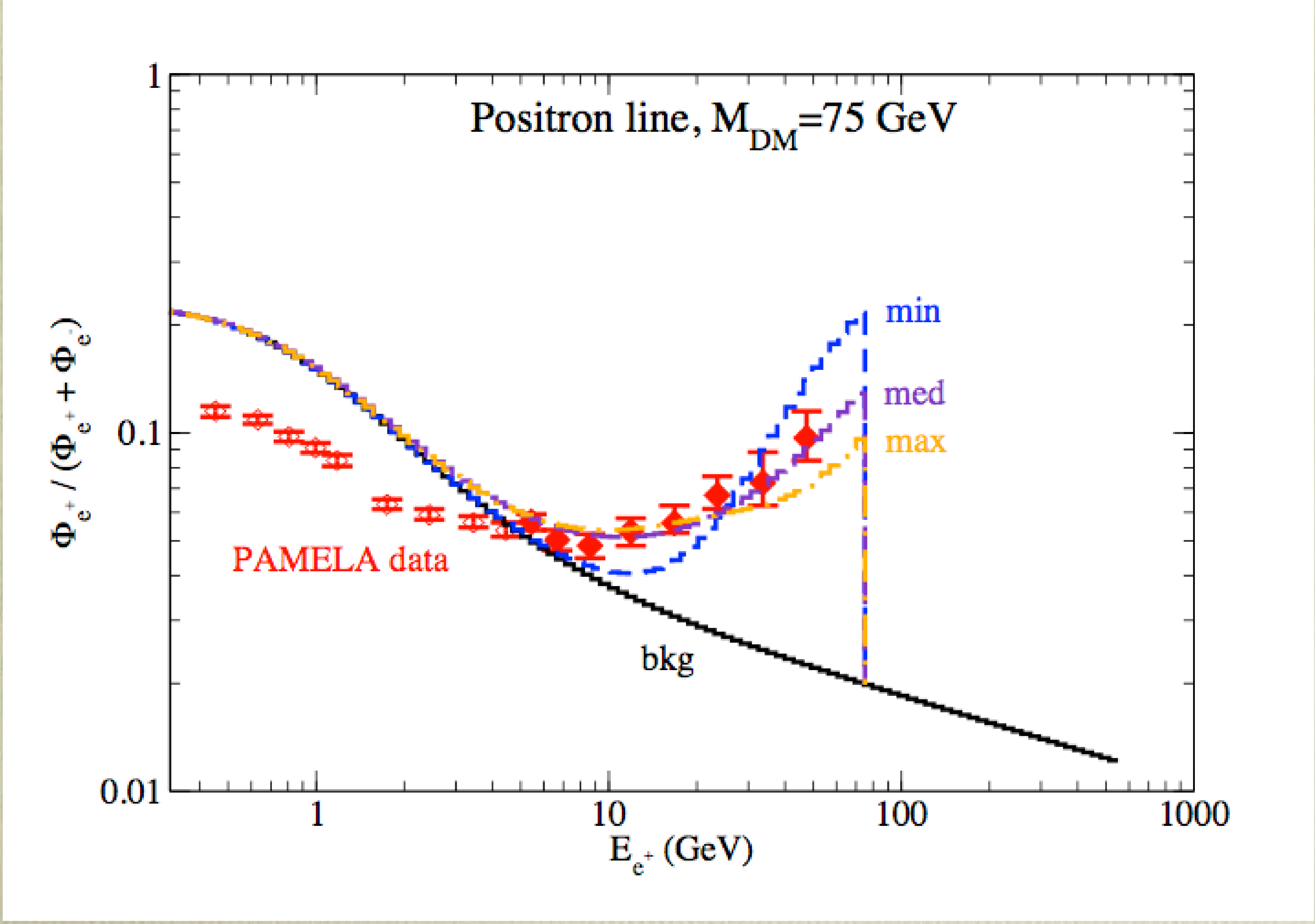

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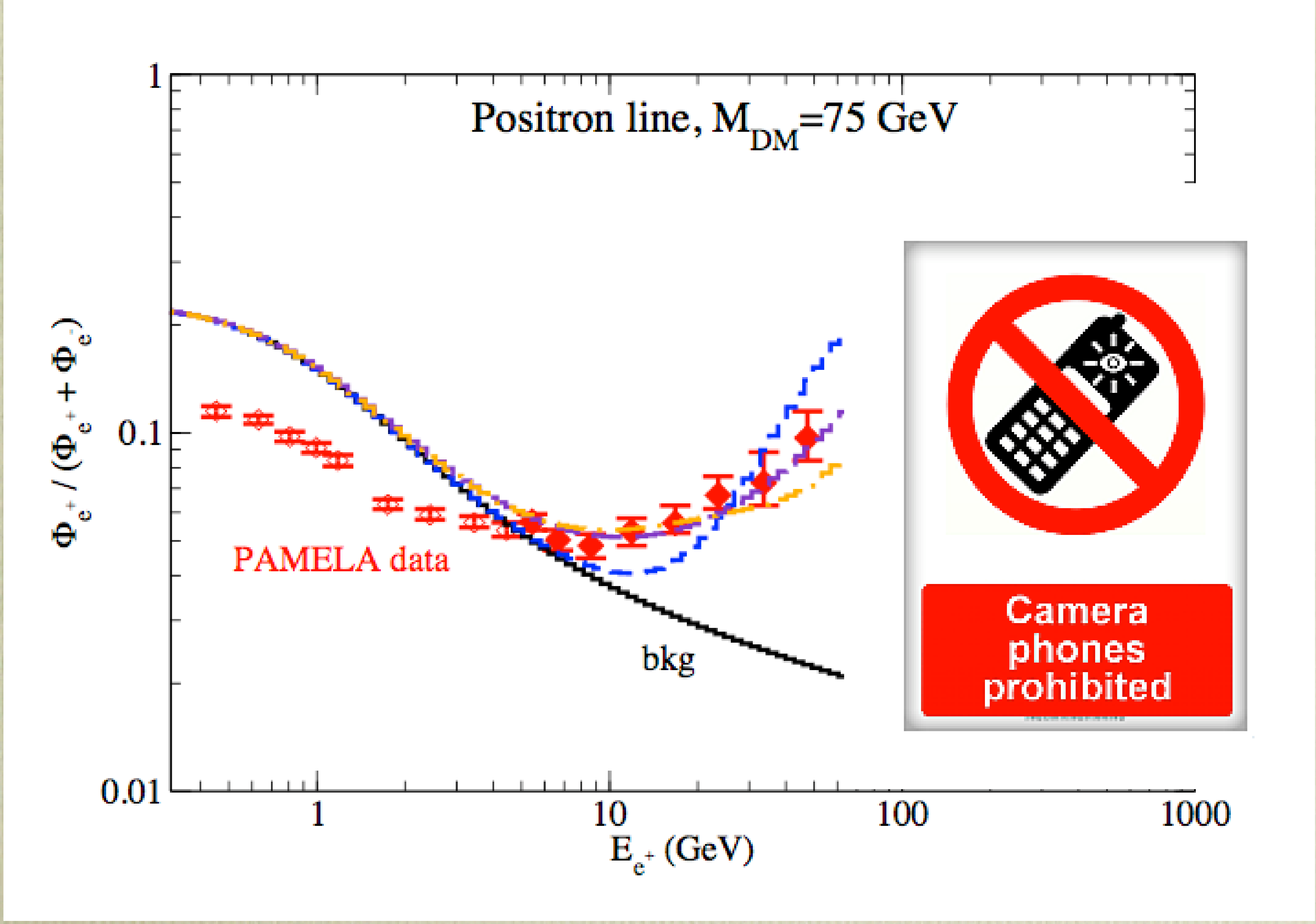

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Back-to-Back Letters

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VOLUME 74, NUMBER 14 PHYSICAL REVIEW LETTERS 3 APRIL 1995

Observation of Top Quark Production in $\overline{p}p$ Collisions with the Collider Detector at Fermilab

F. Abe,[14] H. Akimoto,[32] A. Akopian,[27] M. G. Albrow,[7] S. R. Amendolia,[24] D. Amidei,[17] J. Antos,[29] C. Anway-Wiese,[4] S. Aota,[32] G. Apollinari,[27] T. Asakawa,[32] W. Ashmanskas,[15] M. Atac,[7] P. Auchincloss,[26] F. Azfar,[22]

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[35]*Yale University, New Haven, Connecticut 06511*

(Received 24 February 1995)

We establish the existence of the top quark using a 67 pb^{-1} data sample of $\overline{p}p$ collisions at $\sqrt{s}$ = 1.8 TeV collected with the Collider Detector at Fermilab (CDF). Employing techniques similar

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Lessons from Correspondence

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Advice for Authors

- Be tactful and polite.
- Assume that the referees are your peers.
- Do not assume that the referees are biased just because you disagree with them.
- Present your results clearly, geared for the audience of the journal to which you submit.
- For a Letter, it should be clear to any physicist from the title, abstract, and introduction why the paper meets the PRL criteria of importance and broad interest.
- Please be more patient if you submit around summertime.

