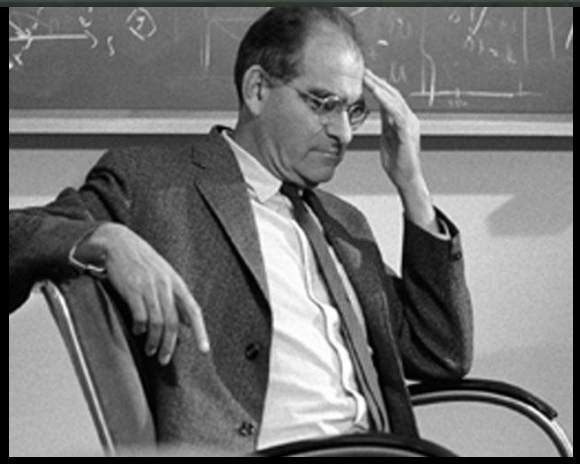
“It was 50 years ago today…”

A Brief Look Back at Physics, MIT, and the World of 1968

David Kaiser

Center *for* Theoretical Physics



MIT's CTP was founded in 1968. Physics Department Head Viki Weisskopf authorized Prof. Herman Feshbach to lead the project.

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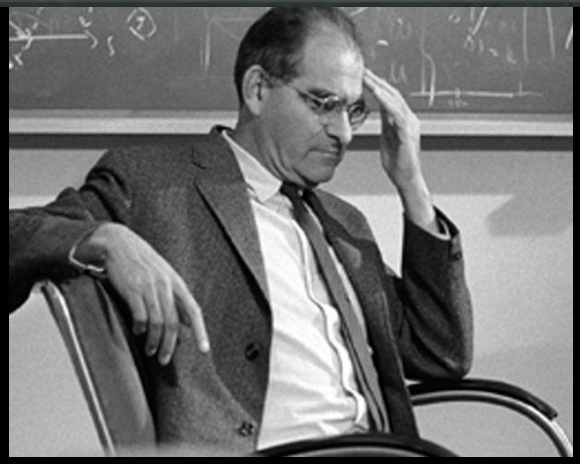

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Under Feshbach's direction, the contractors began renovations to the 3rd and 4th floors of Building 6 in June 1967, and completed the work by the end of October 1967 (!). Feshbach became the CTP's first Director.

Center *for* Theoretical Physics

Herman Feshbach:
What it Meant to be a Physicist in
the Twentieth Century

by

Juana C. Becerra

SUBMITTED TO THE DEPARTMENT OF SCIENCE, TECHNOLOGY AND SOCIETY IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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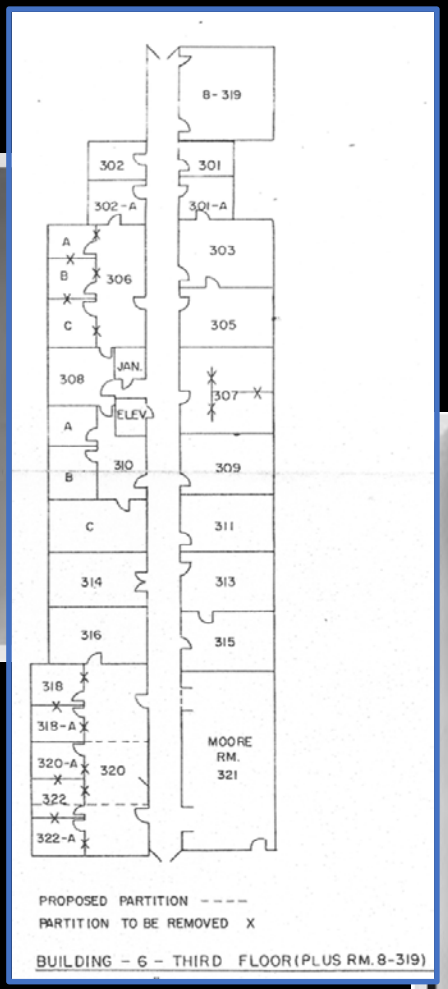

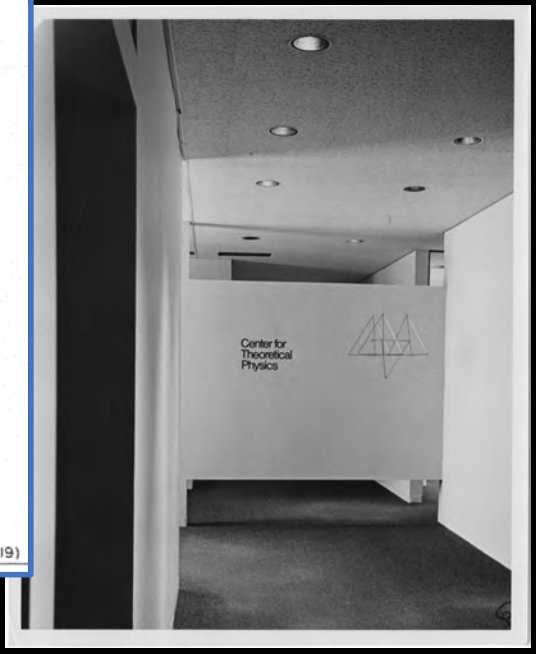

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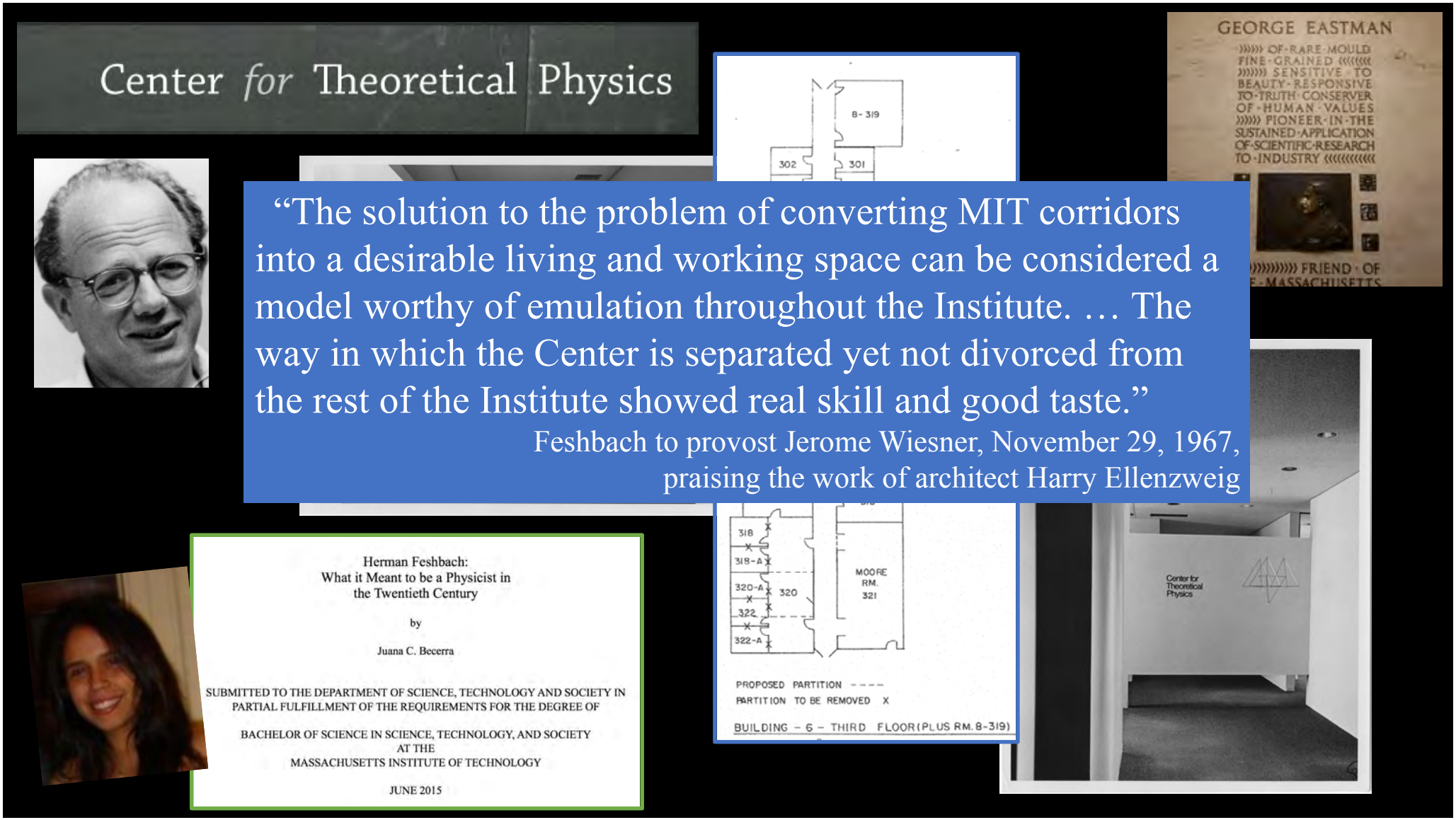
Center for Theoretical Physics
GEORGE EASTMAN
OF RARE MOULD
FINE GRAINED
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SUSTAINED APPLICATION
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Feshbach to provost Jerome Wiesner, November 29, 1967, praising the work of architect Harry Ellenzweig
8-319
302
301
318
318-A
320-A
320
322
322-A
MOORE RM. 321
PROPOSED PARTITION
PARTITION TO BE REMOVED X
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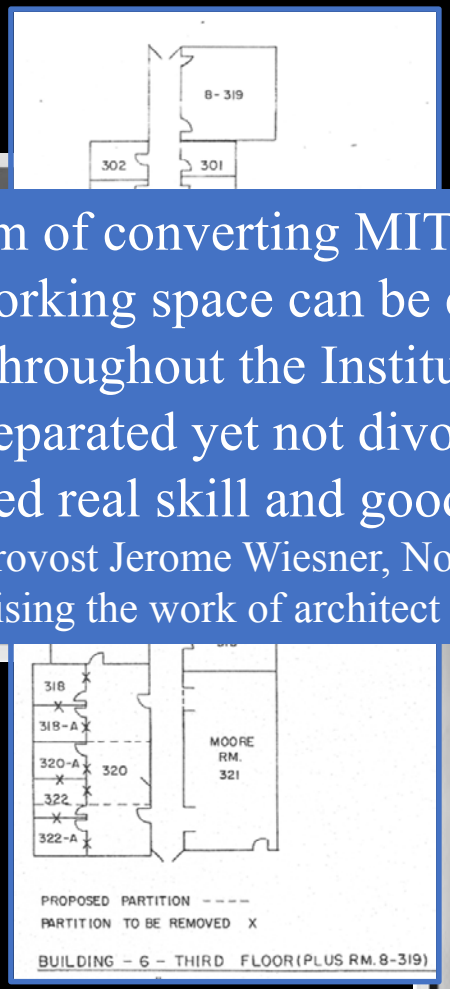

