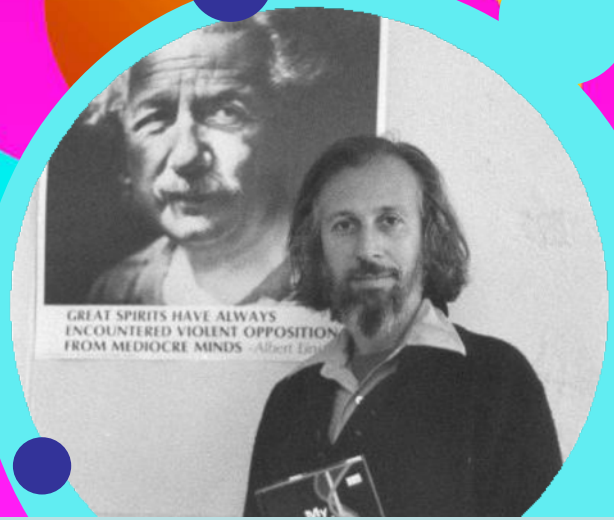
Counterculture and Physics

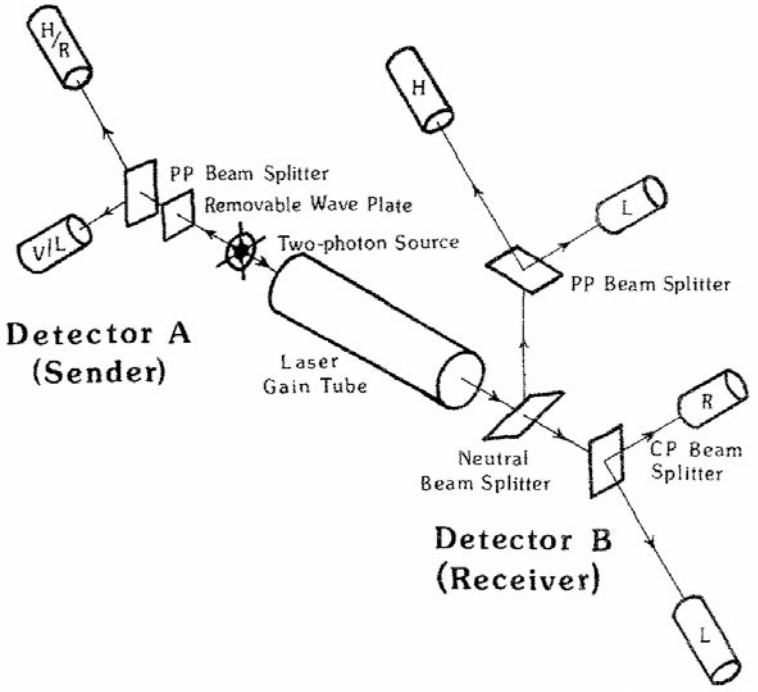


8.225 / STS.042, Physics in the 20th Century
Professor David Kaiser, 9 November 2020

I. New Topics

II. New Patrons, New Forums

III. FLASH!



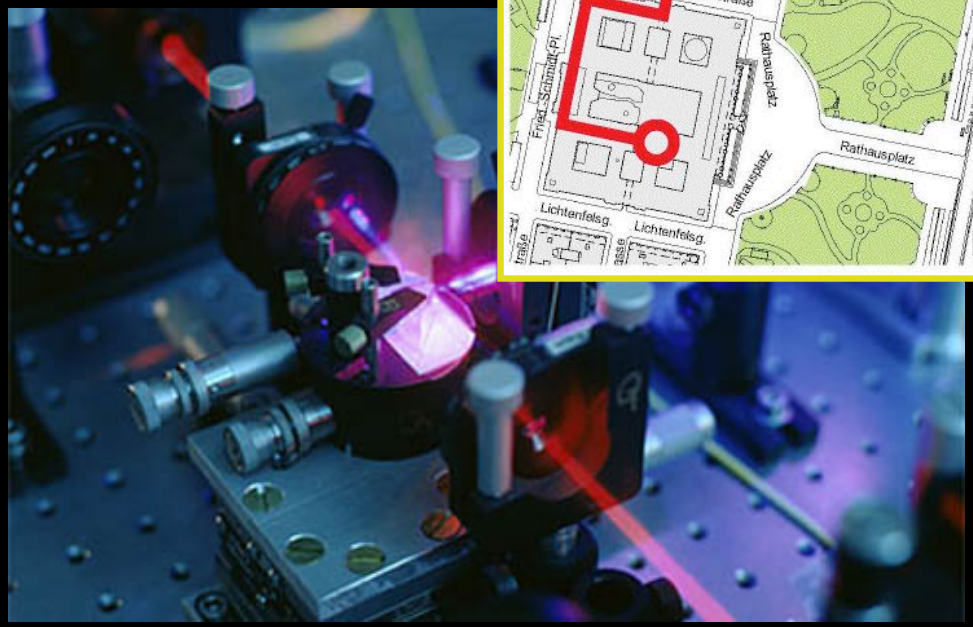
Quantum Encryption

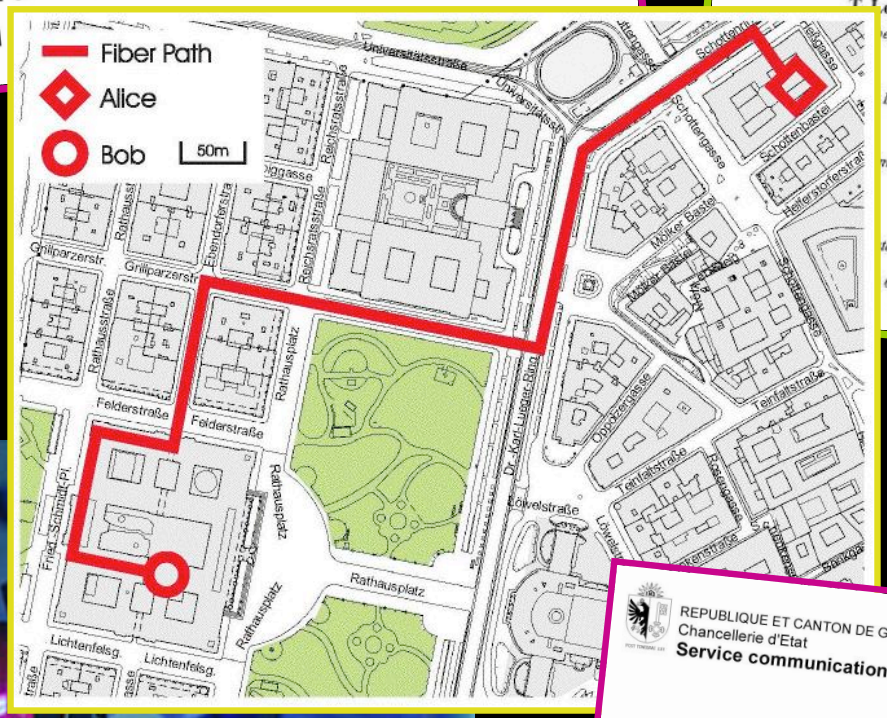
Vienna, 21. April 2004

World Premiere: Bank Transfer via Quantum Cryptography Based on Entangled Photons

Press conference and demonstration of the ground-breaking experiment:

21 April 2004, 11:30, Vienna City Hall





9 August 2004 / Vol. 12, No. 16 / OPTICS EXPRESS 3865

Practical quantum key distribution with polarization entangled photons

A. Poppe, A. Fedrizzi, R. Ursin, H. R. Böhm
Institut für Experimentalphysik, Universität Wien, Boltzmanngasse 5, 1090 Wien, Austria
andreas.poppe@quantum.at

T. Lorünser, O. Maurhardt, M. Peev, M. Suda
ersdorf Research GmbH (ARCS), 2444 Seibersdorf, Austria

C. Kurtsiefer, H. Weinfurter
Ludwig-Maximilians-Universität,D-80797 Muenchen, Germany

T. Jennewein
n Optics and Quantum Information, Austrian Academy of Sciences, Boltzmanngasse 3, 1090 Wien, Austria

A. Zeilinger
talphysik, Universität Wien, Boltzmanngasse 5, 1090 Wien, Austria
Optics and Quantum Information, Austrian Academy of Sciences, Boltzmanngasse 3, 1090 Wien, Austria

