Luciano GIRARDELLO:

A rich career in Physics

Memorial Conference

John Iliopoulos

ENS Paris

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- He did not initially plan to study physics and came to it by a rather circuitous route.

- He was a post-doctoral fellow at Boulder, Colorado and a visitor at Ecole Normale in Paris, at CERN, as well as many Universities in the United States (Harvard, Rockefeller, NUY, SLAC, . . .)

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- He has published almost 120 papers. I will mention very few, with emphasis on his early works, which other speakers may not cover.

Analyticity

Partial-Wave Scattering Amplitudes
for Velocity-Dependent Potentials.

I. - Analyticity Properties in the Energy- and Angular-Momentum Variables.
Asymptotic Behaviour for Large Angular Momentum.

II. - Asymptotic Behaviour for Large Energy.
Levinson Theorem and the N/D Method.

P. BUTERA and L. GIRARDELLO

Istituto di Scienze Fisiche dell'Università, Scuola di Perfezionamento - Milano

They choose a potential of the form

$$V(x, p) = V_1(x) + \left(p^2 V_2(x) \right)_S$$

with V_1 and V_2 Yukawa-type potentials

Coherent states

ON THE COMPLETENESS OF THE COHERENT STATES

V. BARGMANN

Department of Physics, Princeton University, Princeton, New Jersey

P. BUTERA

Istituto di Scienze Fisiche, Universita, Milano and Istituto Nazionale di Fisica Nucleare, Sezione di Milano

L. GIRARDELLO

Istituto di Fisica dell'Universita, Parma and Physics Department, University of Colorado, Boulder, Colorado

and

JOHN R. KLAUDER

Bell Telephone Laboratories, Incorporated, Murray Hill, New Jersey

New "Coherent" States Associated with Non-Compact Groups[*]

A. O. BARUT and L. GIRARDELLO[**]

Institute of Theoretical Physics

and

Department of Physics, University of Colorado, Boulder, Colorado

- In both papers Luciano appears affiliated to the University of Parma (and Milano, in the first)
- In the first they develop the coherent state formalism for the group $SO(2,1)$.
- In the second they prove the completeness property for particular subsets of coherent states.

Infinite dimensional algebras

Representations of the Gauge Groups of Electrodynamics and General Relativity

by L. Girardello[1]

Institute for Theoretical Physics, University of Colorado, Boulder, 80302, USA

and W. Wyss[2]

Department of Mathematics and Institute for Theoretical Physics,
University of Colorado, Boulder, 80302, USA

(12. XI. 71)

Abstract. A semidirect product of the gauge groups of Electrodynamics and General Relativity is determined and unitarily represented on a Hilbertspace of the type $\mathfrak{L}_2(\mathcal{S}', \mu)$.

The Infinite-Dimensional Lie Algebra Common to Dual Models, Current Algebras, Dynamical Groups and Gauge Groups.

A. O. Barut (*), L. Girardello (**) and W. Wyss (***)

Institute for Theoretical Physics, University of Colorado - Boulder, Colo.

Infinite dimensional algebras

- In all these papers Luciano appears affiliated to the University of Parma (and INFN Milano)
- They all show mathematical skill, but also the desire to address questions with a potential physical relevance.

"Phenomenology"

- Luciano appears with three affiliations
- There is no attempt to fit specific data. It is more a study on possible generalisations of KNO scaling. They explore the possibility that, at high energies, the multiplicity distributions are "universal".

