

Jak cząstki naszego Wszechświata zyskują masę?

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Instytut Fizyki UJ

im. Mariana Smoluchowskiego

4 lipca 2012 roku, CERN



Fabiola Gianotti, Rolf-Dieter Heuer, Joe Incandella

Spontaneous Symmetry Breaking (SSB)

1964

All the players... in the same PRL issue

VOLUME 13, NUMBER 9

PHYSICAL REVIEW LETTERS

31 AUGUST 1964

BROKEN SYMMETRY AND THE MASS OF GAUGE VECTOR MESONS*

F. Englert and R. Brout

Faculté des Sciences, Université Libre de Bruxelles, Bruxelles, Belgium

(Received 26 June 1964)

2 pages

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(Received 12 October 1964)

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F. Englert

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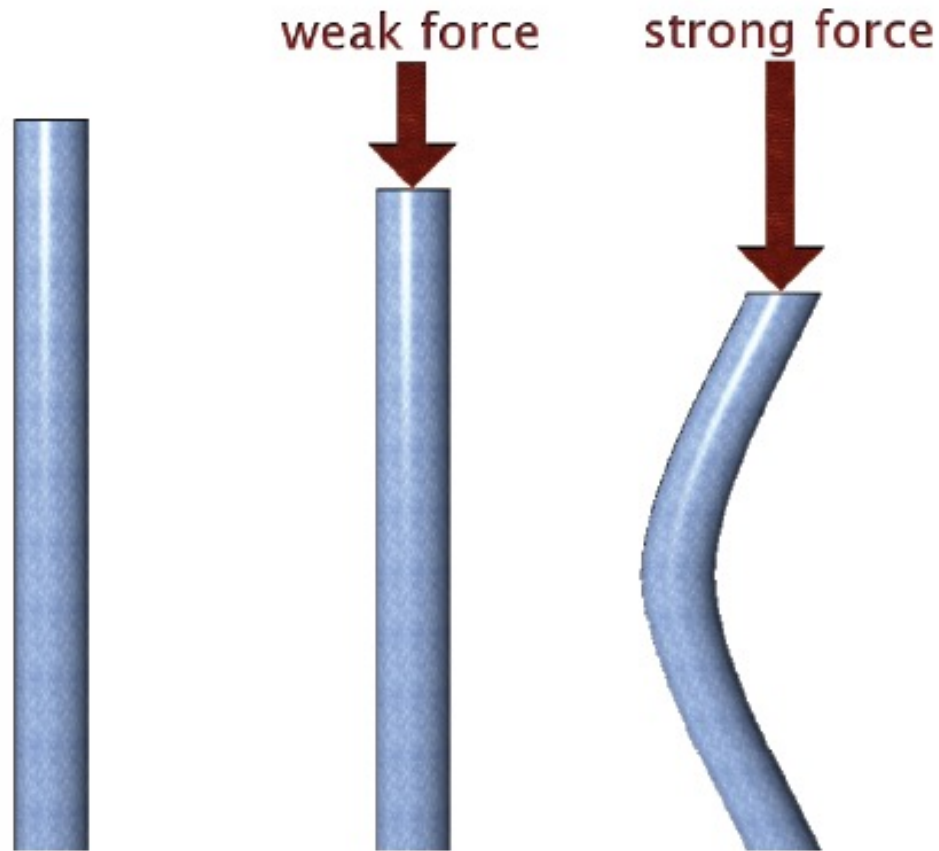
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R. Brout



Spontaniczne łamanie symetrii



Stan podstawowy jest zdegenerowany (symetria obrotowa)

Twierdzenie Goldstone'a



IL NUOVO CIMENTO

VOL. XIX, N. 1

1° Gennaio 1961

Field Theories with «Superconductor» Solutions.