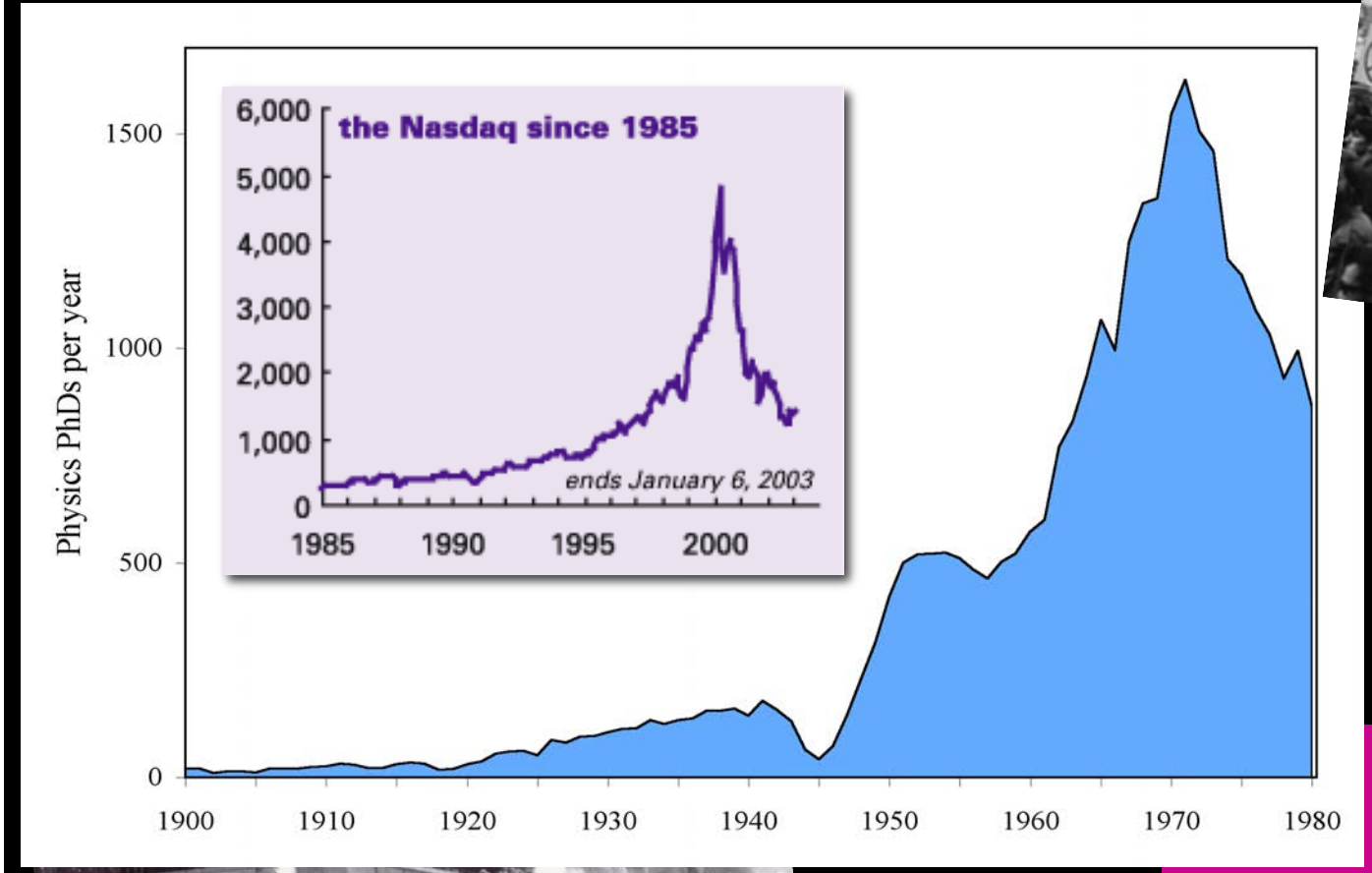
REPUBLIQUE ET CANTON DE GENEVE
Chancellerie d'Etat
Service communication et information

Press release of Geneva State Chancellery

Geneva, October 11th 2007

Geneva is counting on Quantum Cryptography as it counts its Votes

The Cold War Bubble Bursts

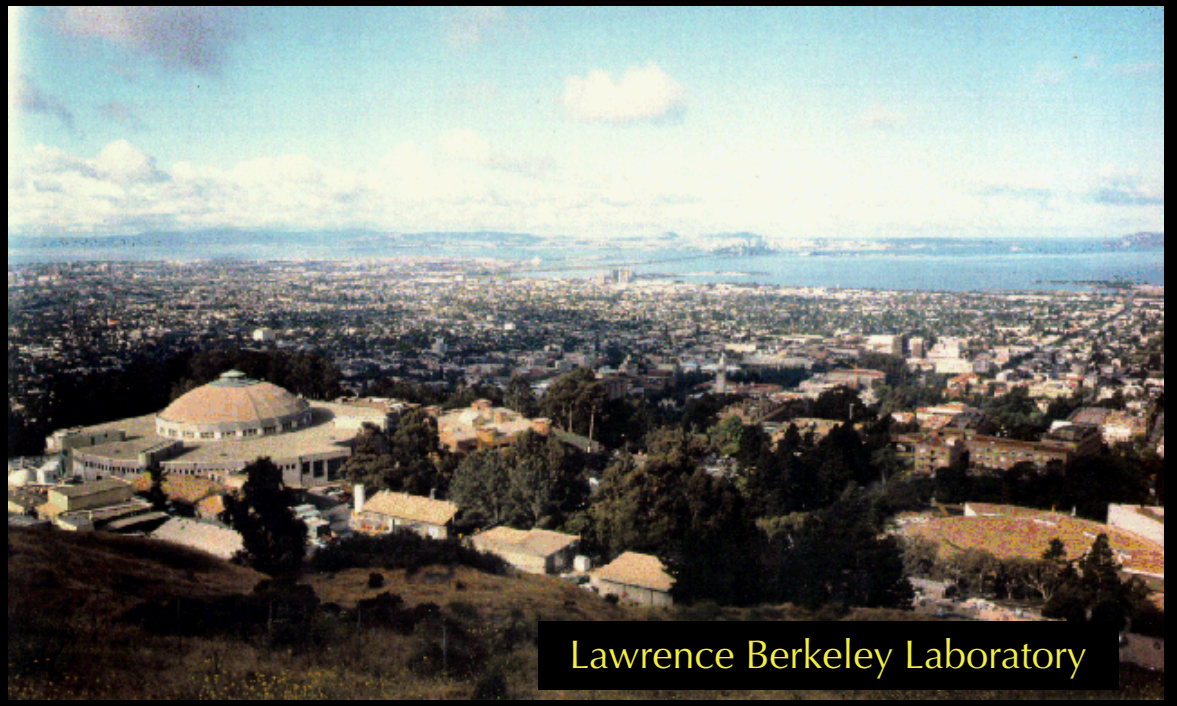


AIP Job Placement Registries

	Students registered	Jobs on offer
1963	449	514
1968	989	253
1970	1010	63
1971	1053	53

The "Fundamental Fysiks Group"

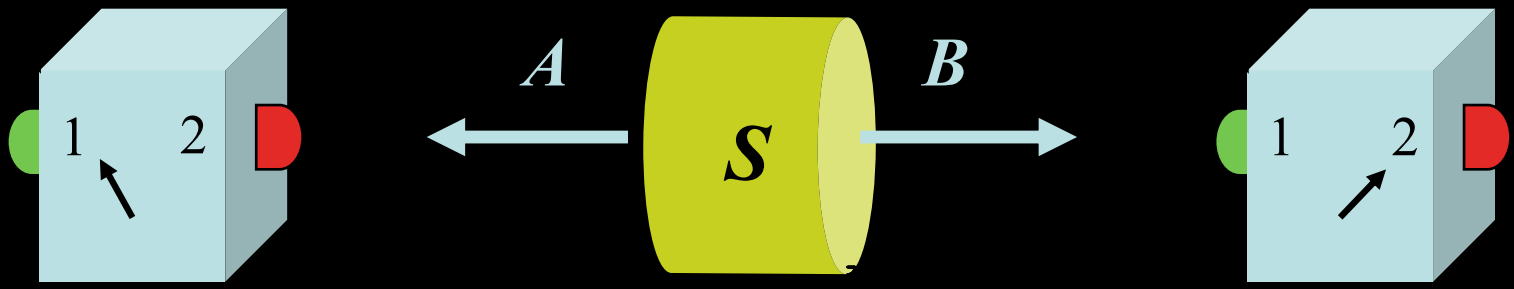
Founded in Berkeley, 1975. Core members had been Ph.D. students during the post-Sputnik boom, who graduated just as the physics job-market crashed.


Lawrence Berkeley Laboratory

They were trained in the era of "shut up and calculate," but were still curious about the foundations of quantum mechanics.

"It would be easier to learn about all this material if we got together for informal discussions and lectures." Elizabeth Rauscher

"Spooky Actions at a Distance"



John S. Bell

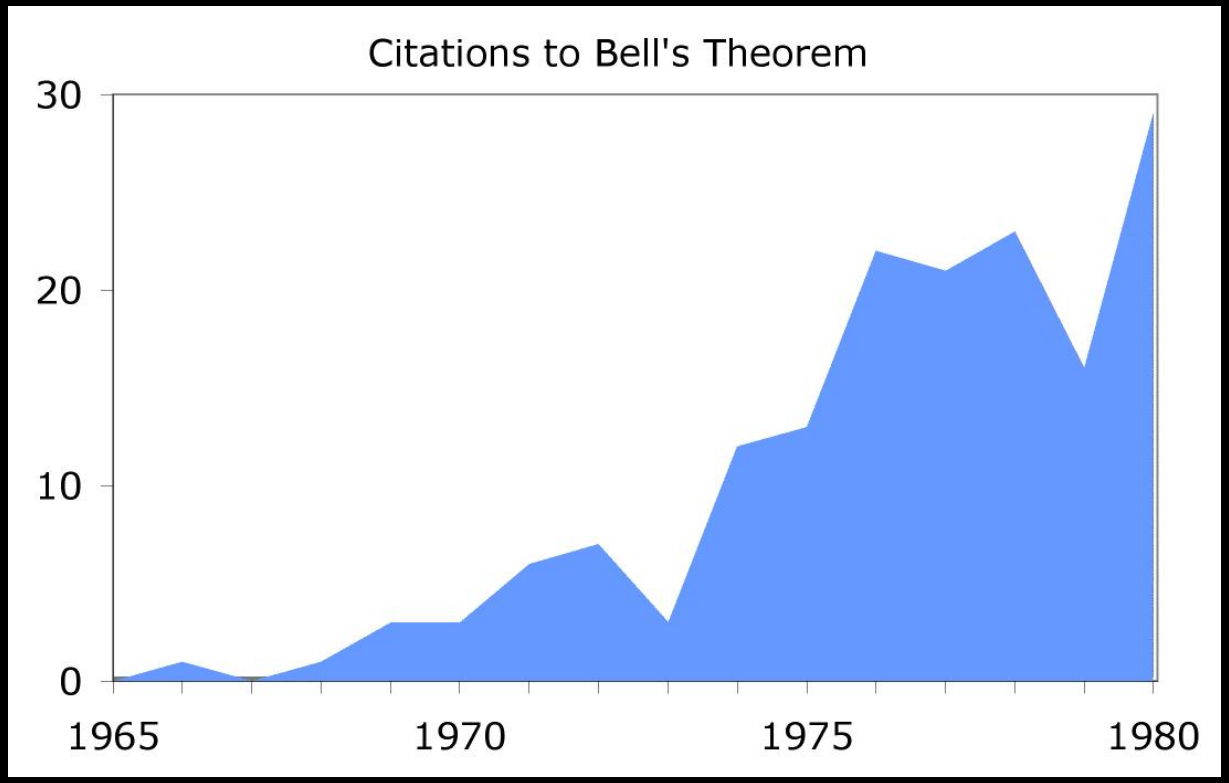
Entanglement: The whole is more than the sum of its parts.