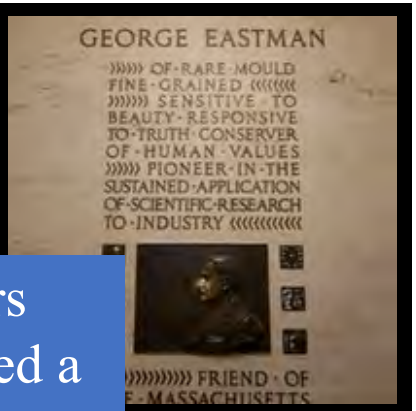

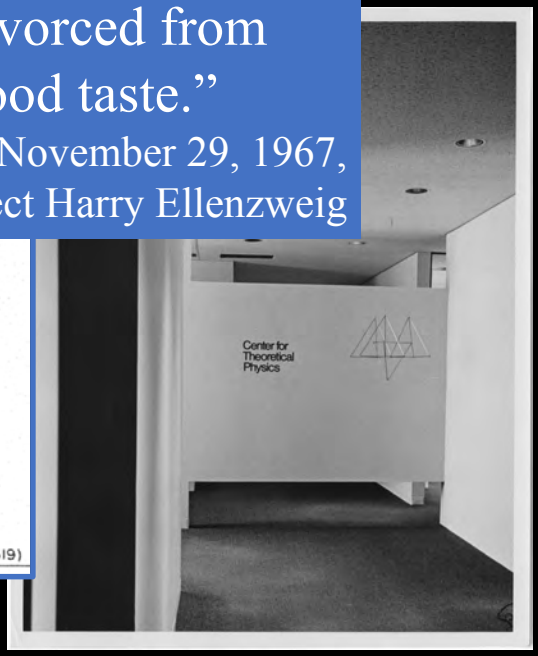

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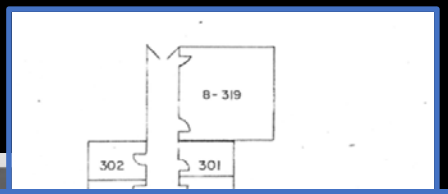

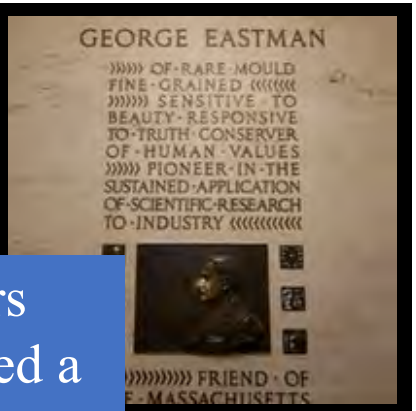

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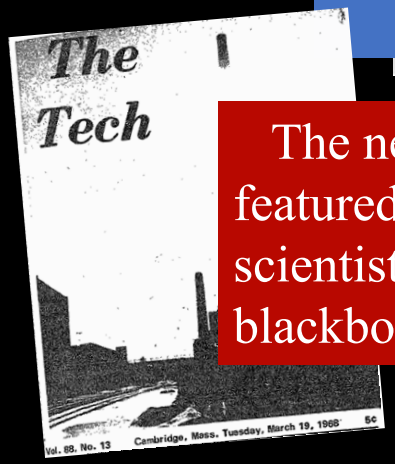

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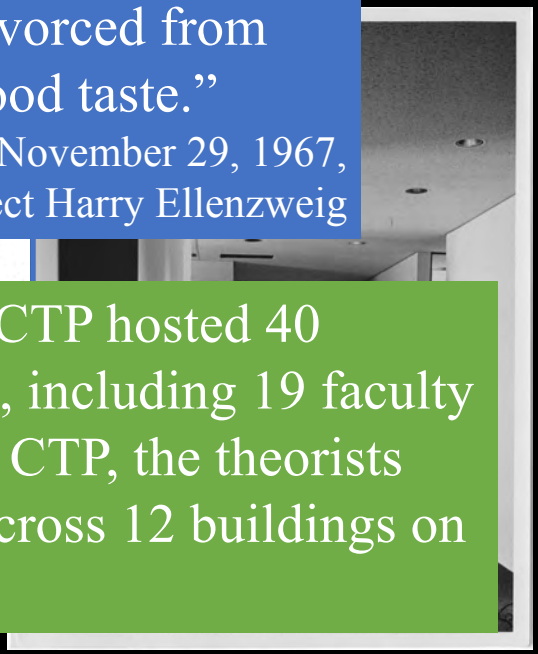
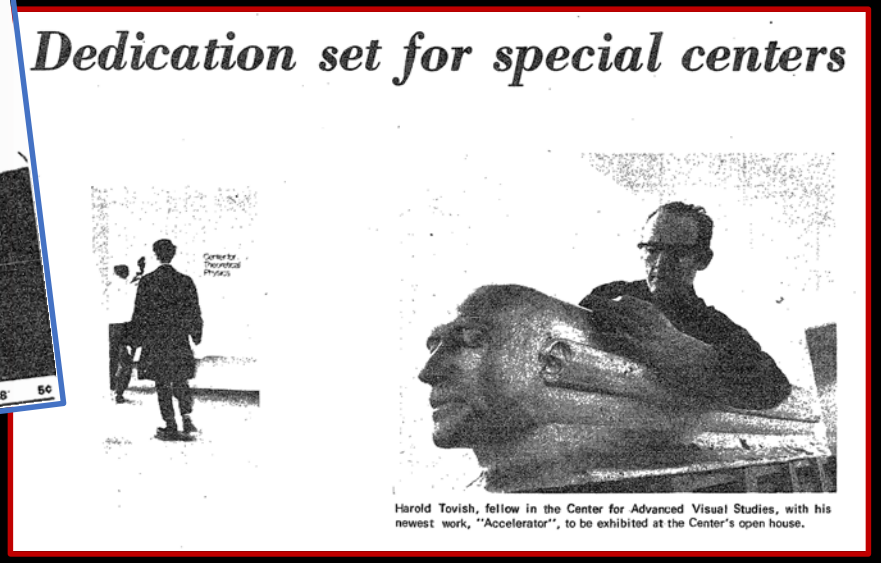


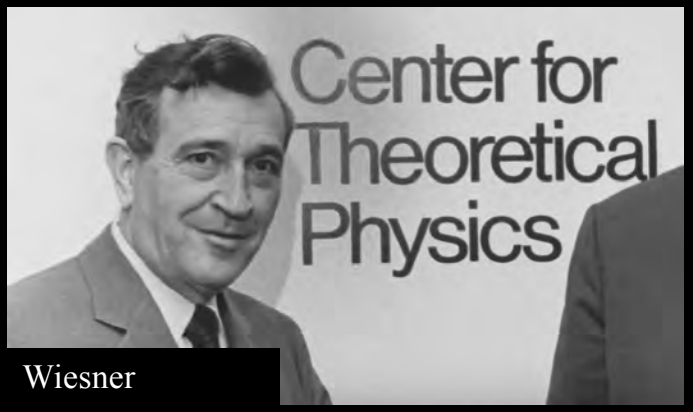
In its first year, the CTP hosted 40 theoretical physicists, including 19 faculty members. Before the CTP, the theorists had been dispersed across 12 buildings on MIT's campus.

Inaugural symposium, March 20 – 22, 1968



Dedication set for special centers

Harold Tovish, fellow in the Center for Advanced Visual Studies, with his newest work, "Accelerator", to be exhibited at the Center's open house.



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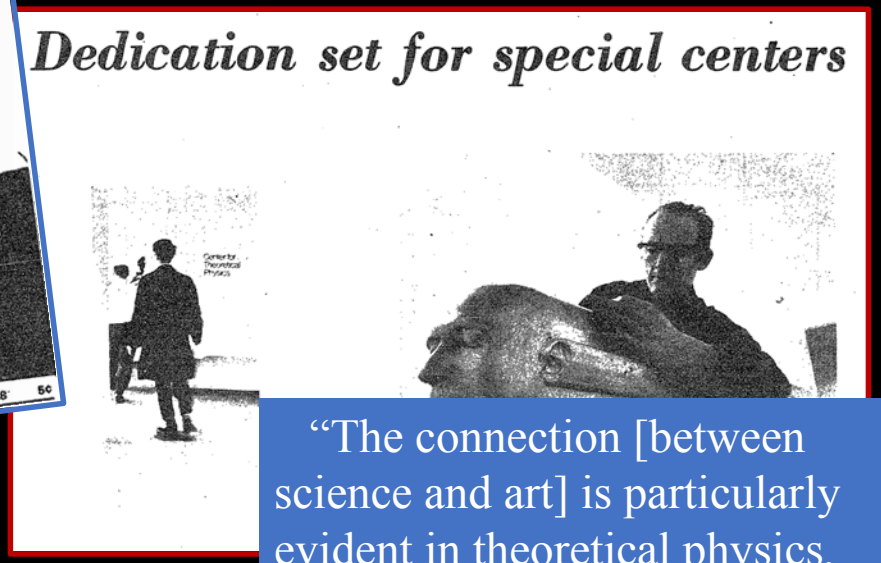

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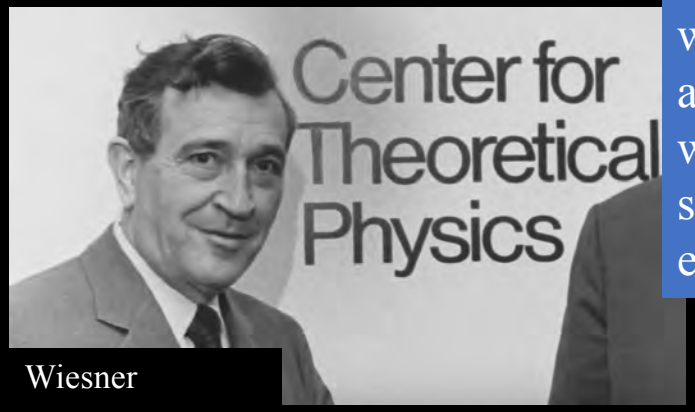

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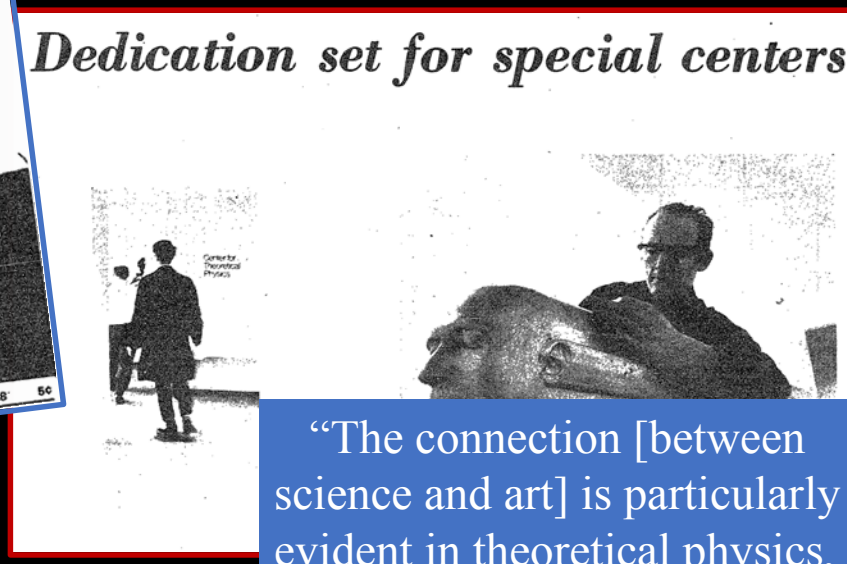
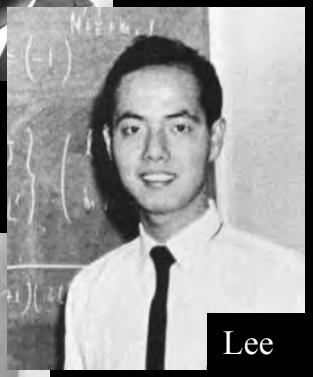