Lessons for Referees

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Advice for Referees

- Be tactful and polite.
- Provide reasons for your recommendations.
- It is helpful if you show that you are an expert (authors are slightly more apt to accept criticism if they are sure it is from a peer).
- Please report in a timely manner. If you cannot, please let us know as soon as possible. You wouldn't want an unresponsive referee if it were your paper.
- If you cannot review, *do* suggest alternative referees.
- Please try review even if you are away, especially around summertime when many referees are away.

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- Receptions held at several meetings
- Symposium held at Stony Brook on June 27 2008

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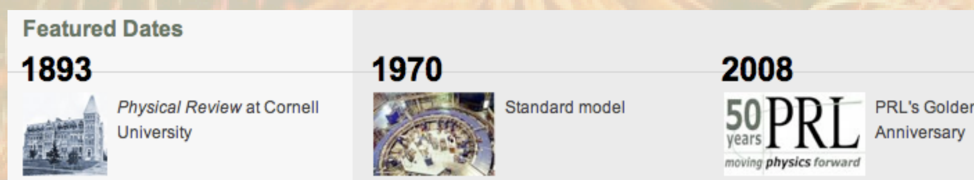

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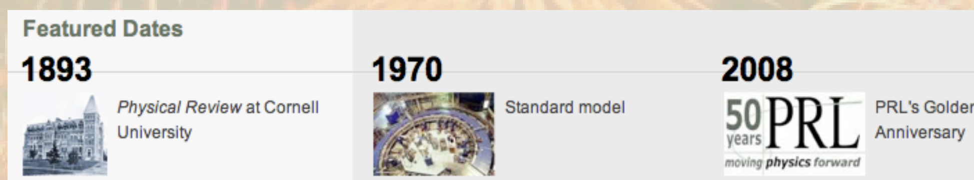

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VOLUME 05 ISSUE 04
SEPTEMBER 08

VIEW CURRENT ISSUE

APS Copyright Policy Update

October 2, 2008 | 8:09 pm

In an editorial on APS' website today, APS' editor-in-chief Gene Sprouse announced that the Americal Physical Society would allow authors of articles in its journals to keep certain rights under their copyright transfer agreement.

Specifically, APS will allow authors to retain copyright, not of the article itself, but of most "derivitave works" that the author might make from the original article. This is useful, and laudable, because one such derivative work might be reworking pieces of the article for posting on a site such as Wikipedia, which often require articles to use a copyleft or commons type license like the GNU Free Document License. These types of licenses simply ensure that the article may be freely reproduced and redistributed, often provided it is kept under the same license and properly attributed. These conditions are often incompatible with some publishers' mandates that authors give the journal the copyright to the original article and any derivative works.

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We have thus changed our copyright agreement to correct this situation. In the new agreement, copyright rests with the author for derivative works that contain at least 10% new material and not more than 50% of their article that is published in an APS journal. We believe that this will allow authors sufficient freedom to reuse material from their articles in APS journals when writing for a new audience, while protecting APS from the wholesale copying of our content. We recommend that if authors wish to post a complete article from an APS journal, they instead provide a link to our site, or to a free copy of the article on their personal web sites.

Phys. Rev. Lett. **97**, 034801 (2006)

Incoherent Effects of Electron Clouds in Proton Storage Rings

E. Benedetto,[1,2] G. Franchetti,[3] and F. Zimmermann[1]
1 *CERN, Geneva, Switzerland*
2 *Politecnico Torino, Italy*
3 *GSI, Darmstadt, Germany*

(Received 16 March 2006; published 21 July 2006)

Electron clouds in the beam pipe of high-energy proton or positron storage rings can give rise to significant incoherent emittance growth, at densities far below the coherent-instability threshold. We identify two responsible mechanisms: namely, (1) a beam particle periodically crosses a resonance and (2) a beam particle periodically crosses a region of the bunch where its motion is linearly unstable. Formation of halo or beam-core blow up, respectively, are the result. Key ingredients for both processes are synchrotron motion and electron-induced tune shift. The mechanisms considered provide a possible explanation for reduced beam lifetime and emittance growth observed at several operating accelerators. Similar phenomena are likely to occur in other two-stream systems.