"Bell's Theorem," 1964

The outcomes of measurements on *A* and *B* are *more strongly correlated* than if each particle had its own, individual properties.

"Renowned"

Today Bell's theorem is among the top 0.01% most-cited articles in all of physics. But it took a long time to get there…



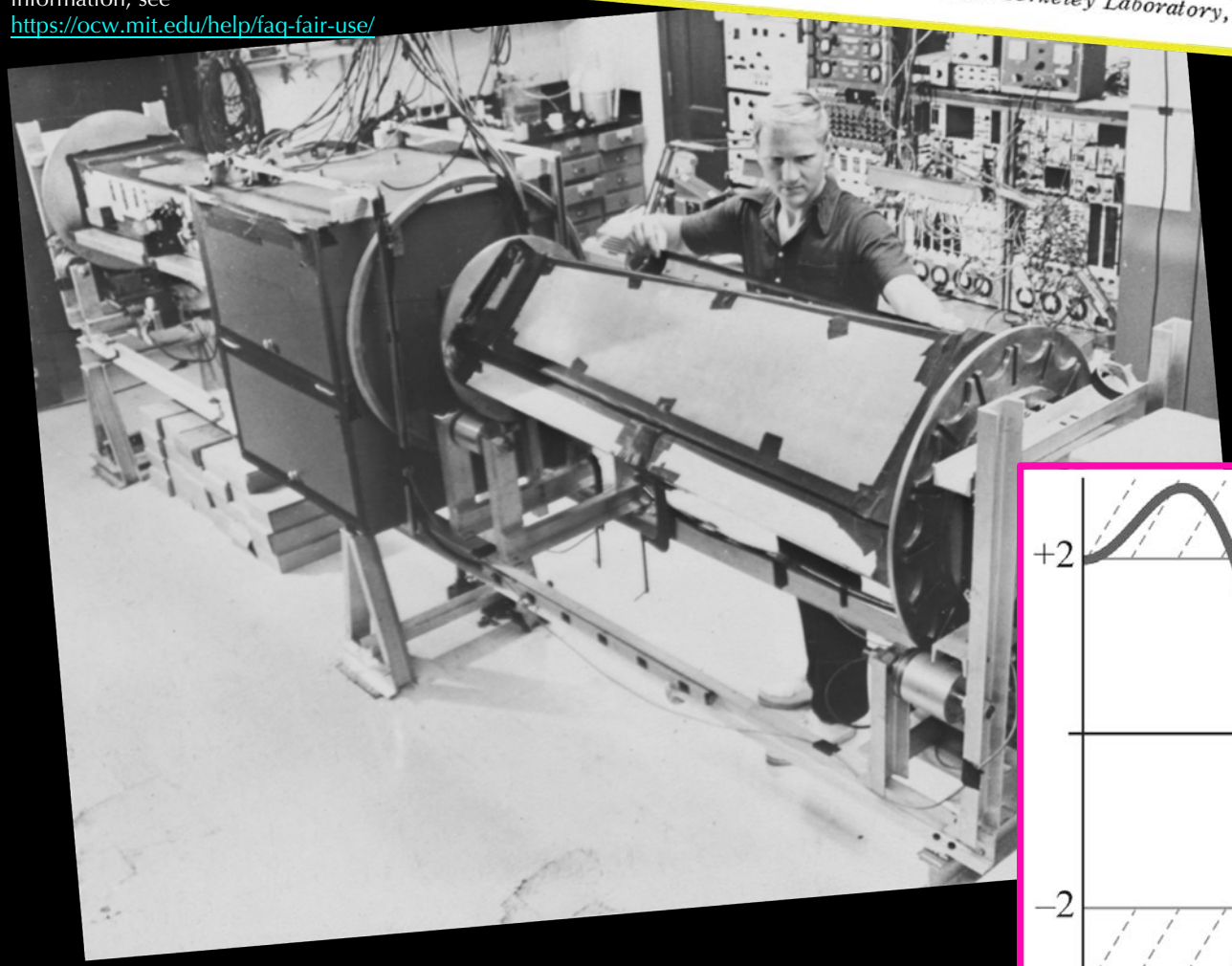
During the early period, *72%* of all US-based articles on Bell's theorem came from members of the FFG. (The proportion rises to *86%* if one includes acknowledgements.)

First Experimental Test

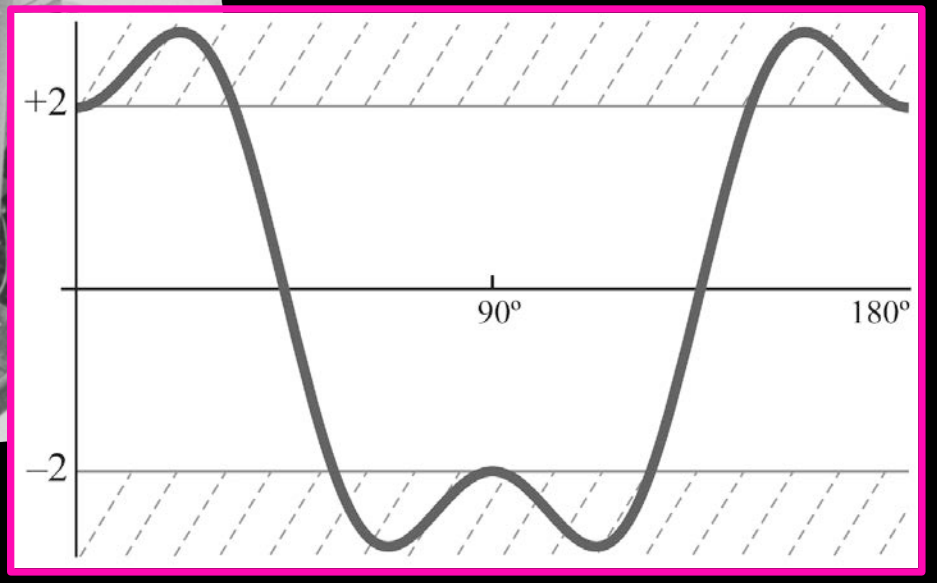
VOLUME 28, NUMBER 14 PHYSICAL REVIEW LETTERS 3 APRIL 1972

Experimental Test of Local Hidden-Variable Theories*

Stuart J. Freedman and John F. Clauser
Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720



John Clauser in his Berkeley lab, 1970s



From ψ to Psi

Use QM — especially Bell's theorem and nonlocality — to explain parapsychology ("psi") phenomena

ESP
- Telepathy
- Precognition
- Remote Viewing
- Psychokinesis

Uri Geller

Harold Puthoff, Russell Targ: papers in *Nature*, *Proc. IEEE*

"The ambiguity in the interpretation of QM leaves ample room for the possibility of psychokinetic and telepathic effects."

"My personal professional judgment as a Ph.D. physicist is that [Uri] Geller demonstrated genuine psycho-energetic ability."