Schwinger


Bethe


Lee

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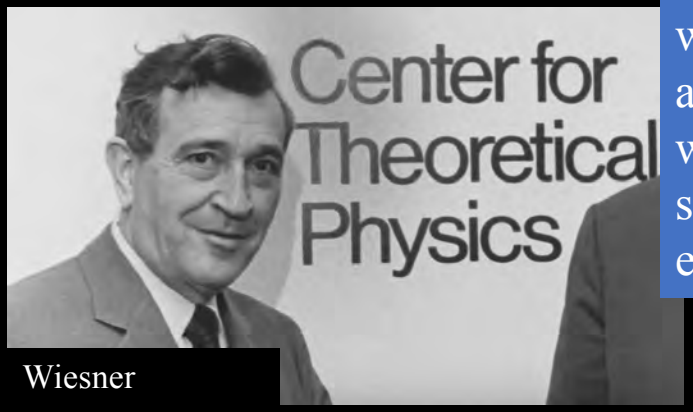

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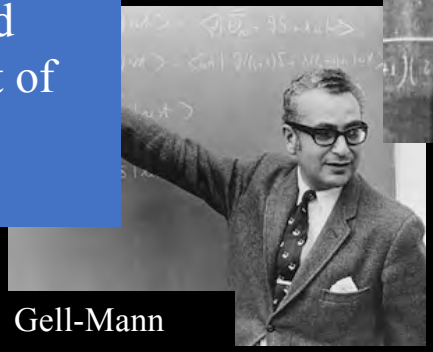
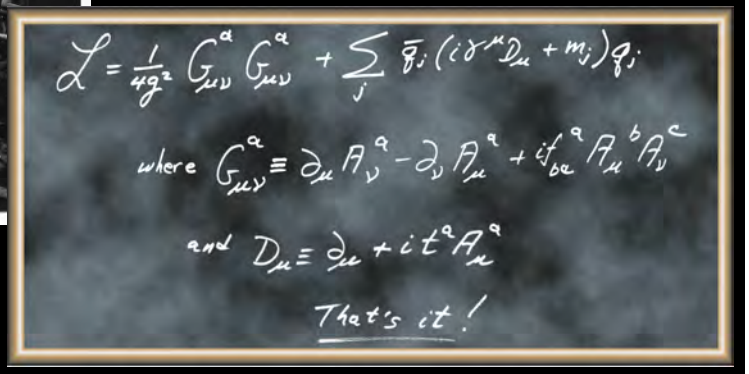

Gell-Mann

400 visitors to the new CTP space

"Theoretical Physics"

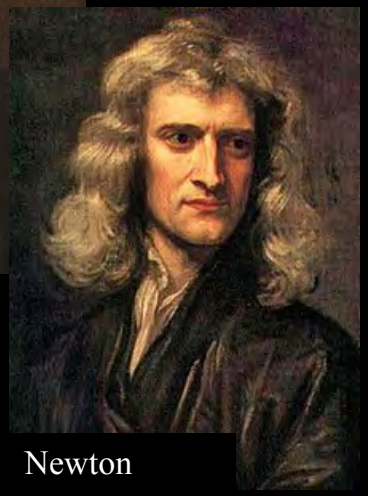
MIT in 1968

Physics, Then and Now



“Theoretical Physicist”?

Galileo



Newton

“mathematician,”
“philosopher”

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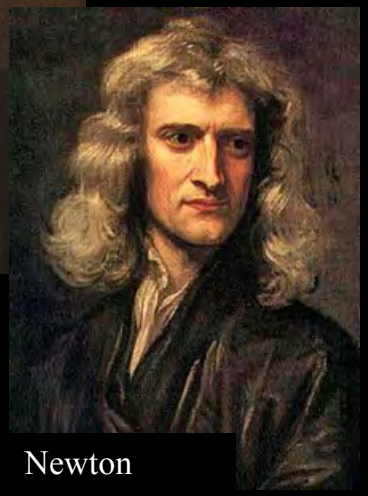

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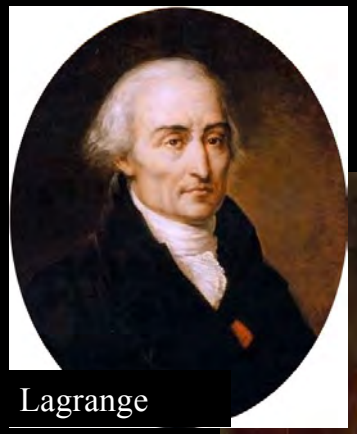

Lagrange

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“mathematician,”
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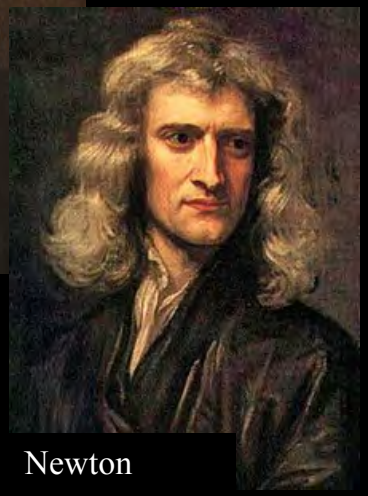

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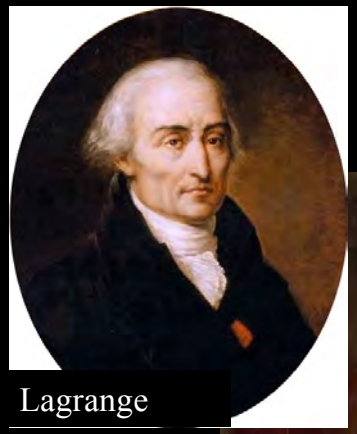

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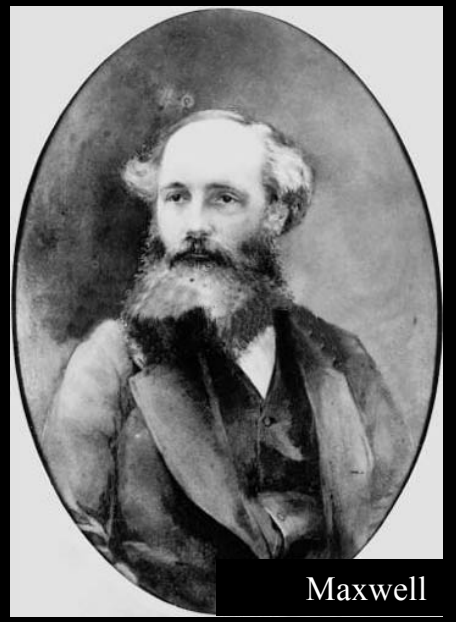

Maxwell

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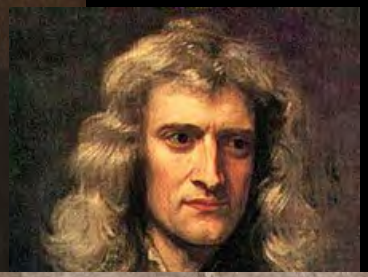

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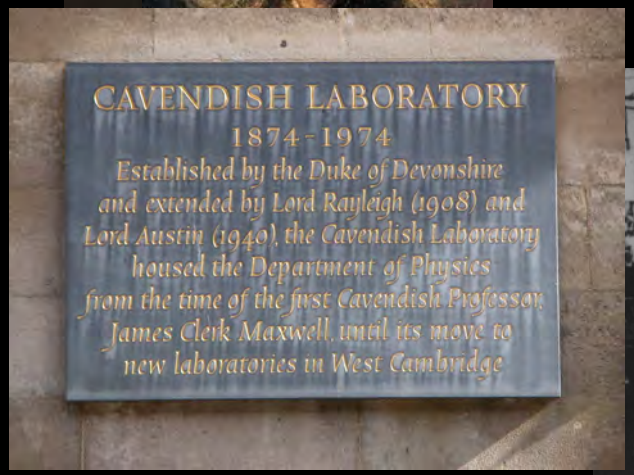
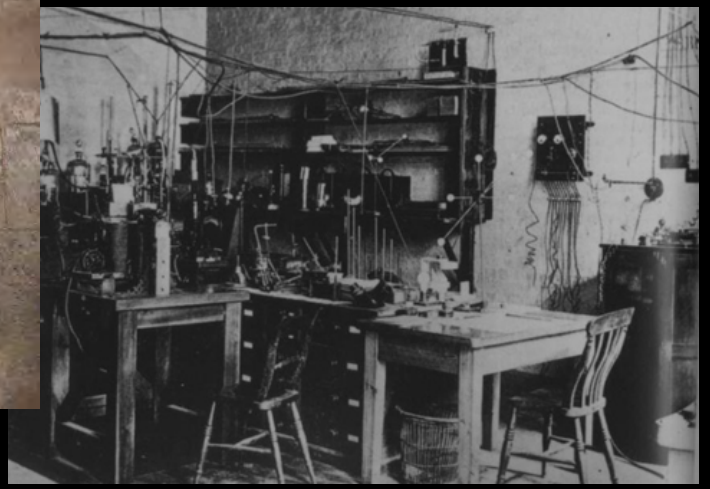
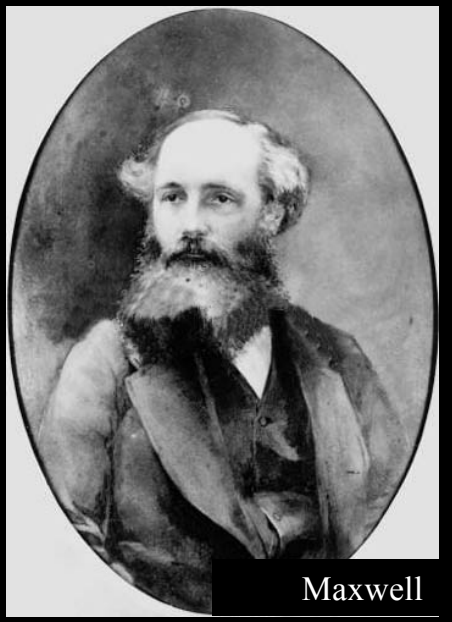




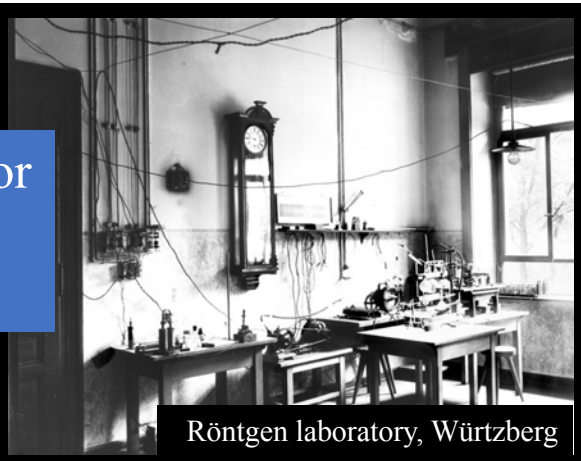
“physicist”



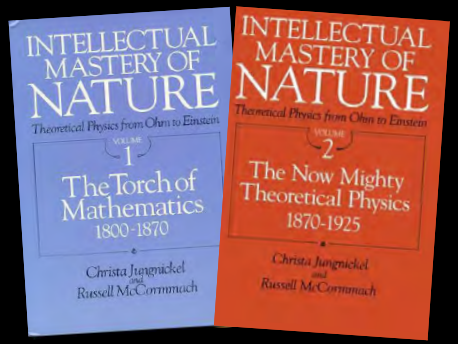
Maxwell

“Theoretical Physicist”

German university system: a single “Ordinarius” professor in a given field. In physics, the ordinarius was in charge of all experimental apparatus for the department.



