

“Oppenheimer”: dilemas de la ciencia

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Zarautz, 2024ko urriaren 1a



Resumen

1-INTRODUCCIÓN

2-OPPENHEIMER

3-RELATIVIDAD. CUÁNTICA. Formación y creación de escuela de Oppenheimer

4-ATOM. Electron. Proton. Neutron

5- La física de las bombas nucleares (mal llamadas atómicas). FISIÓN NUCLEAR

6-Cuatro CARTAS. ALEMANIA

7-MANHATTAN PROJECT. Fecha 1943. Liderado por Groves y Oppenheimer. USA.

UK. Canada. Diversos lugares. Los Alamos el más relevante

8-TRINITY

9-BOMBA DE HIDRÓGENO

10-BATALLA POLÍTICA. MANIPULACIÓN COMITÉS. ÉTICA de la ciencia

J. Robert
Oppenheimer



1924 - 1929

Educación



1929 - 1942

Creación de escuela



1942 - 1945

Proyecto
Manhattan



1945 - 1954

Caída

1954 - 1967

Continuidad

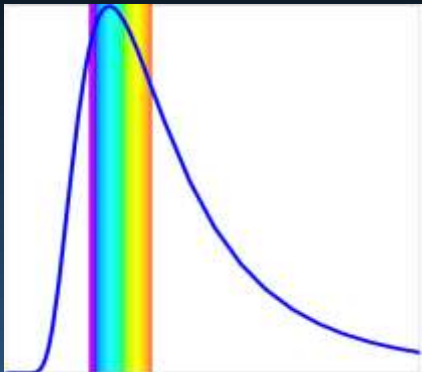


Dos grandes revoluciones en el siglo XX:

los Quanta

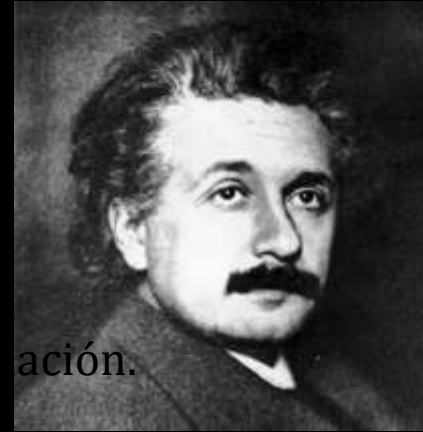


Planck



$$\text{Energía} = h\nu$$

la Relatividad



Einstein



$$\text{Energía} = mc^2$$



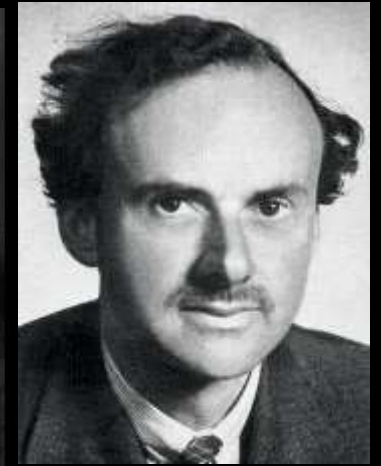
Bohr



De Broglie

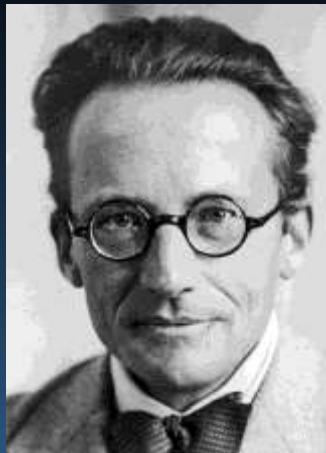


Heisenberg



Dirac

Los padres de la mecánica cuántica



Schrödinger



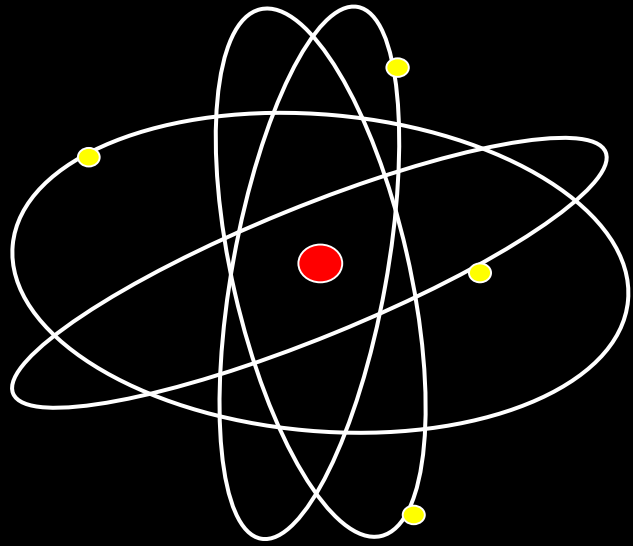
Born



Pauli

Los nueve serían galardonados con el premio Nobel de Física:

- Planck (1918)
- Einstein (1921)
- Bohr (1922)
- De Broglie (1929)
- Heisenberg (1932)
- Pauli (1945)
- Schrödinger (1933)
- Max Born (1954)
- Dirac (1933)



$\times 10^8$



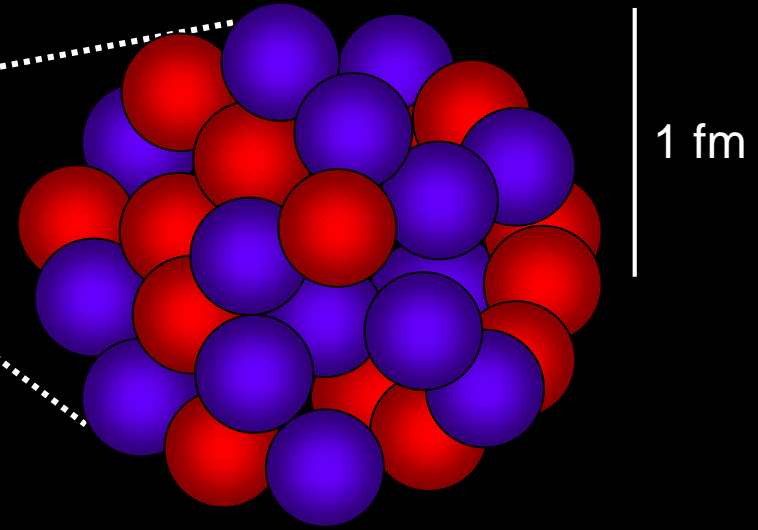
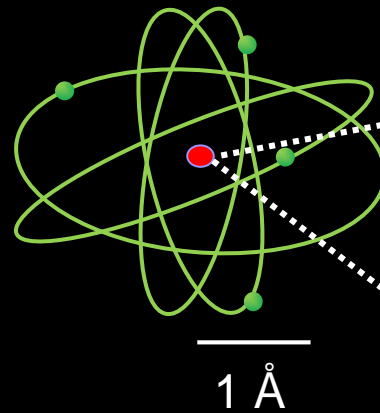
$\times 10^8$