Jack Sarfatti, 1974-75

Counterculture Darlings

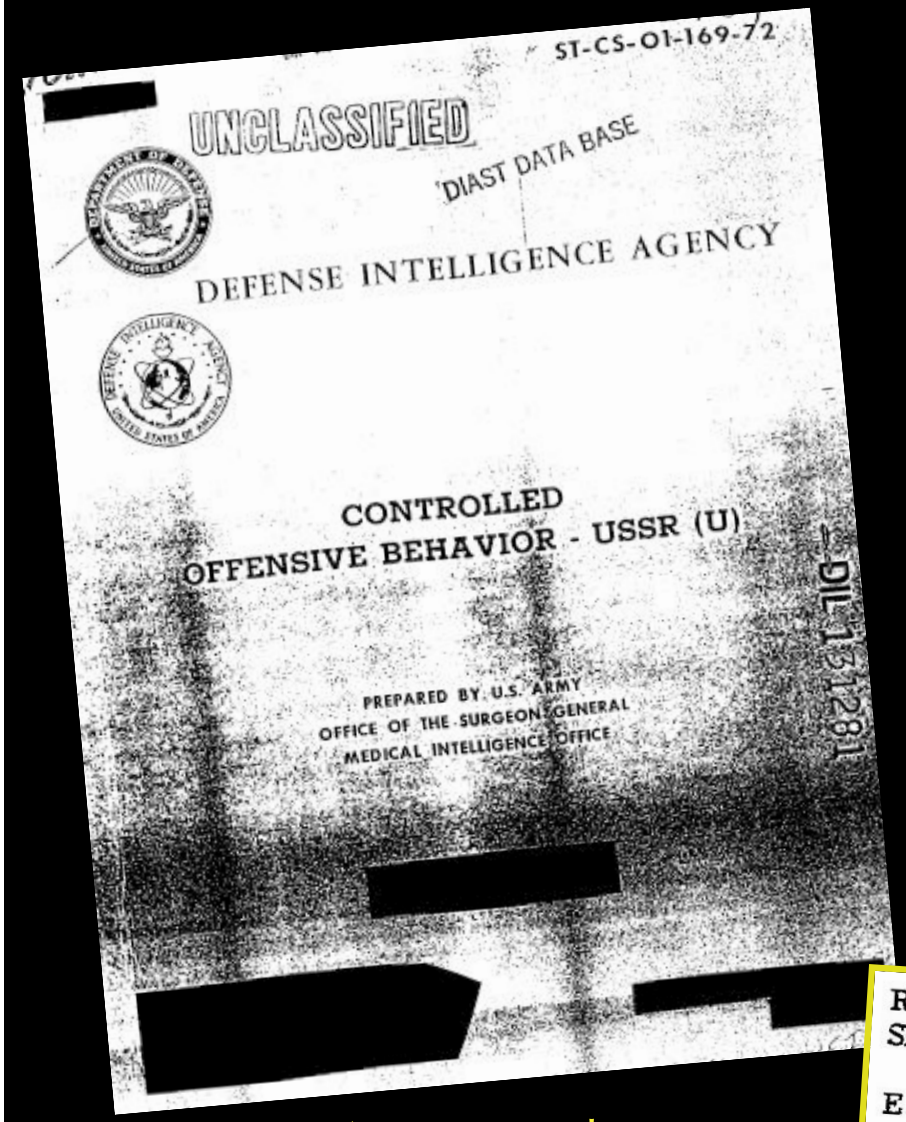
Jack Sarfatti, Saul-Paul Sirag, Nick Herbert, Fred Alan Wolf, 1975

> Sarfatti and co. were "going into trances, working at telepathy, and dipping into their subconscious in experiments toward psychic mobility." *City Magazine [SF]*, 1975

Similar descriptions appeared in magazines and newspapers throughout California; as far away as the *New Hampshire Sunday News*; and in *Time* and *Newsweek*.


Questions?

New Patrons: CIA and the "Psi Gap"



ST-CS-01-169-72

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DEFENSE INTELLIGENCE AGENCY

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OFFENSIVE BEHAVIOR - USSR (U)

PREPARED BY U.S. ARMY
OFFICE OF THE SURGEON GENERAL
MEDICAL INTELLIGENCE OFFICE

DIA 1 31281

DIA report, July 1972

Image is in the public domain.

CIA + DIA funding for "ESPionage"

1972:	$50k	[$250k]
1973:	$150k	[$700k]
1979:	$1m/yr	[$3m/yr]
1984-89:	$10m	[$20m]
1991:	$1m/yr	[$1.5m/yr]

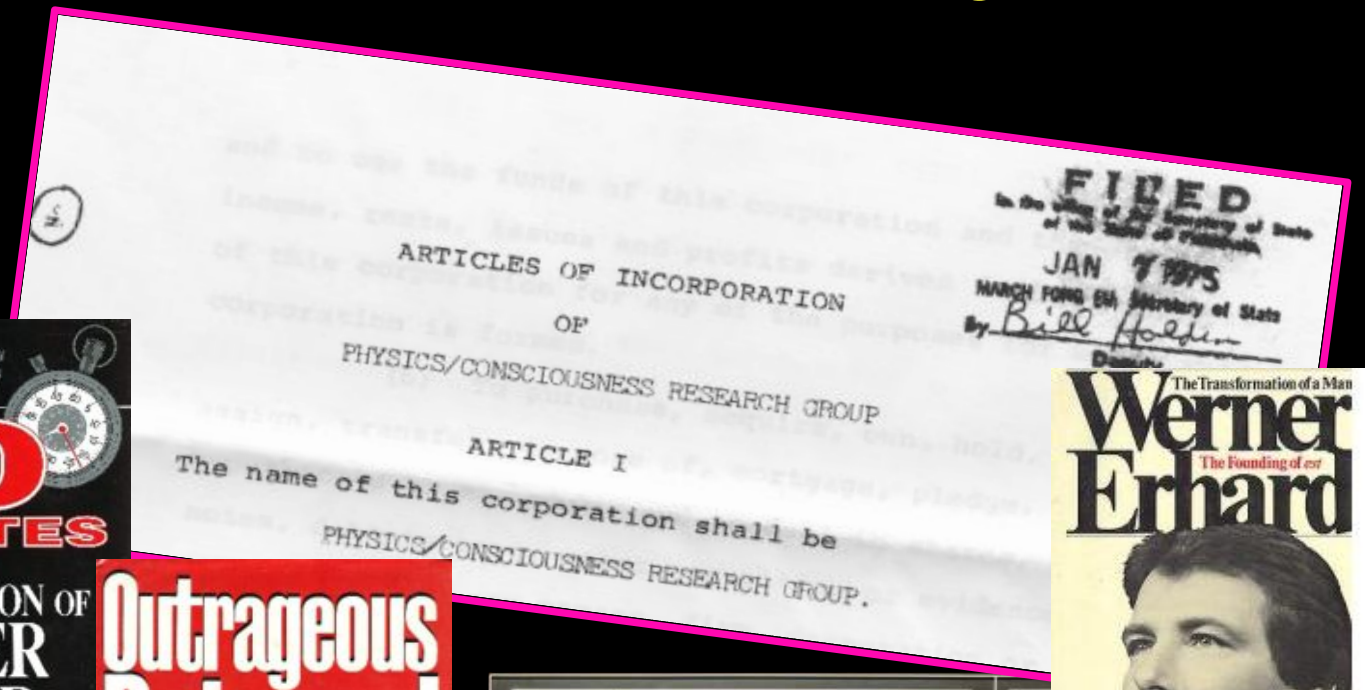
Program canceled in 1995 [?]

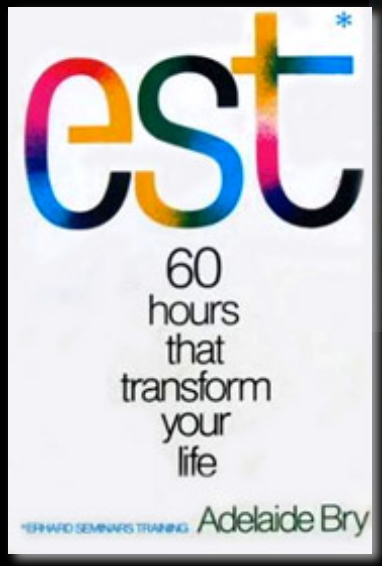
REMOTE PERCEPTION OF NATURAL SCENES, SHIELDED AGAINST ORDINARY PERCEPTION

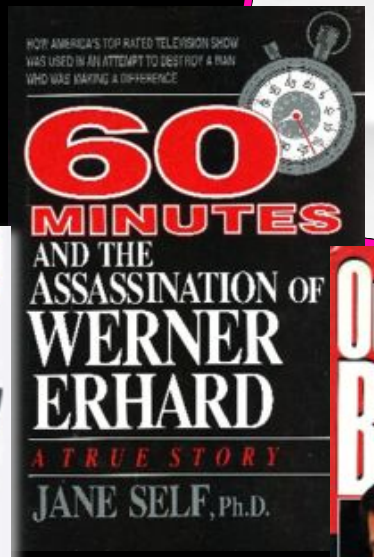
E. A. Rauscher† and G. Weissmann (Lawrence Berkeley Laboratory), J. Sarfatti (Physics/Consciousness Research Group, San Francisco), and S.-P. Sirag (Institute for the Study of Consciousness, Berkeley)

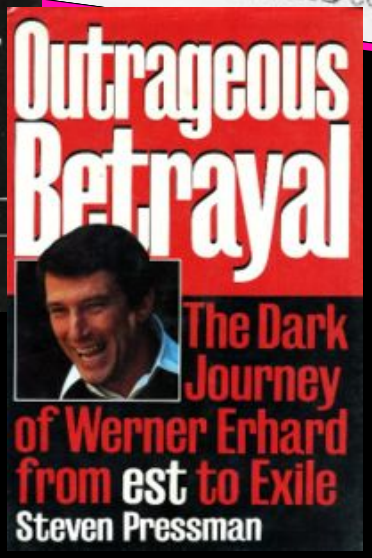
New Patrons: New Age Gurus

Most important new patron: "Werner Erhard" (aka Jack Rosenberg), founder of "Erhard Seminars Training" (*est*).









New Patrons

Overlapping patrons: *est* Foundation Physics conferences, 1977-85.

HARVARD UNIVERSITY

DEPARTMENT OF PHYSICS

JEFFERSON PHYSICAL LABORATORY
CAMBRIDGE, MASSACHUSETTS 02138

July 26, 1976

Dr. R. Feynman
Department of Physics
California Institute of Technology
1201 E. California Blvd
Pasadena, CA 91125

Dear Feynman,

A month ago I was approached by Dr. Robert Fuller of The *est* Foundation. His foundation is interested in sponsoring a series of small topical conferences in physics, vaguely inspired by the Solvay conferences. He sought advice from Chew, Feynman, and D. Finkelstein; they suggested he consult with me; he did, and we concocted the following proposal for the first conference:

2) The *est* Foundation (though a legally independent entity) derives its income from Erhard Seminars Training, a San Francisco based organization that offers expensive weekend self-improvement courses. For what it is worth, my uninformed opinion is that the fact that it is possible to make good money this way is yet another piece of evidence that we are living in the Golden Age of Silliness. However, this is irrelevant, because the proposed conference will be no more devoted to promoting Erhard Seminars than the activities of the Ford Foundation are to pushing Pintos. I have received explicit agreements to this effect from the responsible parties, and I promise you that at the slightest sign these agreements are not being kept, I will throw a tantrum and cancel the conference.