Röntgen laboratory, Würtzberg



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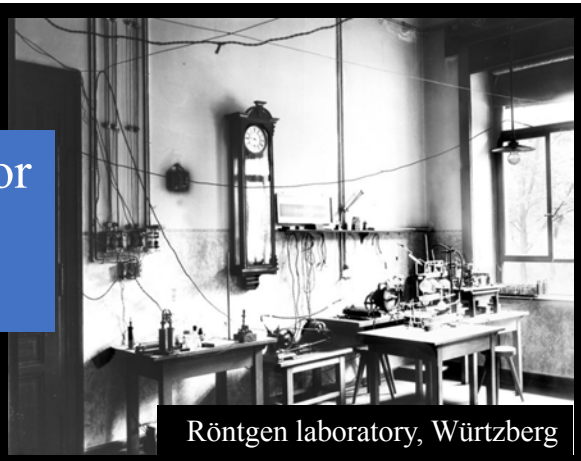

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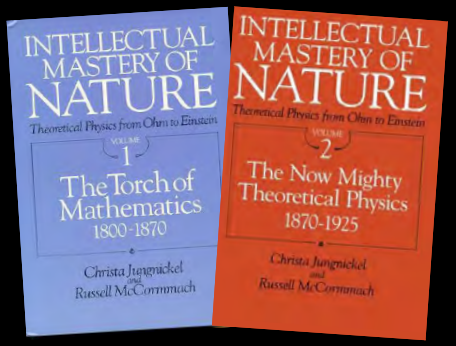
After German unification in 1871, the country underwent rapid industrialization …

Krupp Steelworks



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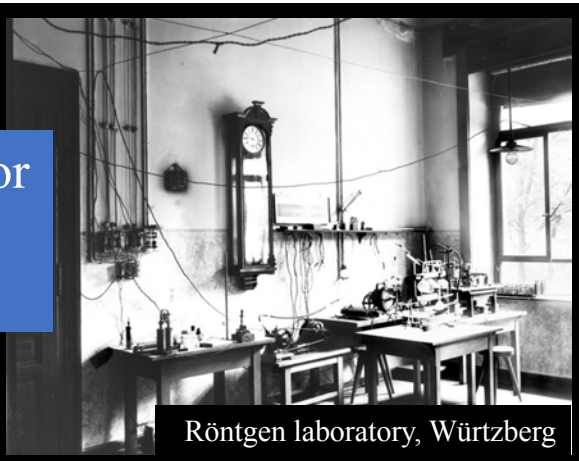

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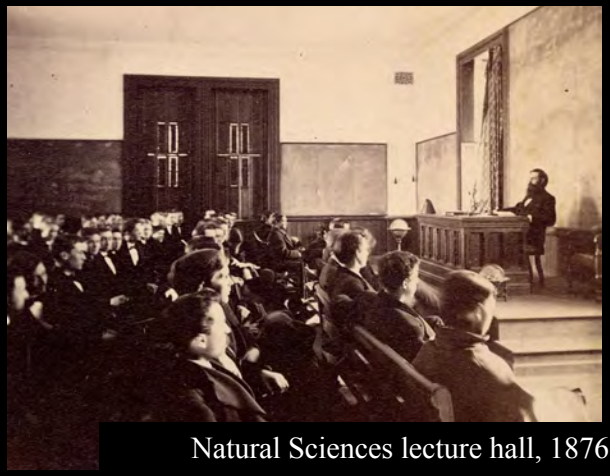
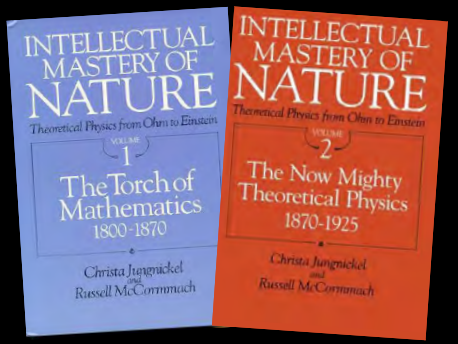
… which called for the rapid training of new physics teachers for secondary schools.



Natural Sciences lecture hall, 1876



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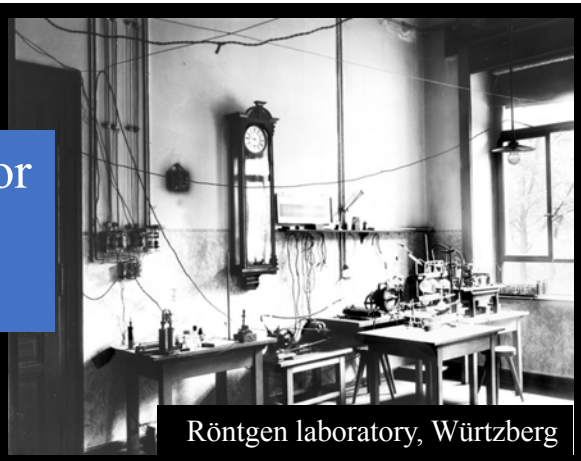

Röntgen laboratory, Würtzberg

Rapid growth of junior-faculty ranks (“extraordinarius” professors) to teach the new classes.

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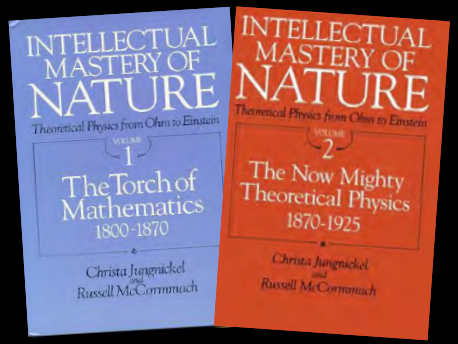

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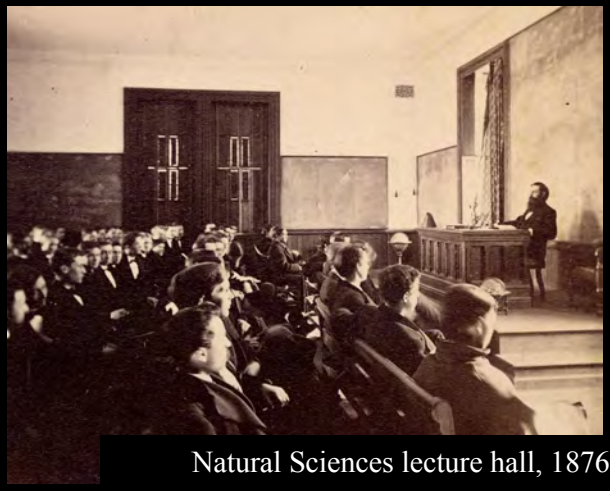
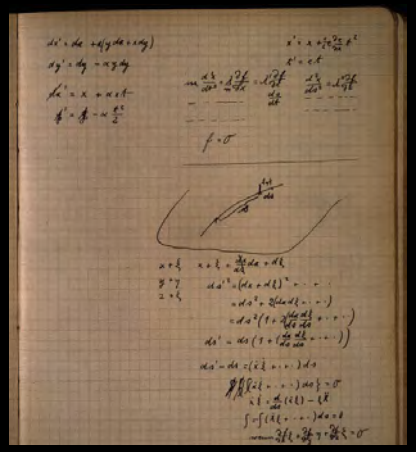
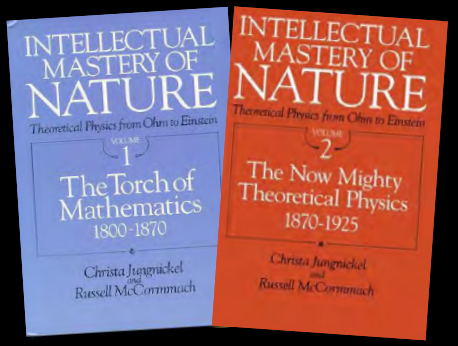


Natural Sciences lecture hall, 1876

But the extraordinarius faculty only had access to pencil and paper.



Einstein’s Zürich notebook, 1912



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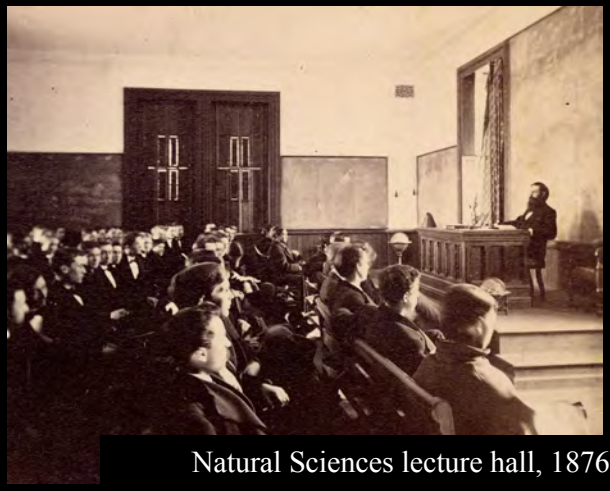

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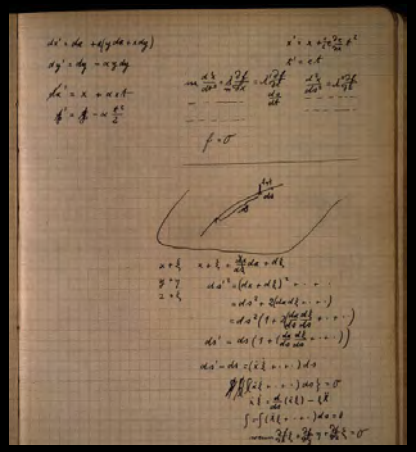

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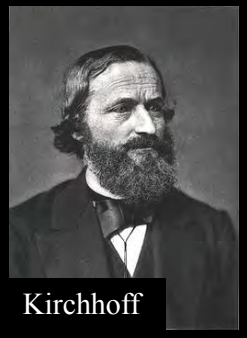
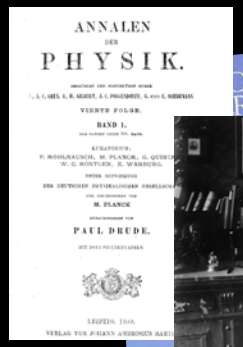
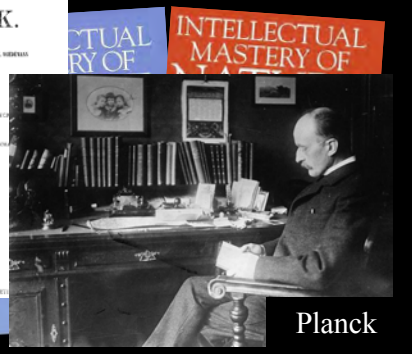
During the 1880s and 1890s, “theoretical physicist” became a recognized specialty, and job title.



Kirchhoff

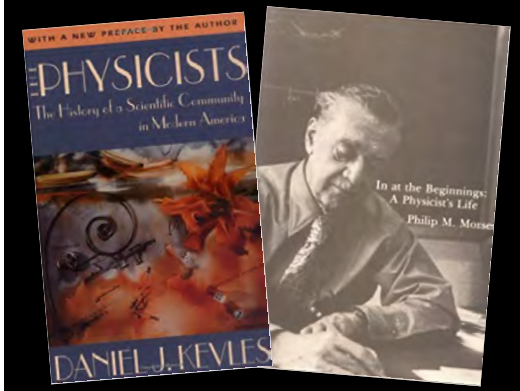




Planck

Theoretical Physics in the US

First physics Ph.D. dissertation in the US on quantum theory (Harvard, 1918). But in order to graduate, he still needed to conduct experiments.