The Rutherford atomic model

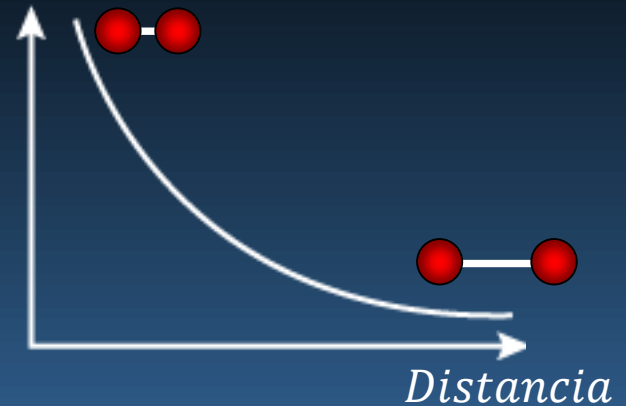


E. Rutherford

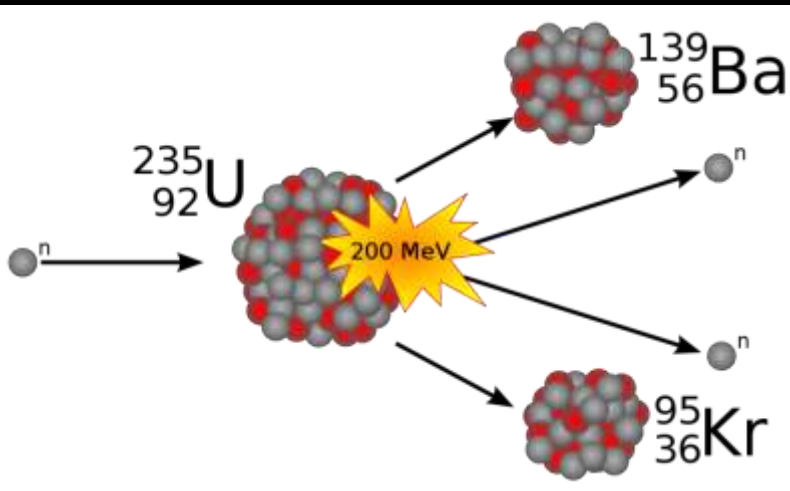


$$\text{Fuerza de repulsión} \approx \frac{1}{\text{Distancia}^2}$$

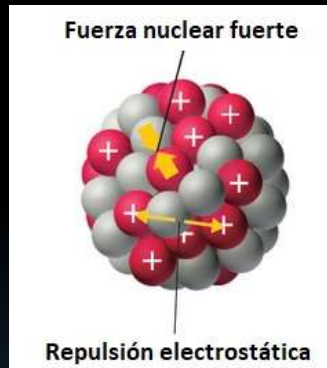
Fuerza de repulsión



FISIÓN NUCLEAR

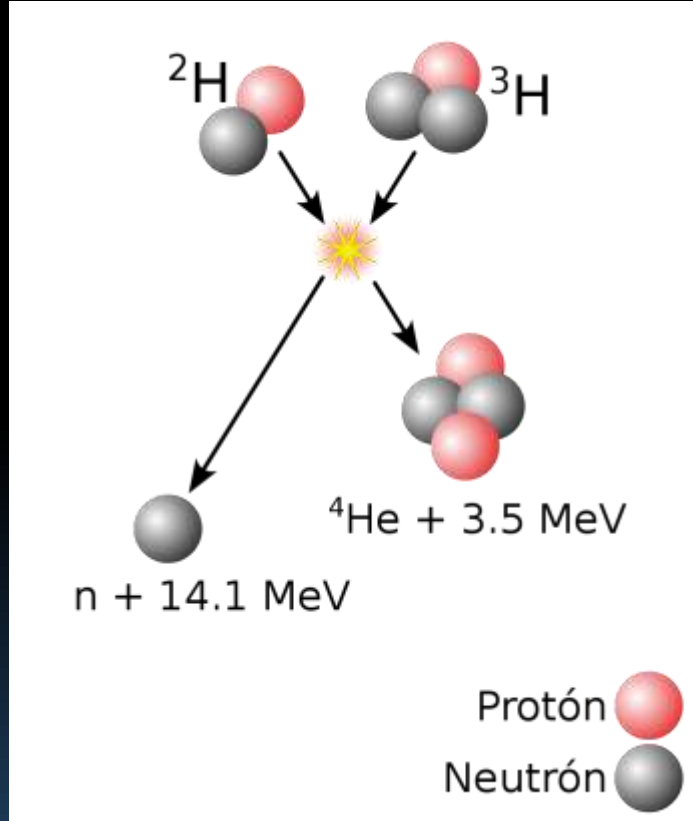


Átomos pesados



$$E = \Delta m c^2$$

FUSIÓN NUCLEAR