I hope we will be doing physics together in San Francisco next January.

Yours truly,

Sidney Coleman

Sidney Coleman
Professor of Physics

Big Thoughts in Big Sur

"Perhaps a new kind of inspired physicist, experienced in the yogic modes of perception, must emerge to comprehend the further reaches of matter, space, and time." Esalen catalog

Physics Month at the Esalen Institute Jan 1976

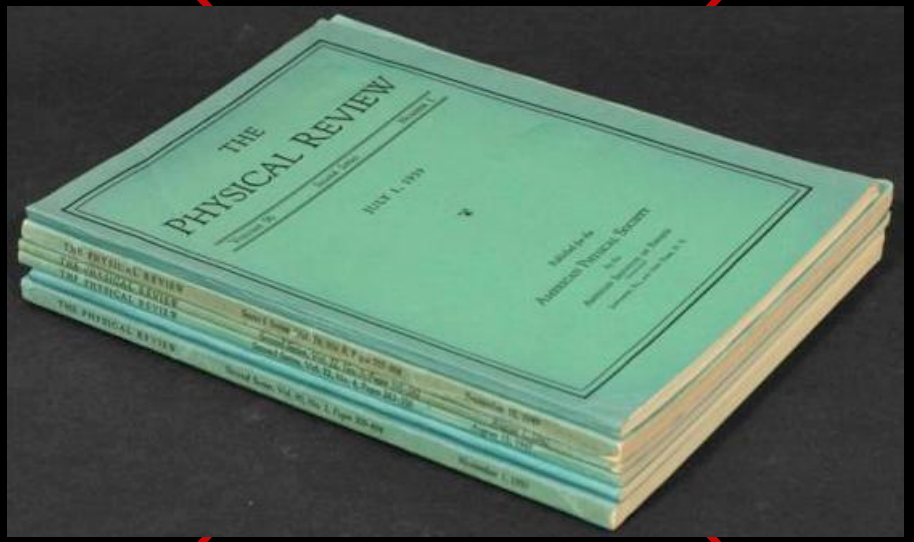
Esalen Institute, Big Sur, CA

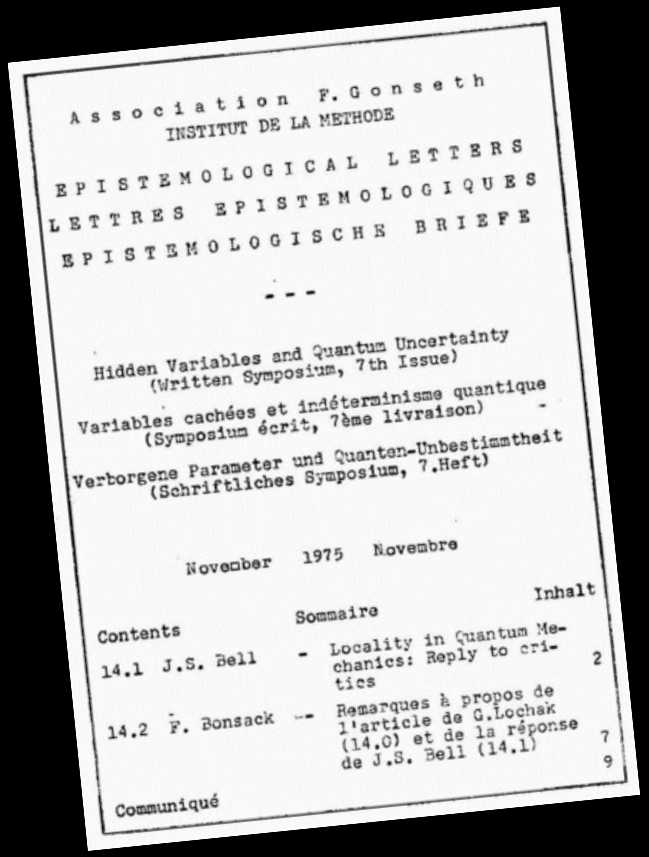
H. P. Stapp (LBL) lecturing in the "Big House" at Esalen

The **Bell's Theorem Study Group**, 1976-88, became the longest running workshop in Esalen's history

Spreading the Word

The editor of the *Physical Review* had *banned* articles on the interpretation of QM, even drawing up a special sheet of instructions for referees.





Association F. Gonseth
INSTITUT DE LA METHODE

EPISTEMOLOGICAL LETTERS
LETTRES EPISTEMOLOGIQUES
EPISTEMOLOGISCHE BRIEFE

Hidden Variables and Quantum Uncertainty
(Written Symposium, 7th Issue)

Variables cachées et indéterminisme quantique
(Symposium écrit, 7ème livraison)

Verborgene Parameter und Quanten-Unbestimmtheit
(Schriftliches Symposium, 7.Heft)

November 1975 Novembre

Contents Sommaire Inhalt

So the new material got shunted into unusual forums, such as the mimeographed "underground newsletter," *Epistemological Letters*.

The "Unicorn" Preprint Service

Ira Einhorn with Abbie Hoffman, late 1960s

Einhorn at first Earth Day rally, 1970

ORIGINAL TO IRA

Too dear from Jack SARFATT

27 April, 1973

A DIRAC EQUATION DESCRIPTION OF A QUANTIZED KERR SPACE-TIME *

Jack Sarfatt
Fred A. Wolf
College of Science, California State University at San Diego, 92115

ABSTRACT

A synthesis of general relativity with quantum field theory is proposed. A nonlinear spinor equation is obtained by using the Dirac "square root" trick on the Kerr-Schild form of the stationary, axisymmetric metric tensor which describes a rotating empty space-time of asymptotic mass m and angular momentum per unit mass a. The new Dirac equation reduces to the old Dirac equation in the limit where the Kerr space-time is replaced by the flat Minkowski space-time. The Kerr space-time can be pictured in a field theoretic way as arising from the "bending" of "neutrino" null geodesics due to the emission and absorption of virtual scalar mesons with a γ_5 vertex. The form of the equations is reminiscent of Salam's renormalizable nonpolynomial finite field theories. For this reason, we conjecture that the new Dirac equation, which describes an extended particle-like structure built from empty curved space with non-Euclidean topology, is free from renormalization infinities. Our equation is somewhat similar to the Heisenberg nonlinear spinor field equation. We have new insight into the wave-particle duality in terms of underlying spinor structure of space-time.

* To be submitted to the Intercontinental Journal of Theoretical Physics FOUNDATIONS OF PHYSICS

See pp4 & 5. on "PSI" EFFECT.

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GERALD FEINBERG
EVAN HARRIS WALKER
CHARLES MUSÈS
TOM BEARDEN
STAN ROSEN
TOM KUHN
PETER KÜMMEL

THE PHILOSOPHY OF GEOMETRODYNAMICS

Geometrodynamics[1] says that there is only empty space-time subject to the fluctuations of the uncertainty principle when we reach the fundamental level of things. Matter is a coherent low energy disturbance of the violently fluctuating "quantum foam"[1]. There is no "foreign" source in the "arena" of space-time[1]. The nonlinearity of the gravitational field "bootstraps" its own source in the form of true singularities of infinite curvature, event horizons and non-Euclidean topologies. The particle is derived from the field. For example, in the Schwarzschild spherically symmetric solution of

$$R_{\mu\nu} = 0 \quad . \qquad (1)$$

the "source" is a true singularity of infinite curvature at r = 0. The topology of space-like slices is non-Euclidean being a double sheeted Einstein-Rosen bridge or a single sheeted wormhole depending on the choice of asymptotic boundary conditions. The 2-sphere wormhole mouths move like extended particles - the equation of particle motion is a consequence of the field equation (1). Equation (1) is fundamental, though it might have torsion[2] and quantum fluctuation[3] corrections. The equation

$$R_{\mu\nu} - \tfrac{1}{2} g_{\mu\nu} R = T_{\mu\nu} \quad . \qquad (2)$$

is not fundamental but arises as a coarse grained description of space-time at the macroscopic level. The fundamental level of quantum foam has a length scale $L^* = (\hbar G/c^3)^{1/2} = 1.6 \times 10^{-33}$ cm. and an energy scale of $m^* = (\hbar c/G)^{1/2} = 10^{19}$ Gev. Leptons and hadrons are collective features having a length scale of order $10^{19} L^*$ and an energy scale of order $10^{-19} m^*$. The experimental facts that hadron resonances lie on straight line Regge trajectories of almost universal slope, that the nucleon looks like a collection of point-like "partons" in deep inelastic electron scattering, that heavy leptons are not seen, that quarks are not seen, and that the hadron has a dual pomeron plus regeon character can all be qualitatively understood from the geometrodynamic point of view[3].

The idea of a "point particle" is a stumbling block for physics. It is the cause of renormalization infinities. Arnowitt, Deser and Misner[4] show that a point particle is not a suitable object in general relativity. A point particle in general relativity must have zero mass-energy. We try to make a quantum field theory that incorporates this result.