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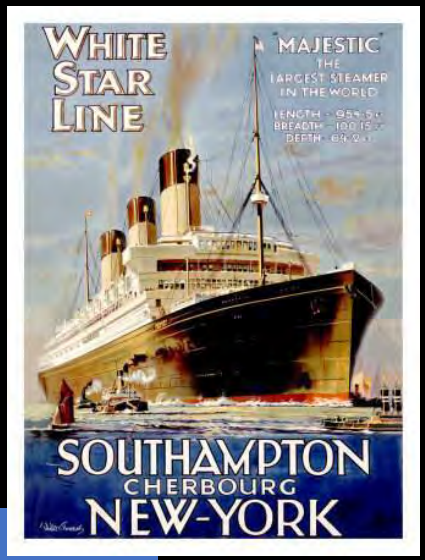
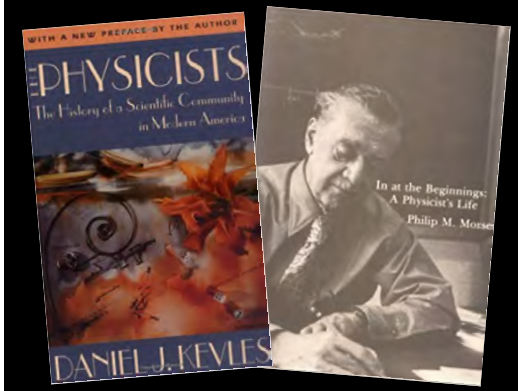
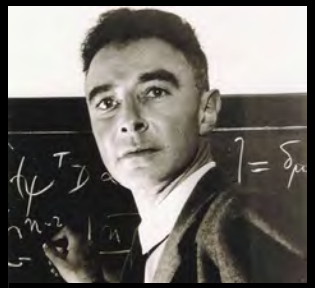


To complete their training, young American theorists in the 1920s typically traveled to Western Europe for postdoctoral fellowships.




Kemble

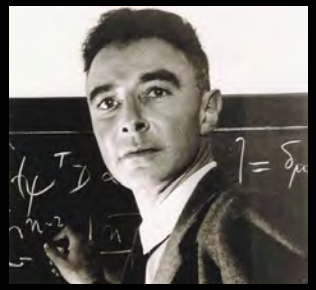

Oppenheimer


Wheeler


Slater


Morse

Theoretical Physics in the US

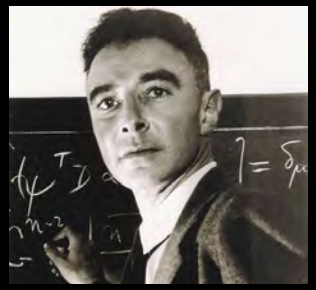


Oppenheimer

Slater

Several members of that first generation of US theorists became prolific mentors and institution-builders during the 1930s.

Theoretical Physics in the US



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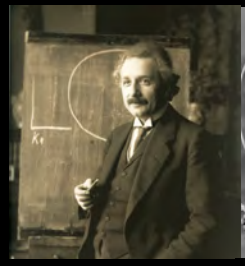
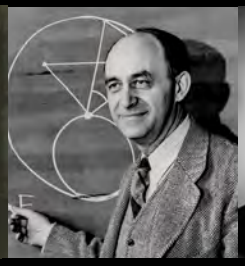
They were soon aided by an influx of European émigrés, fleeing fascism.



Einstein



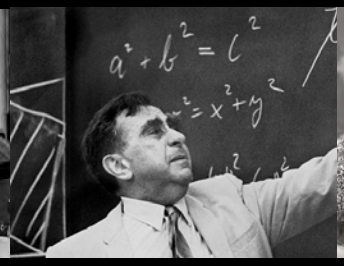
Fermi

Bethe

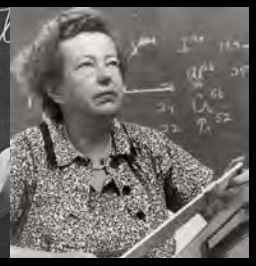
Weisskopf

Wigner

Bloch

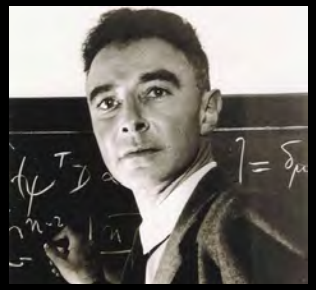


Teller



Goeppert-Mayer

Theoretical Physics in the US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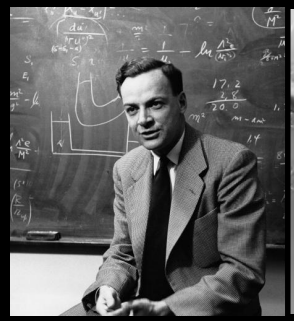
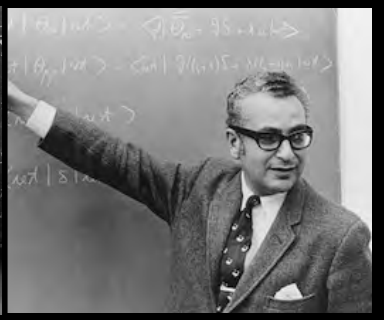

Feynman


Gell-Mann

The next generation was able to complete its training within the US.

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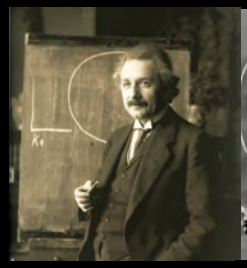
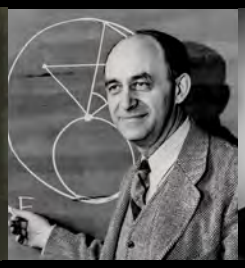

Einstein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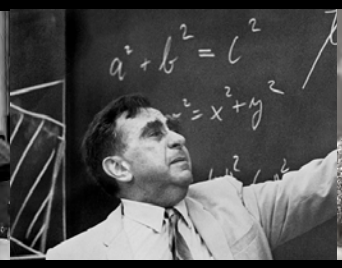
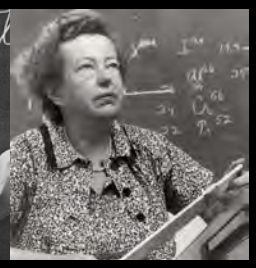

Teller


Goeppert-Mayer

Institutes for Theoretical Physics

1889: Berlin
1906: Munich
1921: Göttingen
1922: Copenhagen
1930: IAS
1945: Tata, Mumbai
1953: Kyoto
1957: NORDITA
1959: DAMTP, Cambridge
1964: ICTP, Trieste
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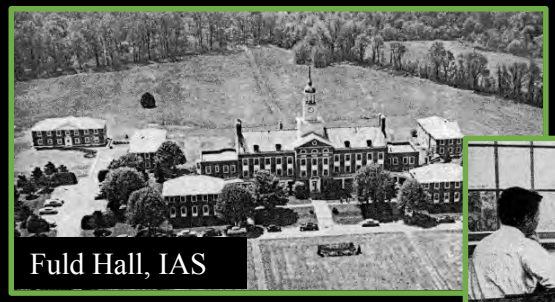

Fuld Hall, IAS


Oppenheimer

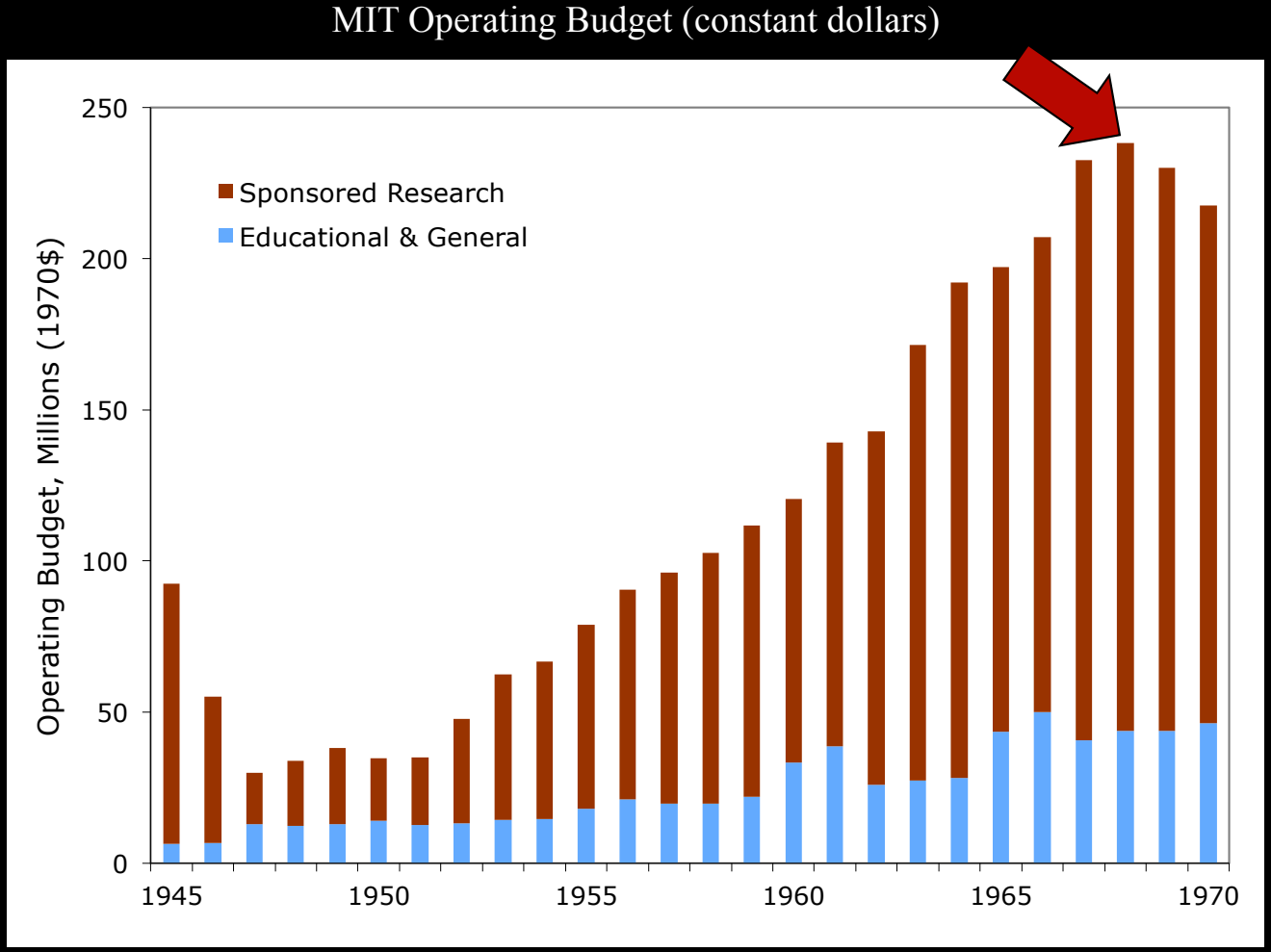

Brookhaven


Yang

MIT

MIT's CTP: Perfect Timing

During 1967, MIT spent $2.1M on renovations ($16M in 2018$)—about 1/3 of it on the CTP.