J. GOLDSTONE

CERN - Geneva

(ricevuto l'8 Settembre 1960)

PHYSICAL REVIEW

VOLUME 127, NUMBER 3

AUGUST 1, 1962

Broken Symmetries*

JEFFREY GOLDSTONE

Trinity College, Cambridge University, Cambridge, England

AND

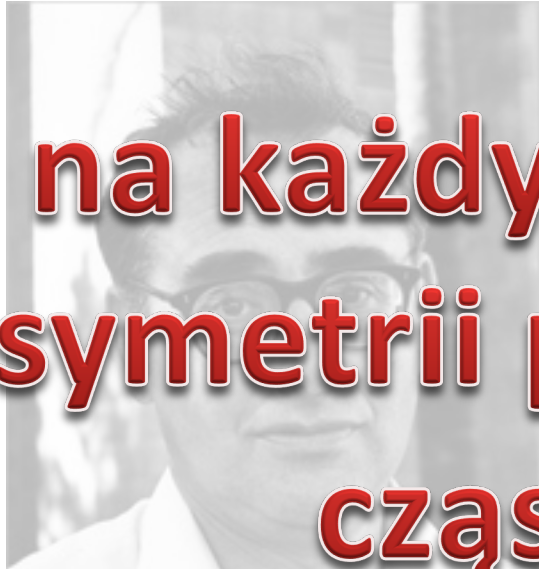
ABDUS SALAM AND STEVEN WEINBERG†

Imperial College of Science and Technology, London, England

(Received March 16, 1962)

Some proofs are presented of Goldstone's conjecture, that if there is continuous symmetry transformation under which the Lagrangian is invariant, then either the vacuum state is also invariant under the transformation, or there must exist spinless particles of zero mass.

Twierdzenie Goldstone'a



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na każdy złamany „kierunek”
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tylko gdzie te cząstki są?

dlaczego ich nie ma w

podejściu nierelatywistycznym?

Some proofs are presented of Goldstone's conjecture, that if there is continuous symmetry transformation under which the Lagrangian is invariant, then either the vacuum state is also invariant under the transformation, or there must exist spinless particles of zero mass.

Jak ominąć twierdzenie Goldstone'a?

Volume 12, number 2

PHYSICS LETTERS

15 September 1964

BROKEN SYMMETRIES, MASSLESS PARTICLES AND GAUGE FIELDS

P. W. HIGGS

Tait Institute of Mathematical Physics, University of Edinburgh, Scotland

wysłany 24 July Received 27 July 1964

- w nierelatywistycznej fizyce materii skondensowanej istnieje wyróżniony układ współrzędnych, symetria translacyjna czy obrotowa jest *ab initio* złamana
- w fizyce relatywistycznej rolę wyróżnionego układu współrzędnych może spełnić wybór cechowania (elektrodynamika)
- można ominąć tw. Goldstone'a dodając sprzężenie do elektrodynamiki

Jak ominąć twierdzenie Goldstone'a?

Tydzień później (31.7.64.) Higgs wysłała do *Phys. Letters* (CERN) pracę z konkretnym modelem, gdzie zespolone pole skalarne z potencjałem typu „Mexican hat” sprzężone jest do elektrodynamiki. Ze spektrum znika bezmasowa cząstka skalarna, foton zyskuje masę.

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P. Higgs: *My life as a boson*

So, I thought (and this was verified by a colleague of mine, Euan Squires, who came back from time at CERN shortly afterwards) it is not good revising this and sending it to *Physics Letters* at CERN, the people at CERN do not understand this sort of thing.

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BROKEN SYMMETRIES AND THE MASSES OF GAUGE BOSONS

Peter W. Higgs

Tait Institute of Mathematical Physics, University of Edinburgh, Edinburgh, Scotland
(Received 31 August 1964)

The model of the most immediate interest is that in which the scalar fields form an octet under $SU(3)$: Here one finds the possibility of two nonvanishing vacuum expectation values, which may be chosen to be the two $Y = 0$, $I_3 = 0$ members of the octet.⁷ There are two massive scalar bosons with just these quantum numbers; the remaining six components of the scalar octet combine with the corresponding components of the gauge-field octet to describe massive vector bosons.

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silne
oddziaływanie!

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dwie cząstki
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