IVAN TOLSTOY
NICK HERBERT
FREEMAN DYSON
TED BASTIN
JOHN A. WHEELER
PHYSICS DEPT.
PRINCETON UNIV. PRINCETON N.J. 08540

The "Unicorn" Preprint Service

Ira Einhorn with Abbie Hoffman, late 1960s

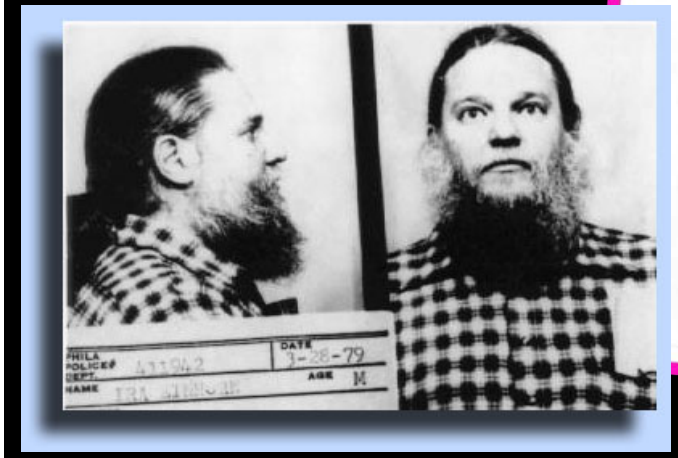

Image is in the public domain.

Einhorn mugshots, 1979

ORIGINAL TO IRA

Too our from file SARFATT

A DIRAC EQUATION DESCRIPTION OF A QUANTI

Jack Sarfatt
Fred A. Wolf
College of Science, California State University

ABSTRACT

A synthesis of general relativity with quantum
proposed. A nonlinear spinor equation is obtained
"square root" trick on the Kerr-Schild form of the
metric metric tensor which describes a rotating empt
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TED BASTIN
JOHN A. WHEELER
PHYSICS DEPT.
PRINCETON UNIV. PRINCETON N.J. 08540

Investigators remove the remains of Holly Maddux from Einhorn's apartment

Capra in the Classroom

Physics Today: not only did Capra's book get the physics right; it couched physics in "the immediate, feeling-oriented vision of the mystic so attractive to many of our best students."

American Journal of Physics: "It should be emphasized that most of these students would not have taken an offering in the Physics Department if it were not this one."

Relating mystical concepts to those of physics: Some concerns
Donald H. Esbenshade, Jr.
Am. J. Phys. 50(3), March 1982

Teaching *The Tao of Physics*
David Harrison[a)]
Am. J. Phys. 47(9), Sept. 1979

Questions?

Superluminal Telegraphy

IRA - PLEASE CIRCULATE WIDELY!
Sarfatti

Sarfatti

May 8, 1978

Commissioner of Patents and Trademarks
Washington D.C. 20231

The undersigned, being the inventor of the disclosed invention, requests that the enclosed papers, on a Faster-than-light-Quantum Communication System, be accepted under the Disclosure Document Program, and that they be preserved for a period of two years.

Sincerely,
Jack Sarfatti

JUN 23 1978

Sarfatti: Faster-than-light page 3

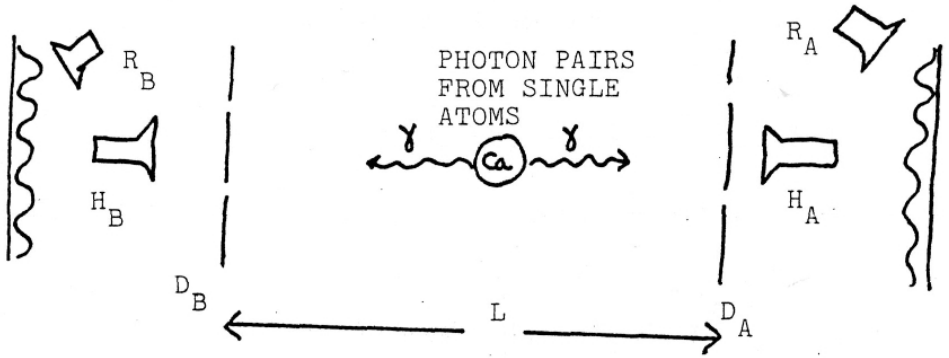
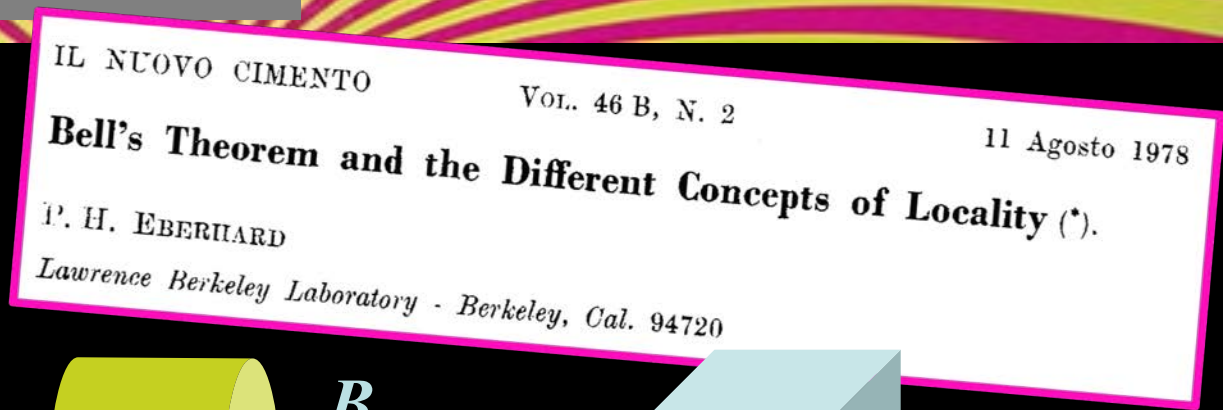


Fig. 1

SCHEMATIC OF THE SYSTEM FOR SUPERLUMINAL COMMUNICATION

"[The device could] give instant communication between an intelligence agent and his headquarters. In this case, we would use ... correlated psycho-active molecules such as LSD, affecting the neurotransmitter chemistry."

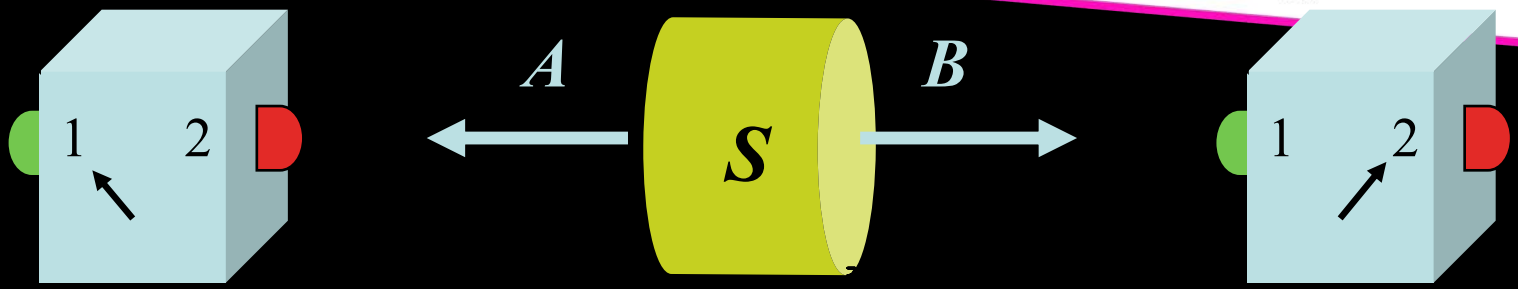
Eberhard's Response


IL NUOVO CIMENTO Vol. 46 B, N. 2 11 Agosto 1978

Bell's Theorem and the Different Concepts of Locality (*).

P. H. EBERHARD

Lawrence Berkeley Laboratory - Berkeley, Cal. 94720



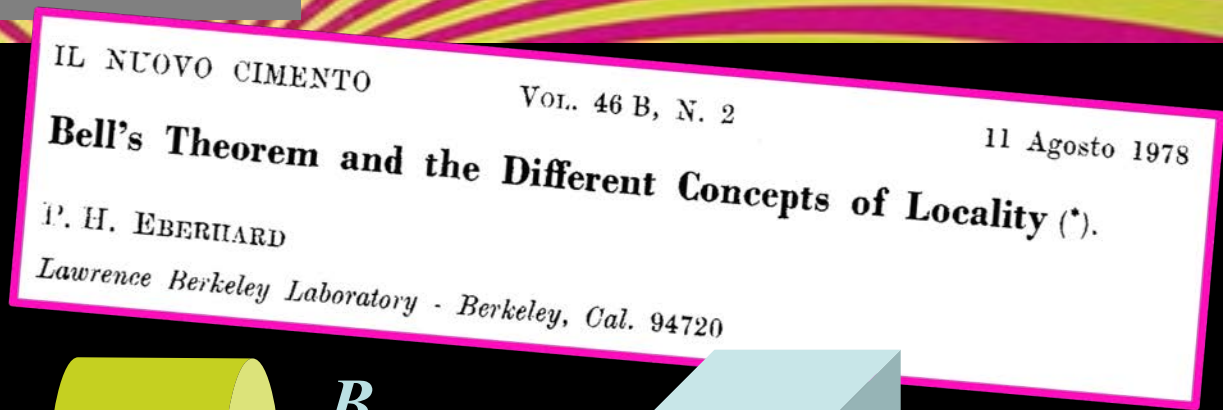
GGRGRRGGR…

GRRGGRGRR…

If one only has access to the output at *one side*, then one finds a ***random pattern*** of **G** and **R**. There is no way to know that each output is ***correlated*** with the outputs at the distant detector until one ***shares information*** about the distant detector settings and measurement outcomes by some means — at or below the speed of light.*