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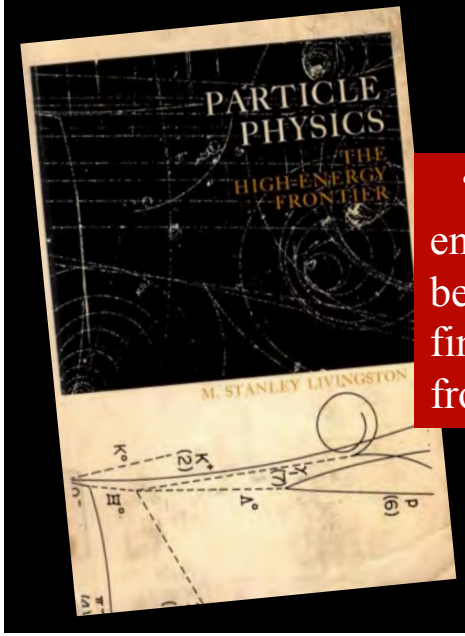
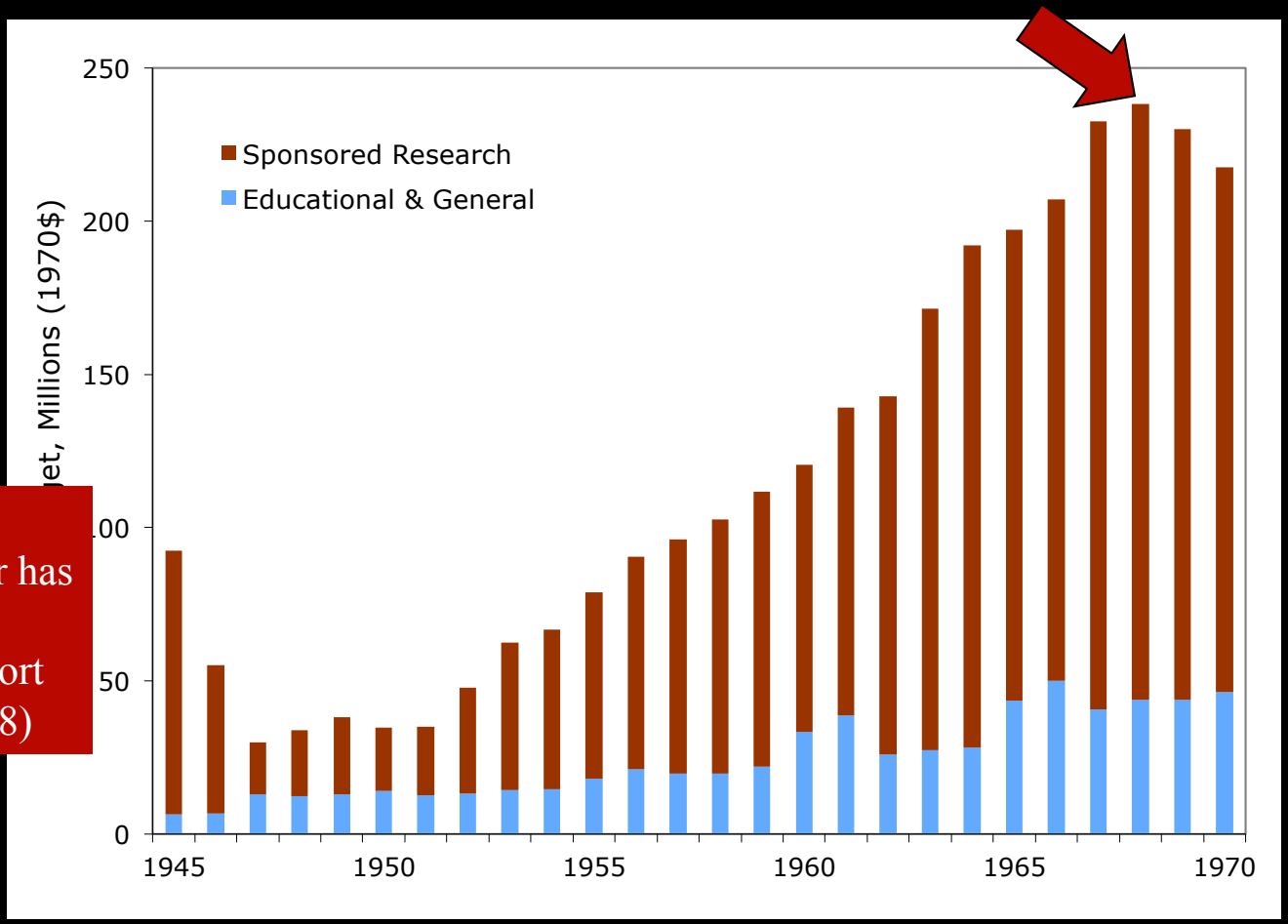
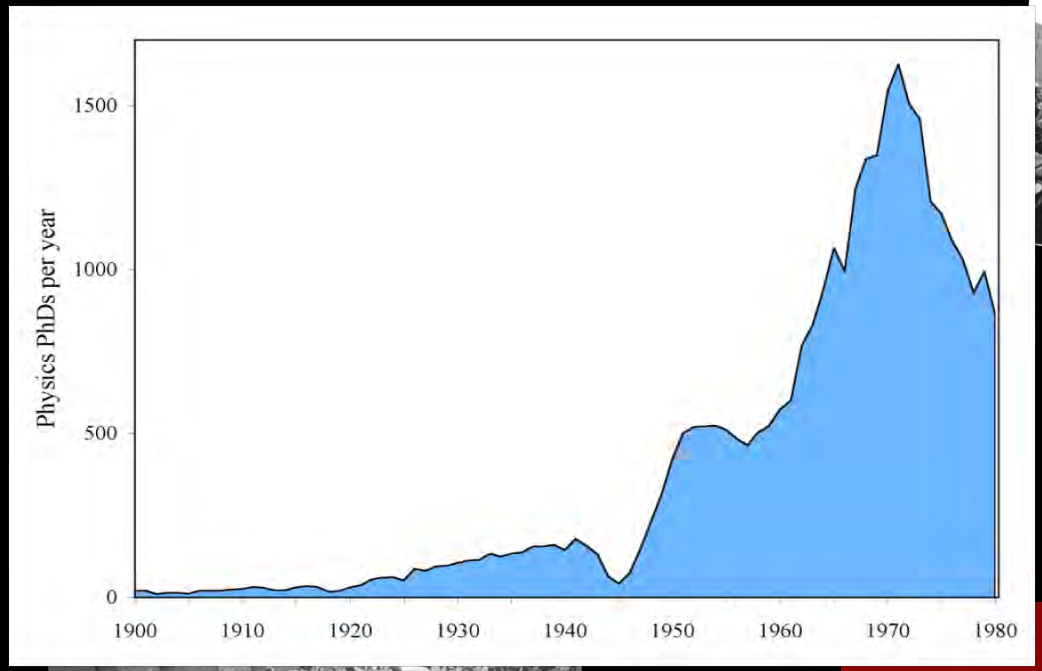
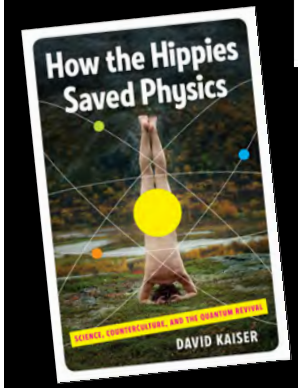


"The high-energy frontier has become the financial-support frontier." (1968)



The Bubble Bursts





AIP Job Placement Registries

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

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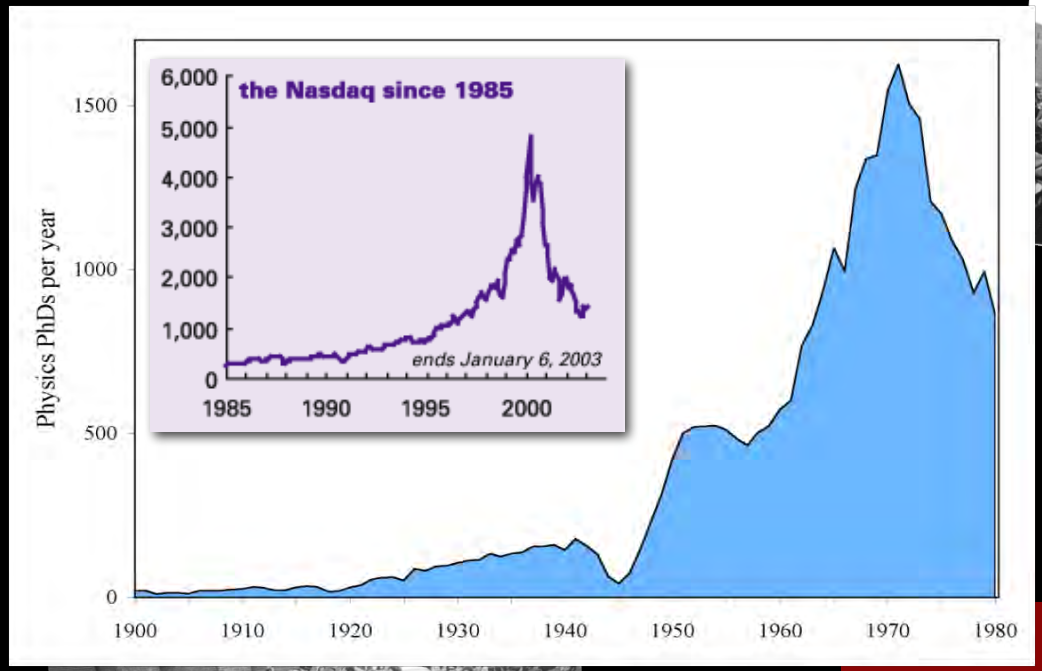

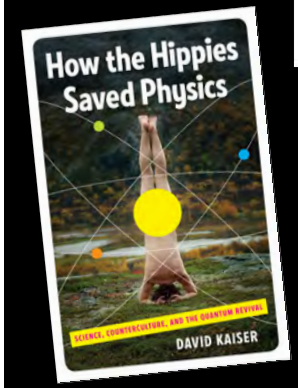

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Debating Scientists' Social Responsibility

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March 4, 1969

Debating Scientists' Social Responsibility

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Alumni Day, June 1969

November 1969


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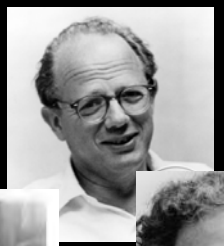

Union of Concerned Scientists

Alumni Day, June 1969

November 1969


November 1969

Time-Constants for Theoretical Physics

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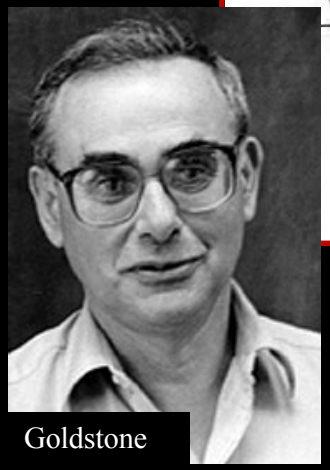
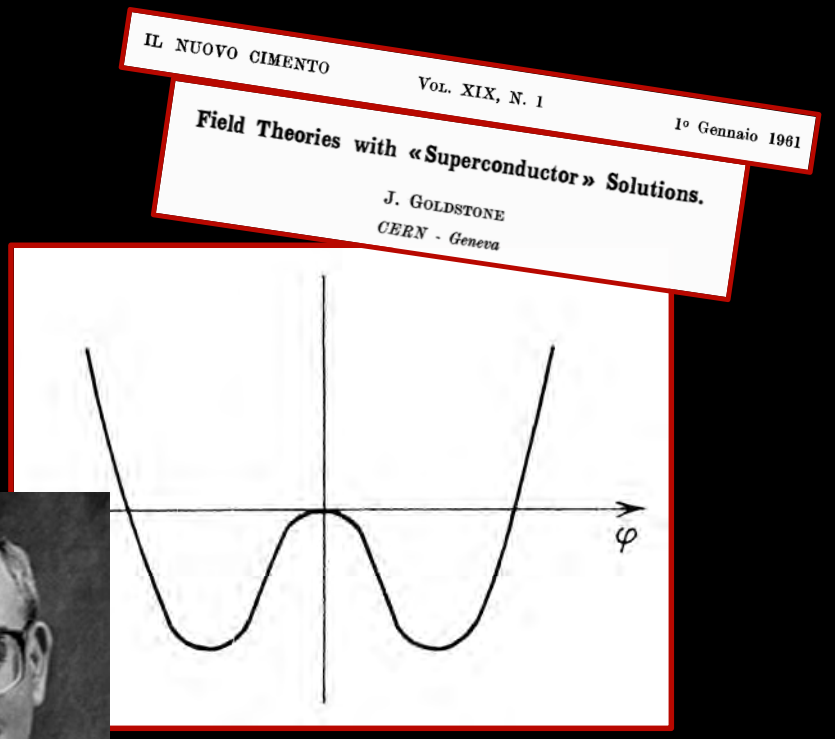


Goldstone



IL NUOVO CIMENTO Vol. XIX, N. 1 1° Gennaio 1961

Field Theories with «Superconductor» Solutions.