SUPERSYMMETRY

In 1978, ten years after the beginning of his research career, Luciano published his first paper on Supersymmetry

AN INFINITE SET OF CONSERVATION LAWS OF THE SUPERSYMMETRIC SINE-GORDON THEORY

S. FERRARA, L. GIRARDELLO [1] and S. SCIUTO [2]

CERN, Geneva, Switzerland

Phys. Lett. Vol. 76B, page 303 (1978)

- They find an infinite set of bosonic conserved currents. The corresponding charges commute with the supersymmetry transformations. As a result, the S-matrix of the model can be computed.
- Since that time, Supersymmetry became the central theme of Luciano's research

SUPERSYMMETRY

Two very influential and seminal papers

SUPER-HIGGS EFFECT IN SUPERGRAVITY WITH GENERAL SCALAR INTERACTIONS

E. CREMMER, B. JULIA, J. SCHERK and P. van NIEUWENHUIZEN [1]
Laboratoire de Physique Théorique de l'Ecole Normale Supérieure [2], 75231 Paris Cedex 05, France

S. FERRARA
CERN, Geneva, Switzerland

and

L. GIRARDELLO
Istituto di Fisica dell 'Università, Milan and INFN, Sezione di Milano, Italy

Using the recently established tensor calculus for supergravity, we construct the most general action for the scalar multiplet coupling. We discuss under which conditions supersymmetry is broken spontaneously and show explicitly that the gravitino acquires a mass by absorbing the Goldstone fermion. Parity violation as well as a cosmological constant can be avoided.

SUPERSYMMETRY

SPONTANEOUS SYMMETRY BREAKING AND HIGGS EFFECT IN SUPERGRAVITY WITHOUT COSMOLOGICAL CONSTANT

E. CREMMER, B. JULIA and J. SCHERK

Laboratoire de Physique Théorique Ecole Normale Supérieure [*]*, Paris, France*

S. FERRARA

CERN, Geneva, Switzerland

L. GIRARDELLO

Istituto di Fisica dell'Università, Milano,
INFN, Sezione di Milano, Italia

P. van NIEUWENHUIZEN [**]

Instituut Lorentz, Leiden, The Netherlands

The super Higgs effect is studied in the $(2, \frac{3}{2}) + (\frac{1}{2}, 0^+, 0^-)$ model. The most general action is obtained using the recently developed tensor calculus: it contains an arbitrary function of *two* variables $\mathcal{G}(A, B)$, A and B being the 0^+ scalar and 0^- pseudoscalar fields of the matter system. The conditions are given which $\mathcal{G}$ must satisfy in order that both the gravitino ψ_μ becomes massive and no cosmological term is induced. Explicit examples are given, a class of them leading to the mass formula $m_A^2 + m_B^2 = 4m_{3/2}^2$.

SUPERSYMMETRY

The problem that triggered my collaboration with Luciano

General mass formula in broken supersymmetry

S. Ferrara

Laboratori Nazionali di Frascati, Istituto Nazionale di Física Nucleare, Frascati, Italy

L. Girardello*

Gordon McKay Laboratory, Harvard University, Cambridge, Massachusetts 02138

F. Palumbo

Laboratori Nazionali di Frascati, Istituto Nazionale di Física Nucleare, Frascati, Italy

The mass formula $\sum_J (-1)^{2J}(2J+1)m_J{}^2 = 0$ is derived for a very general class of interactions with spontaneously broken supersymmetry. It shows the vanishing of the graded trace of the square of the mass operator, with m_J the mass associated with a (real) field of spin J. This mass relation is shown to be true even in the presence of explicit breaking, provided it fulfills suitable requirements.

SUPERSYMMETRY

QUANTUM CORRECTIONS TO A MASS FORMULA IN BROKEN SUPERSYMMETRY

L. GIRARDELLO [1,2]

Gordon Mc Kay Laboratory, Harvard University, Cambridge, MA 02138, USA

and

J. ILIOPOULOS [3]

CERN, Geneva, Switzerland

We investigate the quantum corrections to a mass formula which holds for a general class of models with broken supersymmetry. Three models (supersymmetric QED, the O'Raifertaigh model and the Wess–Zumino model with explicit breaking) are discussed in detail. We find that, in general, quantum corrections modify the mass formula. However, in the case of spontaneous symmetry breaking, the mass formula remains exact to first order in the symmetry breaking parameter but to all orders in perturbation theory. Finally, we include some remarks about the possible origin of the mass relation at the tree level.

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- we have lost Luciano.