* See optional Lecture Notes on "Bell's inequality and quantum entanglement"

Eberhard's Response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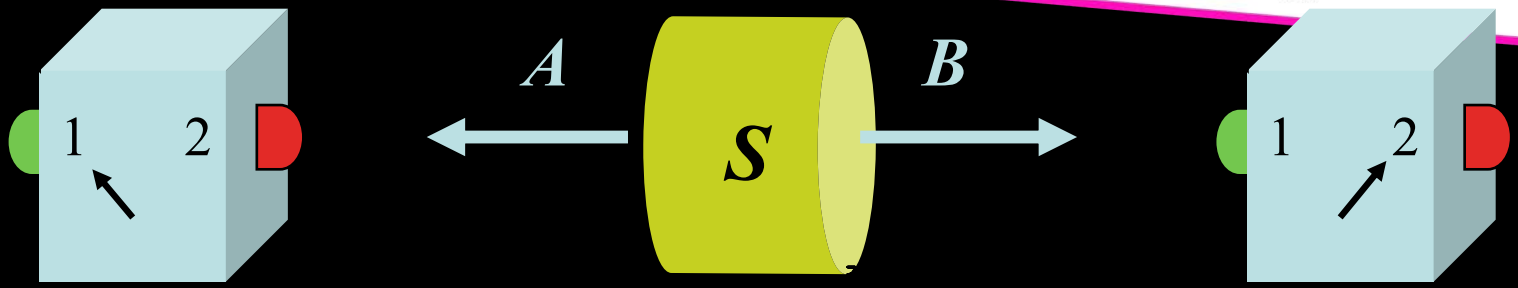
Bell's Theorem and the Different Concepts of Locality (*).

P. H. EBERHARD

Lawrence Berkeley Laboratory - Berkeley, Cal. 94720

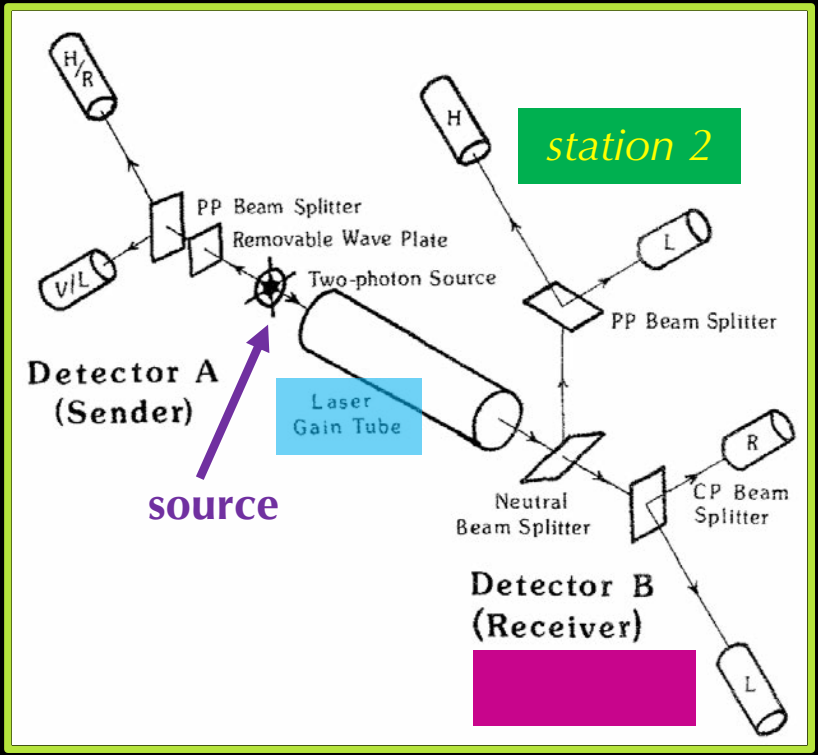


GGRGRRGGR…

GRRGGRGRR…

Eberhard's conclusion: the proof depended on several assumptions, which might fail. "Consequently any attempt to discourage the work that is being performed [by the FFG] would be either futile or counterproductive."

FLASH*



Circular polarization states (*R*, *L*) and plane polarization states (*H*,*V*)

$$|R\rangle = \frac{1}{\sqrt{2}}\Big\{\,|H\rangle + i\,|V\rangle\,\Big\}$$
$$|L\rangle = \frac{1}{\sqrt{2}}\Big\{\,|H\rangle - i\,|V\rangle\,\Big\}$$

Prepare entangled states at the source

$$|\Psi^-\rangle = \frac{1}{\sqrt{2}}\Big\{\,|H\rangle_A|V\rangle_B - |V\rangle_A|H\rangle_B\,\Big\}$$
$$= \frac{i}{\sqrt{2}}\Big\{\,|R\rangle_A|L\rangle_B - |L\rangle_A|R\rangle_B\,\Big\}$$

Measure photon *A* in *either* the (*H*, *V*) *or* the (*R*, *L*) basis. Next photon *B* enters a ***laser gain tube***, which emits ***many copies*** of photon *B*. Send half of those copies to ***station 1***, which measures in the (*R*, *L*) basis, and half the copies to ***station 2***, which measures in the (*H*, *V*) basis.

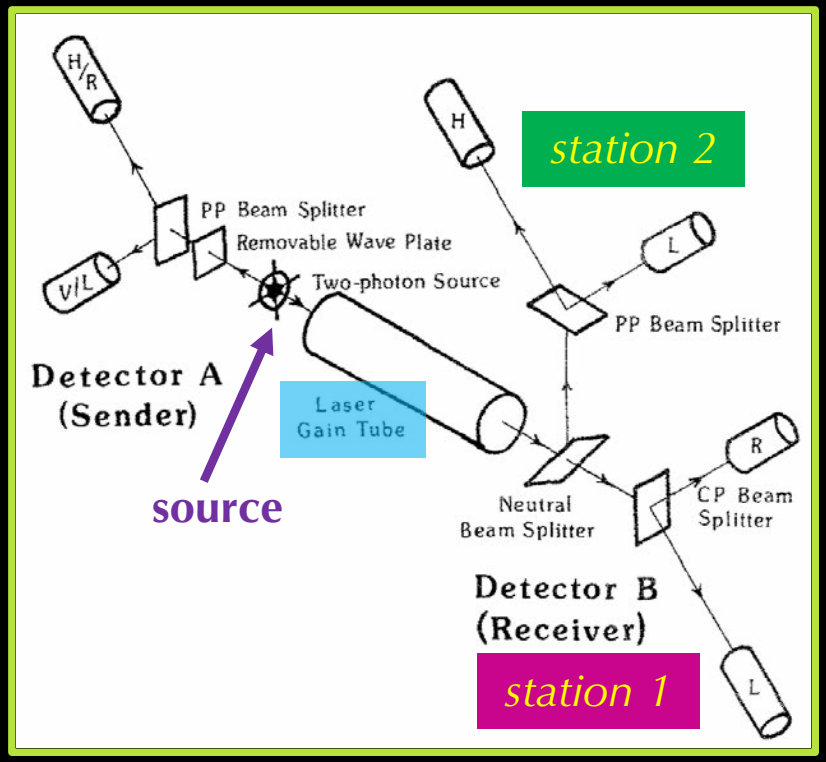
If measure *A* in the (*R*, *L*) basis and find *L*, then *B* should find:

station 1	station 2
R: 50	*H*: 25
L: 0	*V*: 25

If measure *A* in the (*H*, *V*) basis and find *H*, then *B* should find:

station 1	station 2
R: 25	*H*: 0
L: 25	*V*: 50

FLASH*



If measure *A* in the (*R*, *L*) basis and find *L*, then *B* should find:

station 1	station 2
R: 50	*H*: 25
L: 0	*V*: 25

NSF # 81-2003

FLASH--A SUPERLUMINAL COMMUNICATOR BASED UPON A NEW KIND OF QUANTUM MEASUREMENT

ABSTRACT: The FLASH communicator consists of an apparatus which can distinguish between plane-unpolarized (PUP) and circularly-unpolarized (CUP) light plus a simple EPR arrangement. FLASH exploits the peculiar properties of "measurements of the 3rd kind". One purpose of this article is to focus attention on the operation of laser gain tubes at the one-photon limit.

NICK HERBERT
NOTIONAL SCIENCE FOUNDATION
BOX 261
BOULDER CREEK
CALIF 95006

FOUNDATIONS OF PHYSICS

1) "This is an important result. The article is beautifully written and I recommend its publication."

2) "We have not been able to identify any fundamental flaws with the proposed experiment that reveal the origin of the paradox." (The "we" here are two authors.)

3) "I spoke to several people in Europe, and everybody believes that it (Herbert's FLASH Experiment) should work."

NSF image is in the public domain.

*First Laser-Amplified Superluminal Hookup

From No Cloning…

Foundations of Physics, Vol. 12, No. 12, 1982

FLASH[1]—A Superluminal Communicator Based Upon a New Kind of Quantum Measurement

Nick Herbert[2]

via Einhorn network

Dear Professor van der Merwe,
Concerning the paper "Flash - a Superluminal Communicator Based Upon a New Kind of Quantum Measurement" by Nick Herbert, I consider that it has to be rejected in toto for the reasons I am describing on the enclosed sheet.
With my best regards.

Yours sincerely,

GianCarlo Ghirardi
Istituto di Fisica Teorica
Università di T…

March 29th, 1982
Velocity of light limit on information propagation and quantum nonseparability imply existence of spontaneous emission.