J. GOLDSTONE
CERN - Geneva

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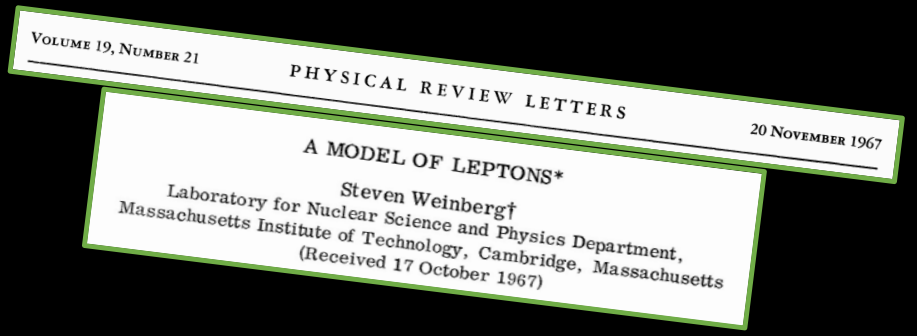
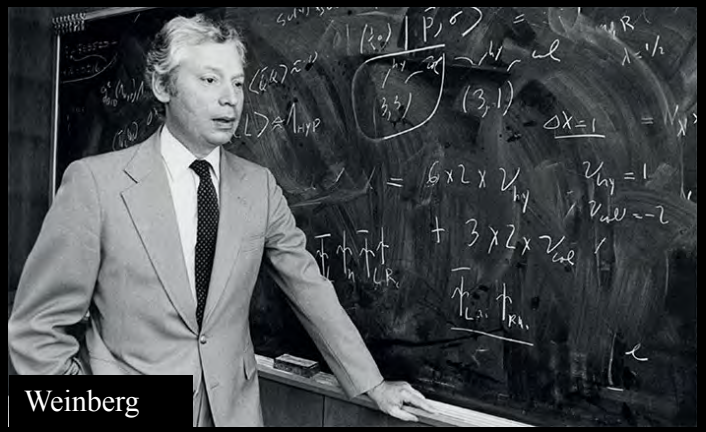


VOLUME 19, NUMBER 21 PHYSICAL REVIEW LETTERS 20 NOVEMBER 1967

A MODEL OF LEPTONS*

Steven Weinberg†
Laboratory for Nuclear Science and Physics Department,
Massachusetts Institute of Technology, Cambridge, Massachusetts
(Received 17 October 1967)



Weinberg

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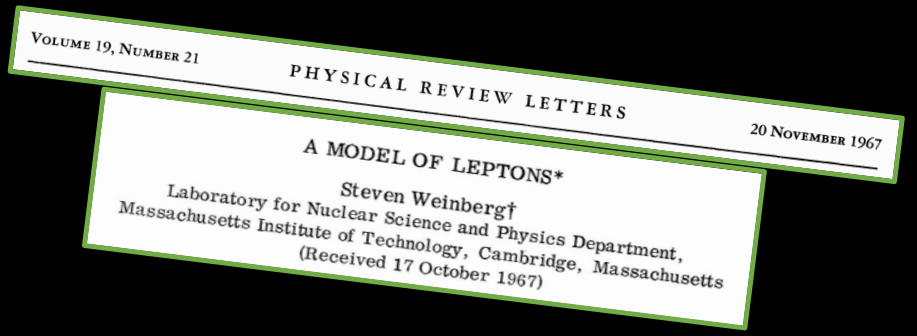
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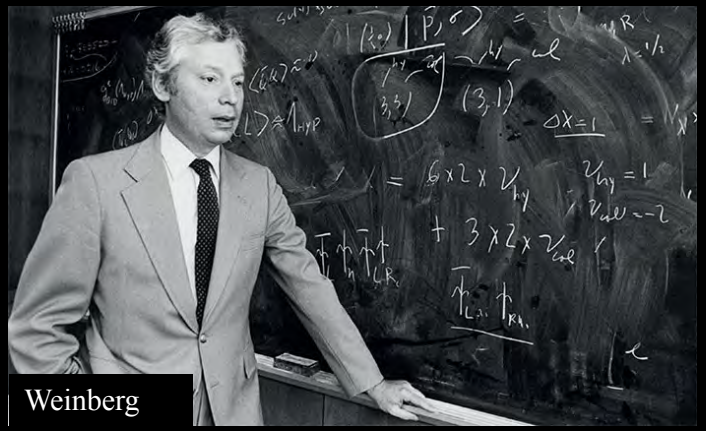
Citations:
1967: 0
1968: 0
1969: 0
1970: 1
1971: 4
1972: 64
1973: 162

"Gerard 't Hooft wrote a paper on the renormalization of gauge theories that revealed Weinberg and Salam's frog to be an enchanted prince."

Sidney Coleman, 1979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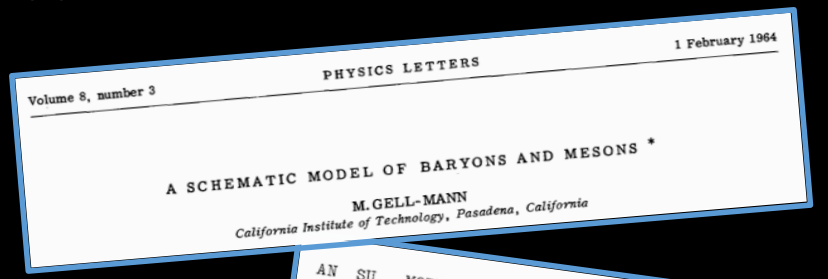
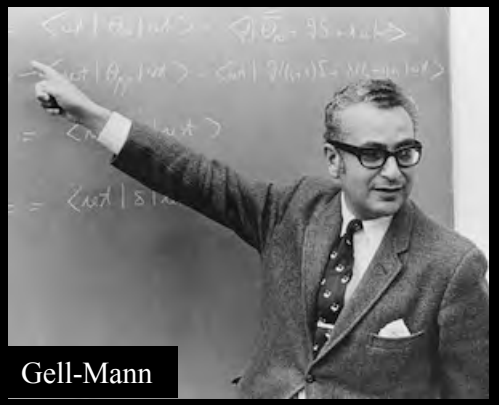

Volume 8, number 3 PHYSICS LETTERS 1 February 1964

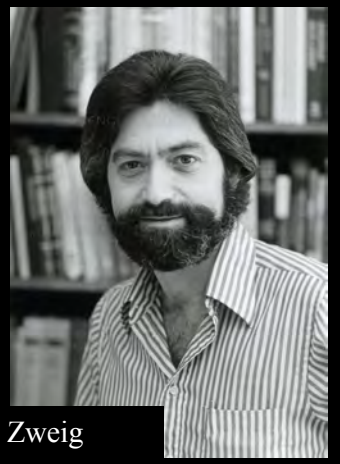
A SCHEMATIC MODEL OF BARYONS AND MESONS *

M. GELL-MANN
California Institute of Technology, Pasadena, California


AN SU_3 MODEL FOR STRONG INTERACTION SYMMETRY AND ITS BREAKING

G. Zweig *)
CERN - Geneva


Gell-Mann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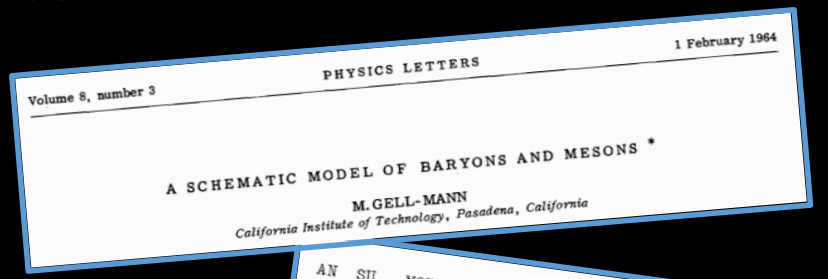
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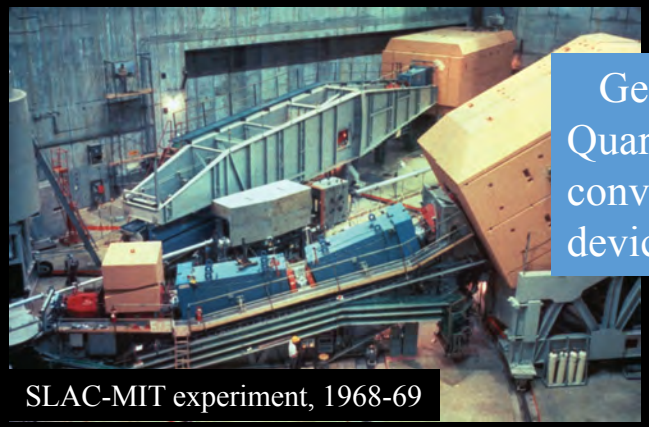
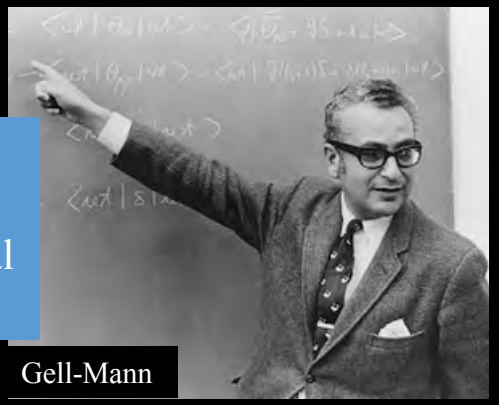

SLAC-MIT experiment, 1968-69

Gell-Mann, 1972: Quarks are "merely a convenient mathematical device…"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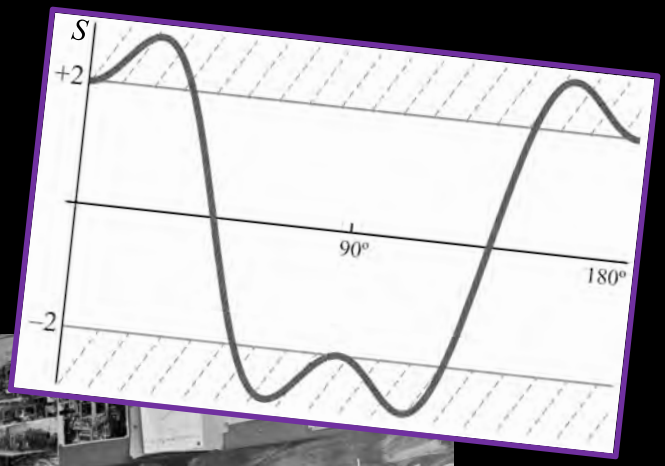