Átomos ligeros

FISIÓN

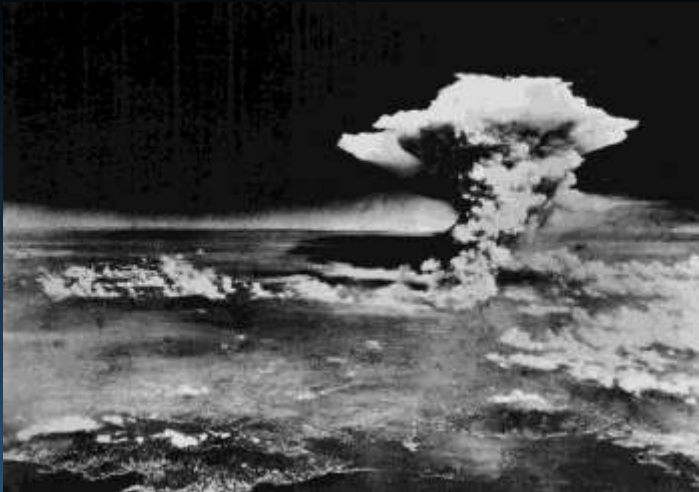
FUSIÓN

Controlada



Planta nuclear

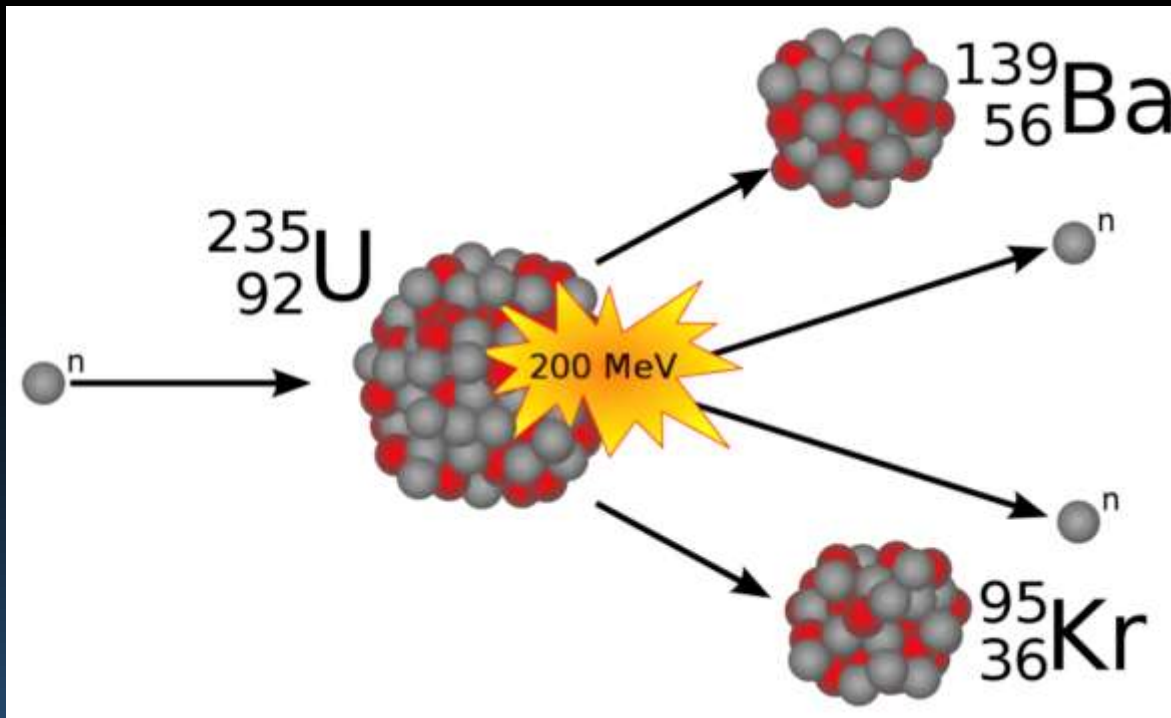
Incontrolada



Bomba atómica

Bomba Tsar

*Nuclear fission:
desintegration of uranium
by neutrons*



December 1938



O. Hahn

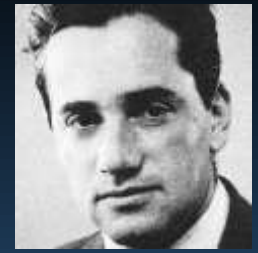


F. Strassman

January 1939

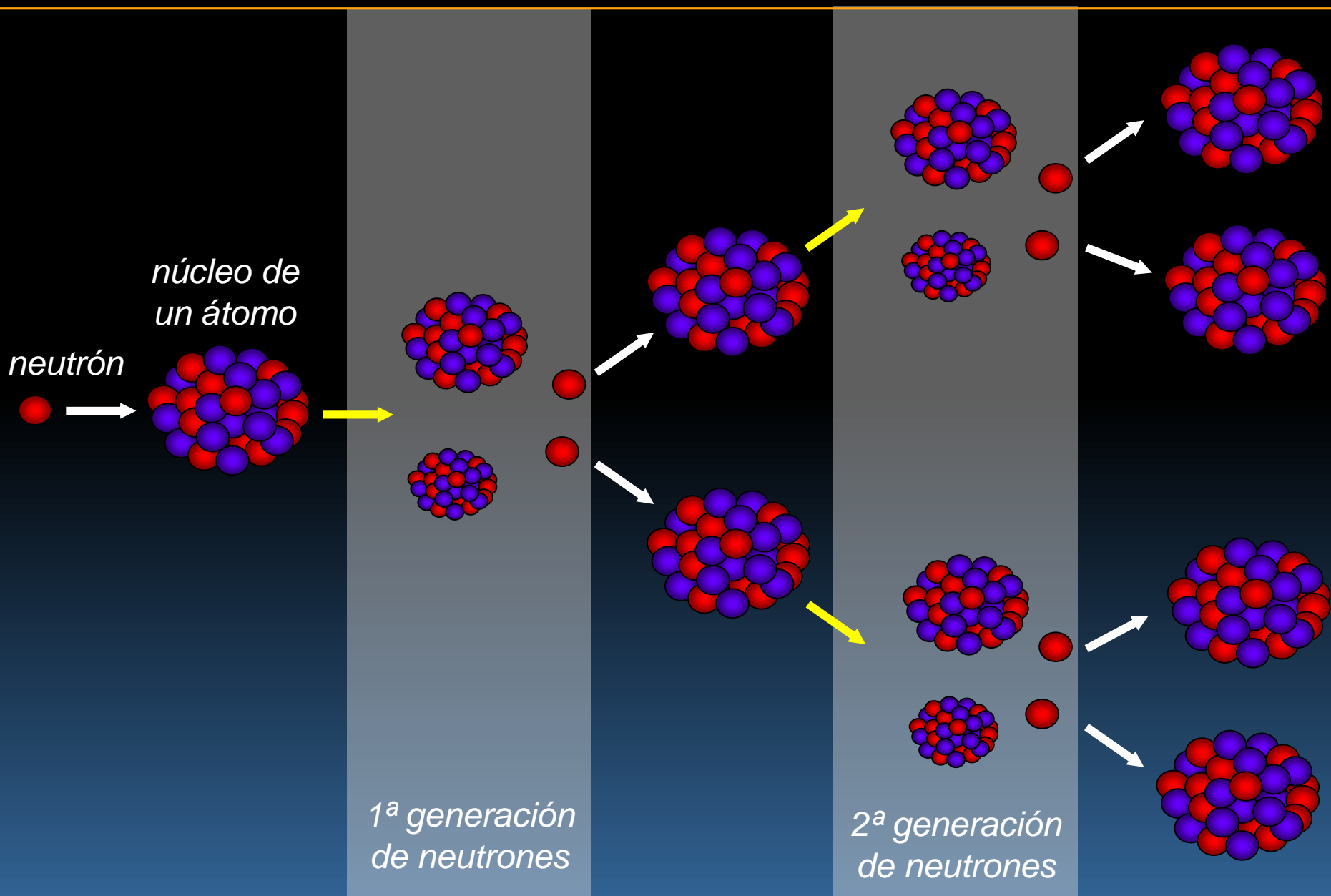


L. Meitner



O. Frisch

Reacción de fisión nuclear en cadena





Property of Marcial Etxenike

*The Farm Hall
transcripts
July-December 1945*



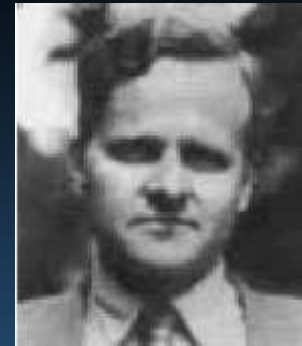
Heisenberg



Hahn



Von Laue



*Von
Weizsäcker*



Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd, 1939

F.D. Roosevelt,
President of the United States,
White House
Washington, D.C.

Sir:

Some recent work by E.Fermi and L. Szilard, which has been com-

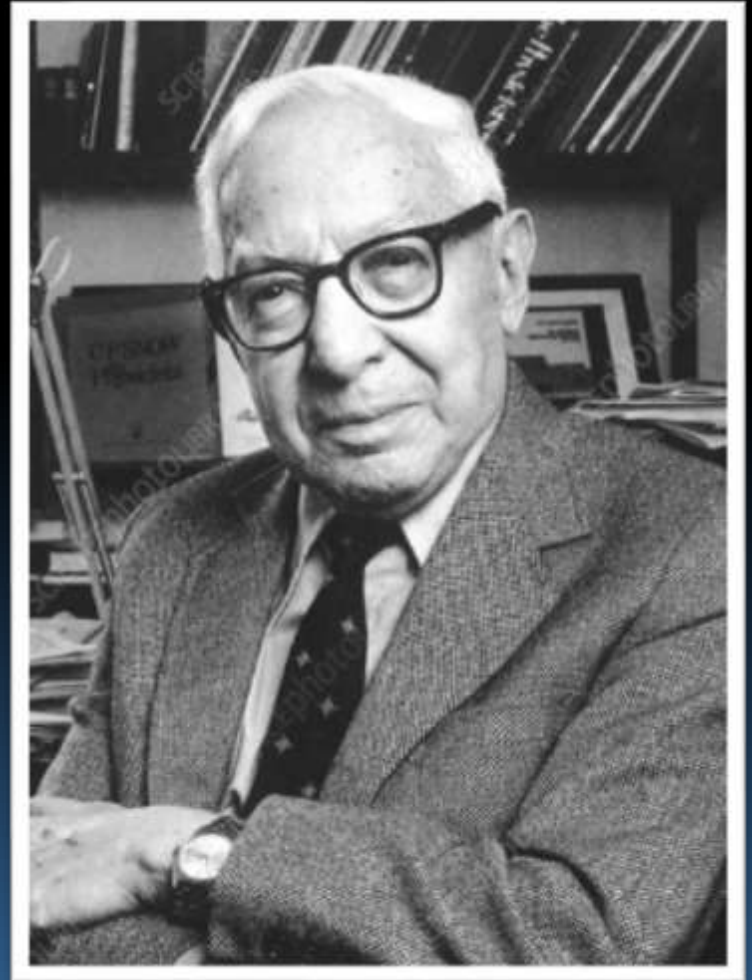
This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However,

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.



General Groves

Isidor Rabi



Constelación de talentos

Premios Nobel – Proyecto Manhattan



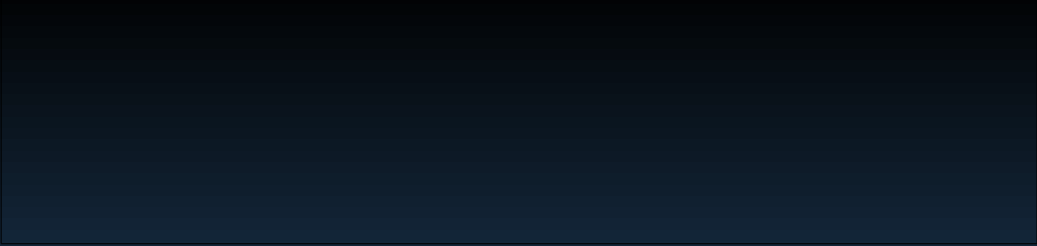
31 premios = 30 ciencia + 1 paz

**“Ahora me he convertido en la
muerte, el destructor de mundos”**

Bhagavad-gītā

We believe that these considerations make the use of nuclear bombs for an early unannounced attack against Japan inadvisable. If the United States were to be the first to release this new means of indiscriminate destruction upon mankind, she would sacrifice public support throughout the world, precipitate the race for armaments and prejudice the possibility of reaching an international agreement on the future control of such weapons.

The Franck Report, June 1945
(Franck, Szilard, Seaborg...)



Hiroshima
15kt

Nagasaki
21kt



Mount Everest
(8849m)

