Counterculture and Physics
I. New Topics

II. New Patrons, New Forums

III. FLASH!
Quantum Encryption

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

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

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

AIP Job Placement Registries
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.

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
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.
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

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
Use QM — especially Bell’s theorem and nonlocality — to explain parapsychology (“psi”) phenomena.

“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

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"

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 [?]

DIA report, July 1972

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. Strag (Institute for the Study of Consciousness, Berkeley)

Image is in the public domain.
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.

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:

1) 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,

[Signature]

Sidney Coleman
Professor of Physics
“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.”

-H. P. Stapp (LBL) lecturing in the “Big House” at Esalen Institute, Big Sur, CA
The editor of the *Physical Review* had *banned* articles on the interpretation of QM, even drawing up a special sheet of instructions for referees.

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

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

Image is in the public domain.
Einhorn mugshots, 1979

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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
Am. J. Phys. 47(9), Sept. 1979
“[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.”
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 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.”
Circular polarization states \((R, L)\) and plane polarization states \((H, V)\)

Prepare entangled states at the source

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**
  - \(R: 50\)
  - \(L: 0\)

- **station 2**
  - \(H: 25\)
  - \(V: 25\)

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

- **station 1**
  - \(R: 25\)
  - \(L: 25\)

- **station 2**
  - \(H: 0\)
  - \(V: 50\)
If measure $A$ in the $(R, L)$ basis and find $L$, then $B$ should find:

- **station 1**: $R: 50$, $L: 0$
- **station 2**: $H: 25$, $V: 25$
From No Cloning…

**From linearity:**

\[ |R\rangle = [ |H\rangle + i |V\rangle ] \]

so the amplifier yields

\[ |R\rangle \rightarrow [ |HHH...\rangle + i |VVV...\rangle ] \]

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.

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**A single quantum cannot be cloned**

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Theoretical Astrophysics

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COMMUNICATION BY EPR DEVICES

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...To Quantum Encryption

FLASH¹—A Superluminal Communicator Based Upon a New Kind of Quantum Measurement

Nick Herbert

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)

A single quantum cannot be cloned

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Volume 92A, number 6 PHYSICS LETTERS 22 November 1982

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“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.”

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

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