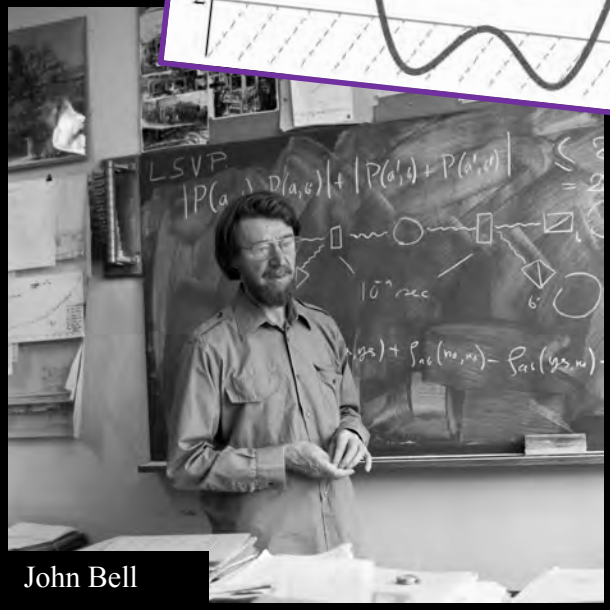

John Bell

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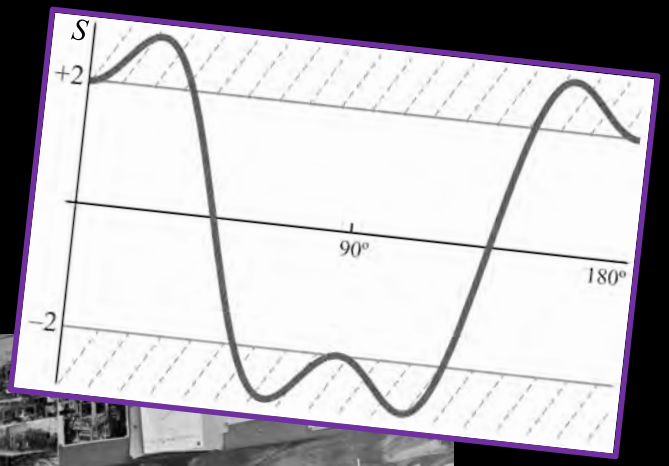
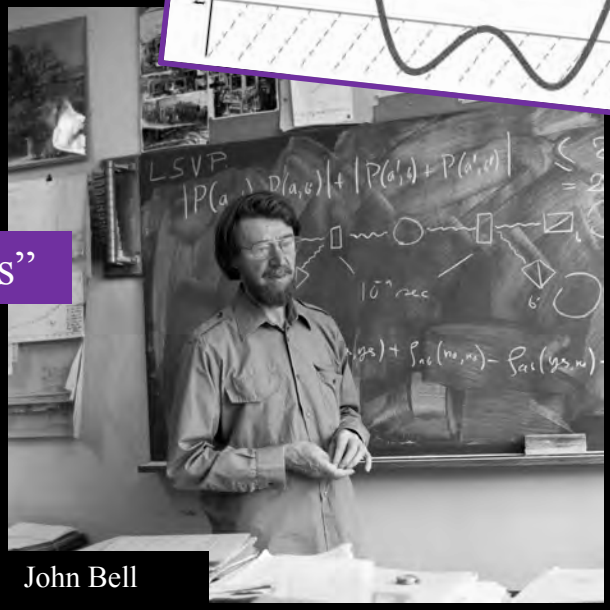
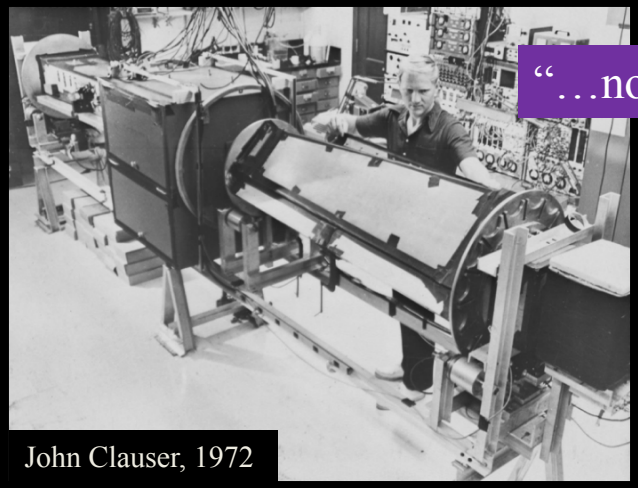


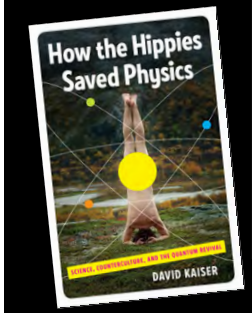


John Bell

"…not real physics"



John Clauser, 1972



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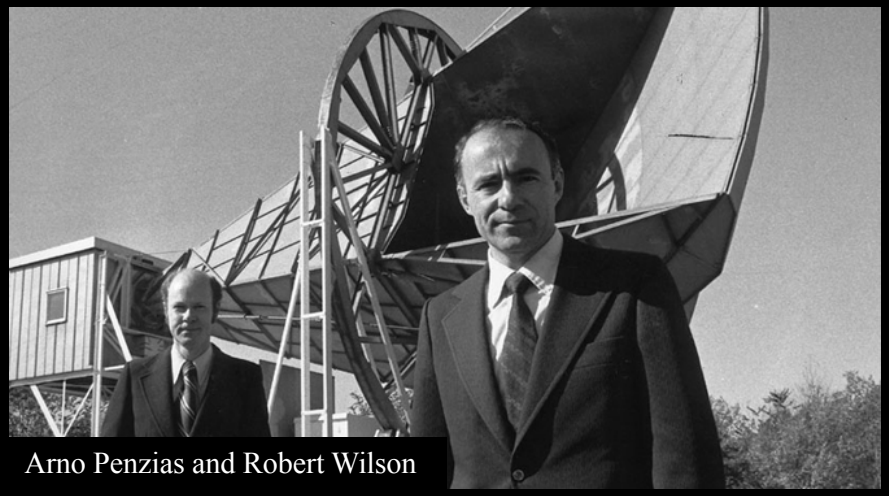
COSMIC BLACK-BODY RADIATION*

R. H. DICKE
P. J. E. PEEBLES
P. G. ROLL
D. T. WILKINSON

A MEASUREMENT OF EXCESS ANTENNA TEMPERATURE AT 4080 Mc/s

A. A. PENZIAS
R. W. WILSON



Arno Penzias and Robert Wilson

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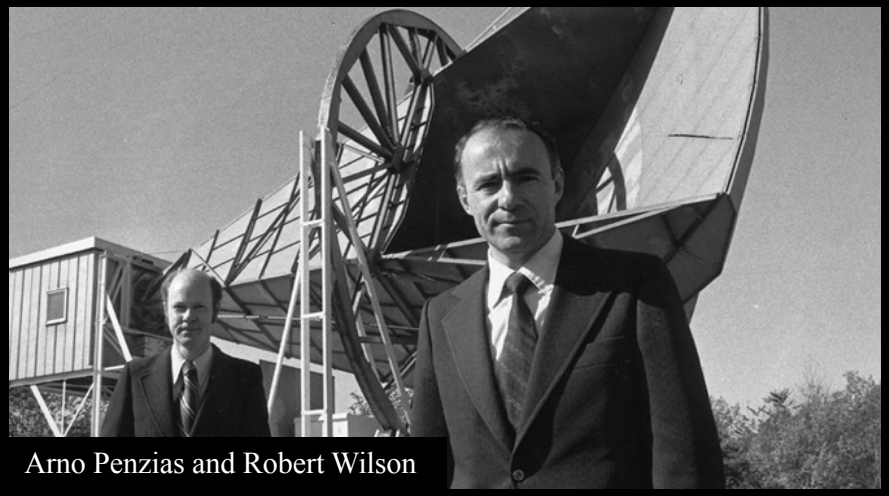
Follow-up paper on the theory of the CMB was rejected *twice*…



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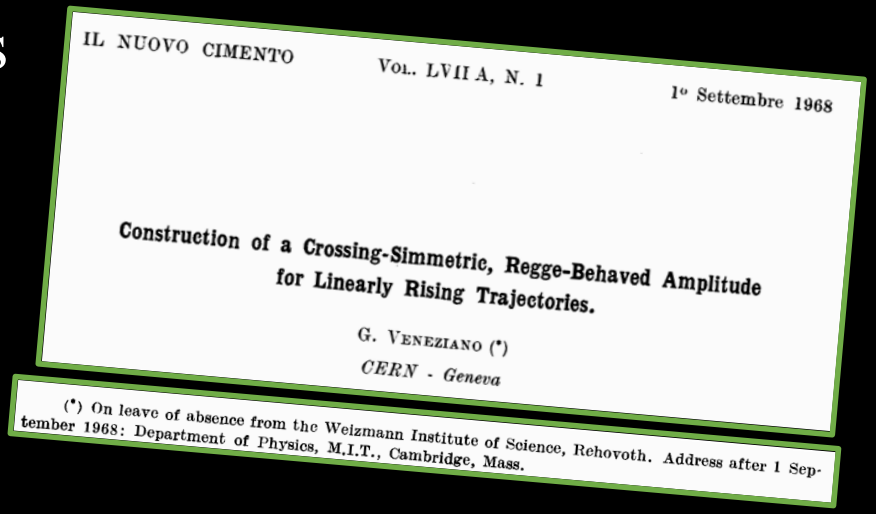

IL NUOVO CIMENTO Vol. LVII A, N. 1 1° Settembre 1968

Construction of a Crossing-Simmetric, Regge-Behaved Amplitude for Linearly Rising Trajectories.

G. VENEZIANO (*)

CERN - Geneva

(*) On leave of absence from the Weizmann Institute of Science, Rehovoth. Address after 1 September 1968: Department of Physics, M.I.T., Cambridge, Mass.

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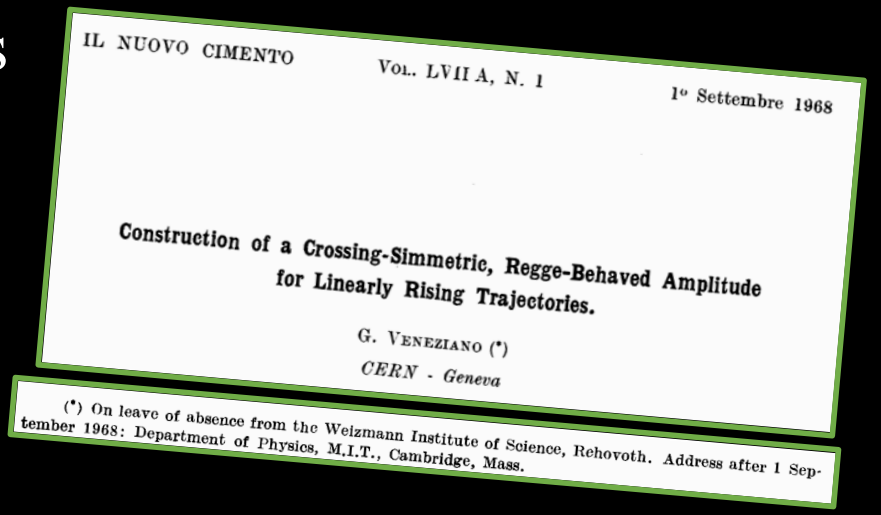

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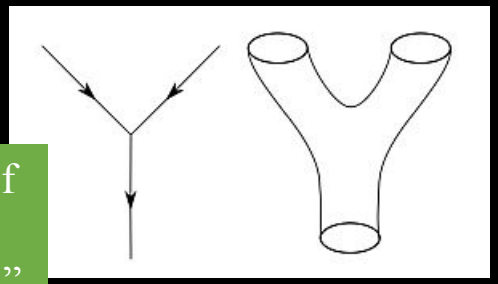

1974: perhaps not a theory of strong interactions after all…
1984: "first string revolution"

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$\Delta t = O$ (decade[s])
Many-body interactions are critical!

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Many-body interactions are critical!

We need institutions dedicated to fostering collaboration, with an emphasis on the long view.