80

60

40

20

95 km



Mount Everest

Common cruising altitude for planes

'Little Boy'
(15 kt)
dropped on Hiroshima
1945

'Fat Man'
(21 kt)
dropped on Nagasaki
1945

'Licorne'
(1,000 kt)
tested by France
1970

'Castle Bravo'
(15,000 kt)
tested by the United States
1954

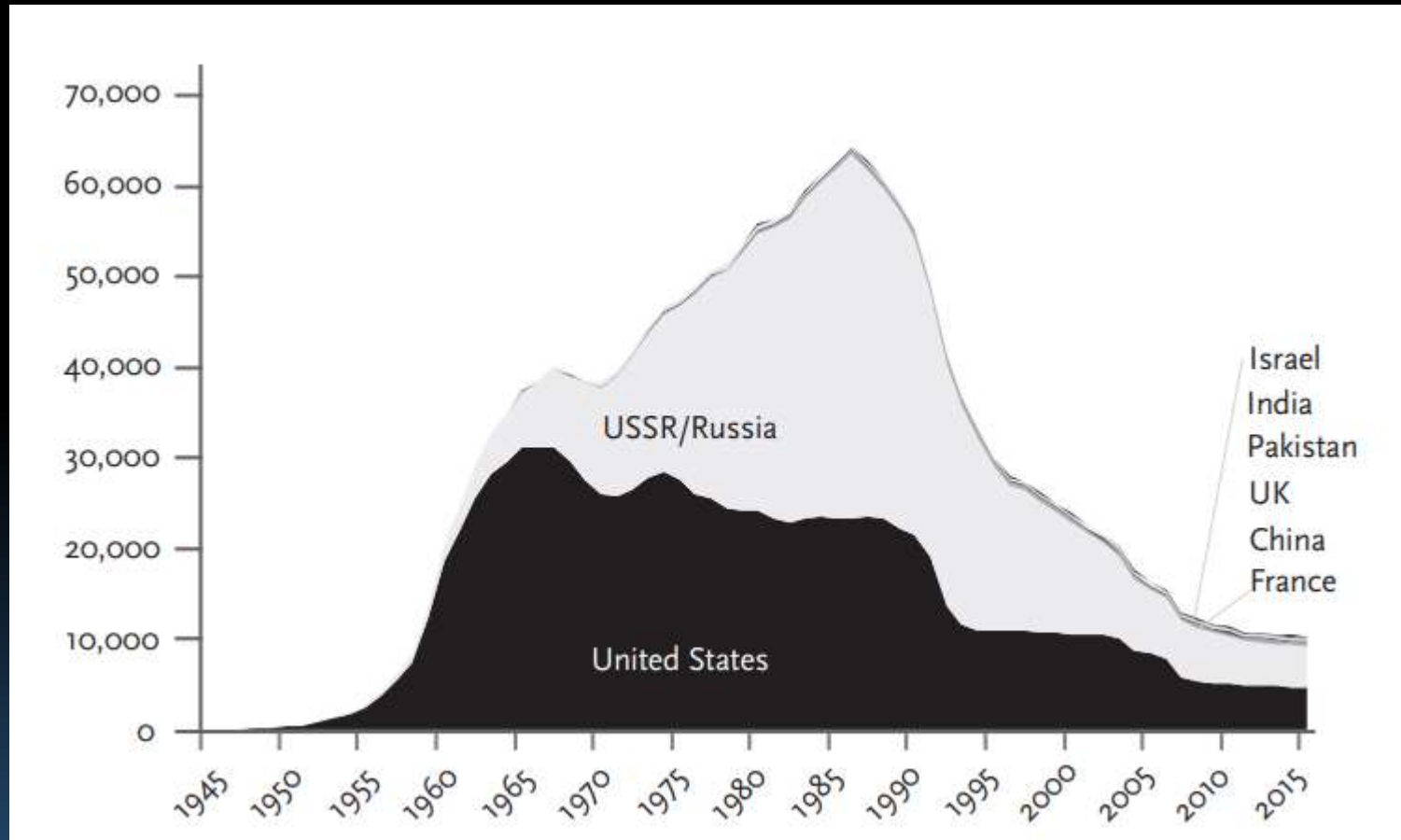
'Tsar Bomba'
(50,000 kt)
tested by the U.S.S.R.
1961

Compton –speaking for himself, Oppenheimer, Lawrence and Fermi- wrote Henry Wallace and explained:

*“We feel that this development [the H-bomb] should not be undertaken, primarily because **we should prefer defeat in war to victory obtained at the expense of the enormous human disaster that would be caused by its determined use.**”*

*“The triumph and tragedy of J. Robert Oppenheimer”,
by Kai Bird and Martin J. Sherwin*

Nuclear weapons, 1945-2015



Security hearing (1954)