In an attempt to propagate information faster than light one could try to use nonseparably correlated pairs of photons, produced, for example, in a decay of positronium atom: A collection of such atoms could be placed between the two observers and used as a source of nonseparably correlated pairs of photons. If it were possible to amplify the polarization of one of these photons exactly then one would be able to pass the information at the velocity exceeding the velocity of light.
To realize Kleb's project one could have to employ an amplifier capable of amplifying polarization of a single photon. It is therefore of important to invoke the polarization amplification based on the stimulated emission.
Q 1: How good could be such amplifier to [illegible] faster than light communication?
Guess: correlation between the pol'n of photon & the pol'n of the amplified light.

LASER

Wojciech Zurek's notebook

From *linearity*:

$|R\rangle = [|H\rangle + i|V\rangle]$, so the amplifier yields

$|R\rangle \rightarrow [|HHH\ldots\rangle + i|VVV\ldots\rangle]$, rather than

$[|H\rangle + i|V\rangle]^N$.

Measurement would yield *all H* or *all V* (each with 50% probability), not 50 copies of each.

Nature Vol. 299 28 October 1982

A single quantum cannot be cloned

W. K. Wootters*

Center for Theoretical Phys…
Austin, Texas 78712, USA

W. H. Zurek

Theoretical Astrophysics 13…
Pasadena, California 91125

Volume 92A, number 6 PHYSICS LETTERS 22 November 1982

COMMUNICATION BY EPR DEVICES

D. DIEKS
Fysisch Laboratorium, Rijksuniversiteit Utrecht, Utrecht, The Netherlands

…To Quantum Encryption

Foundations of Physics, Vol. 12, No. 12, 1982

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COMMUNICATION BY EPR DEVICES

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Fysisch Laboratorium, Rijksuniversiteit Utrecht, Utrecht, The Netherlands

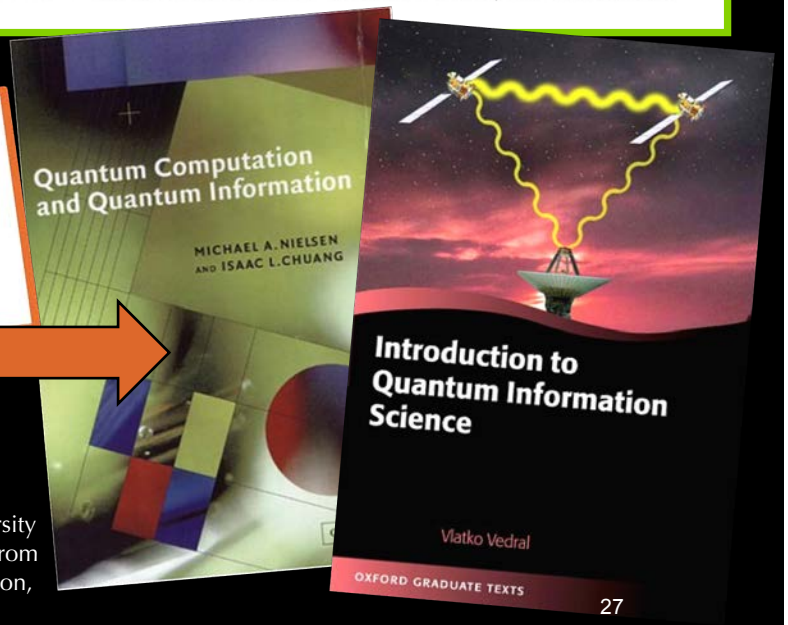
Conjugate Coding *

Stephen Wiesner

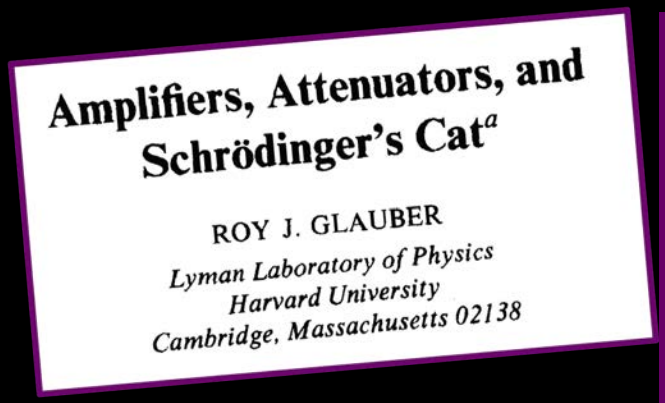
Columbia University, New York, N.Y.
Department of Physics

QUANTUM CRYPTOGRAPHY: PUBLIC KEY DISTRIBUTION AND COIN TOSSING

Charles H. Bennett (IBM Research, Yorktown Heights NY 10598 USA)
Gilles Brassard (dept. IRO, Univ. de Montreal, H3C 3J7 Canada)



Productive Mistakes

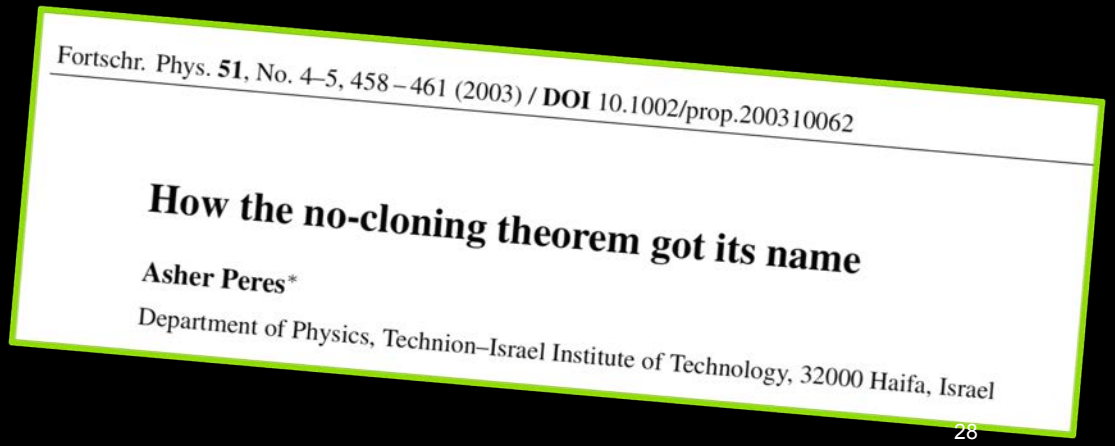


Amplifiers, Attenuators, and Schrödinger's Cat[a]

ROY J. GLAUBER
Lyman Laboratory of Physics
Harvard University
Cambridge, Massachusetts 02138

"There was a time, well over a century ago, when clever schemes to construct perpetual motion machines were all the rage. The effort spent on them was not all wasted; they did help teach us two important principles of thermodynamics. […] The same infernal ingenuity that once went into perpetual motion machines is now suggesting means for communicating faster than light. […] Some of these are interesting schemes; they too might just be capable of teaching us something."

"Nick Herbert's erroneous paper was a spark that generated immense progress."



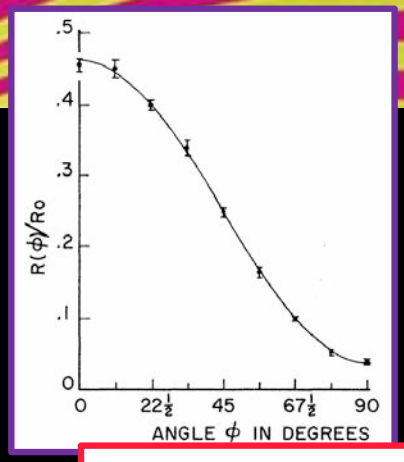
Fortschr. Phys. **51**, No. 4–5, 458 – 461 (2003) / **DOI** 10.1002/prop.200310062

How the no-cloning theorem got its name

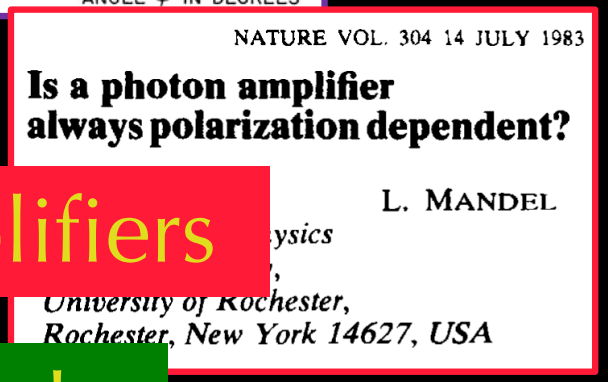
Asher Peres*
Department of Physics, Technion–Israel Institute of Technology, 32000 Haifa, Israel

Groovy Entanglements

First experimental tests

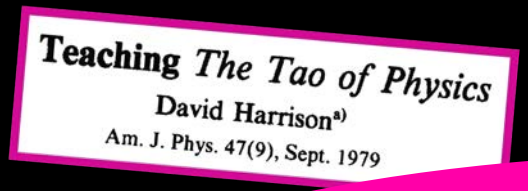


Compatibility of Bell's theorem and relativity

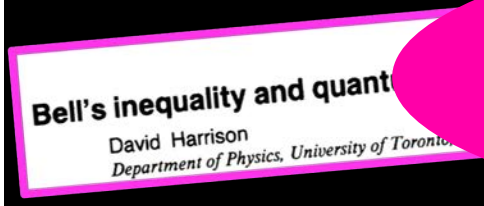


Quantum limits to amplifiers

Quasi-Textbooks



Early lesson plans



This work — with all its excesses — helped to bring foundational topics back into US physics classrooms.

STS.042J / 8.225J Einstein, Oppenheimer, Feynman: Physics in the 20th Century
Fall 2020