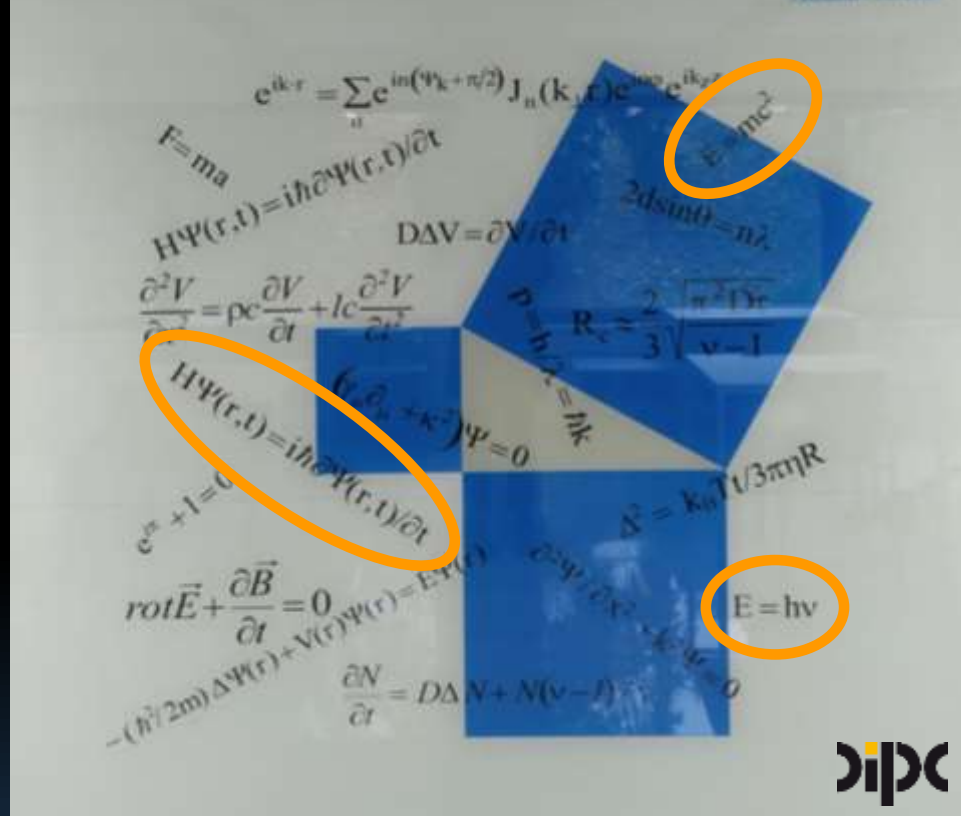


Fermi medal (1963)



Scribbles that changed the course of human affairs

Arnold A. Lucas



It is still an unending source of surprise for me to see how a few scribbles on a blackboard or on a sheet of paper could change the course of human affairs.

S. Ulam

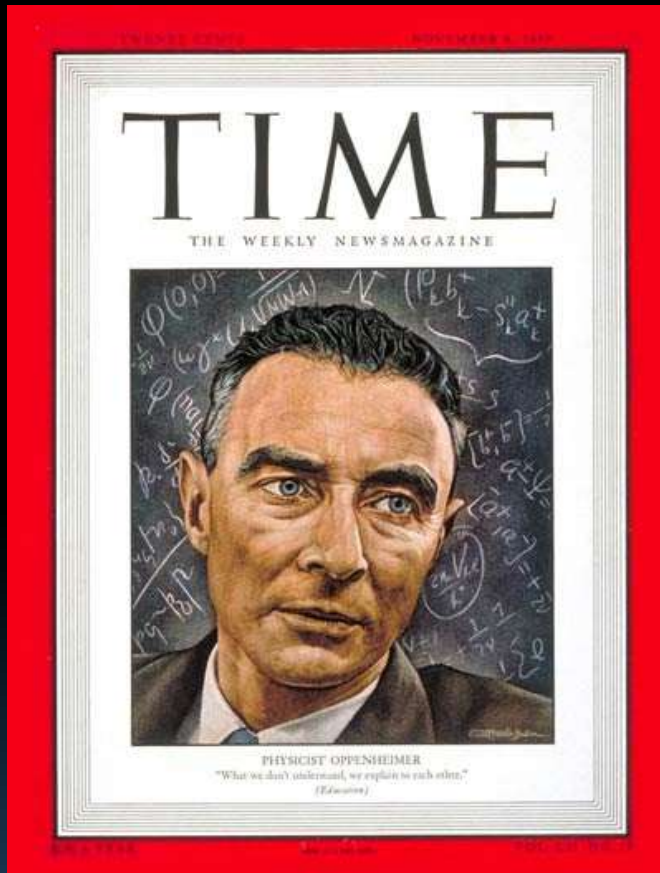


Sir Joseph Rotblat
“A Hippocratic Oath for Scientists”
Nobel Peace Prize Laureate (1995)

Pugwash Group:

“I promise to work for a better world.
I will not use my education for any
purpose intended to harm human
beings or the environment.
**I will consider the ethical implications
of my work**
before I take action.”

1948



*“What we don’t understand,
we explain each other”*

1954



*“Beyond loyalty, the harsh
requirements of security”*



Mila esker!