IGNATIOS ANTONIADIS

Scientific Symposium

J. Iliopoulos - ENS-Paris

June 2022

Signs of old age

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- *"It is always astonishing to see one's children grow up, and to find that they can do things their parents can no longer fully understand. . ."*
  Hans Albrecht Bethe (Ithaca, N.Y. 1961)

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- See your youngest students retiring


Toscana

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- Published his first paper, March 1979

ON THE SPONTANEOUS BREAKING OF CHIRAL SYMMETRY IN QCD

I. ANTONIADIS
Laboratoire de Physique Théorique de l'Ecole Normale Supérieure [1], *75231 Paris Cédex, France*

Received 12 March 1979

We calculate the vacuum polarization functions of the vector and axial current for massless quarks in second-order perturbation theory We find that, contrary to previous speculations, there is no indication, at this level, of spontaneous breaking of chiral symmetry in QCD

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- "The power of instruction is seldom of much efficacy, except in those happy dispositions where it is almost superfluous."
  Edward Gibbon (1737-1794)

Ignatios ANTONIADIS

His thesis (3e Cycle) was based on two articles

Nuclear Physics B168 (1980) 394–408
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A PROOF OF THE FACTORIZATION OF MASS SINGULARITIES IN THE BJORKEN LIMIT

I. ANTONIADIS and L. BAULIEU[1]
Laboratoire de Physique Théorique de l'Ecole Normale Supérieure, Paris, France*
Lyman Laboratory of Physics, Harvard University, Cambridge, MA 02138, USA

C. KOUNNAS
Centre de Physique Théorique, Ecole Polytechnique, Plateau de Palaiseau, 91128 Palaiseau Cedex, France

Received 27 December 1979

PHYSICAL REVIEW D VOLUME 24, NUMBER 2 15 JULY 1981

Factorization properties and their probabilistic interpretation in polarized electroproduction and annihilation processes

I. Antoniadis*
Laboratoire de Physique Théorique de l'Ecole Normale Supérieure, Laboratoire propre du Centre National de la Recherche Scientifique Associé à l'Ecole Normale Supérieure et à l'Université de Paris-Sud, France

C. Kounnas†
Centre de Physique Théorique, Ecole Polytechnique, 91128 Palaiseau Cedex, France
(Received 27 May 1980; revised manuscript received 5 February 1981)

Our first joined paper

Volume 97B, number 3,4 PHYSICS LETTERS 15 December 1980

A PRECISE FORMULATION OF SPONTANEOUS BREAKING OF GRAND UNIFIED THEORIES

I. ANTONIADIS, C. BOUCHIAT and J. ILIOPOULOS
Laboratoire de Physique Théorique de l'Ecole Normale Supérieure [1], *Paris, France*

Received 7 October 1980

We present a precise formulation using the renormalization group, of the phenomenon of spontaneous breaking of a semi-simple group G to a product of factors $G \to G_1 \times G_2 \times \ldots$. Our treatment takes exactly into account the effect of the different masses, in particular that of the superheavy gauge and Higgs bosons. Therefore it allows for an accurate determination of these parameters.

Our first joined paper

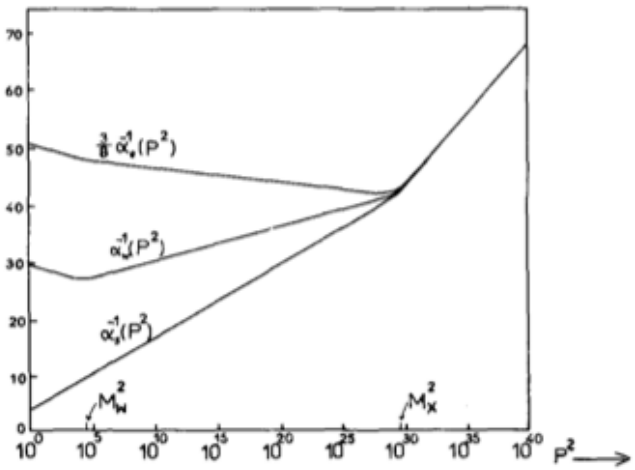


Fig. 7. Plot of the effective coupling constants α_A^{-1}, α_w^{-1}, α_s^{-1} in the region $p^2 = 10^0 - 10^{40}$ (GeV)^2.

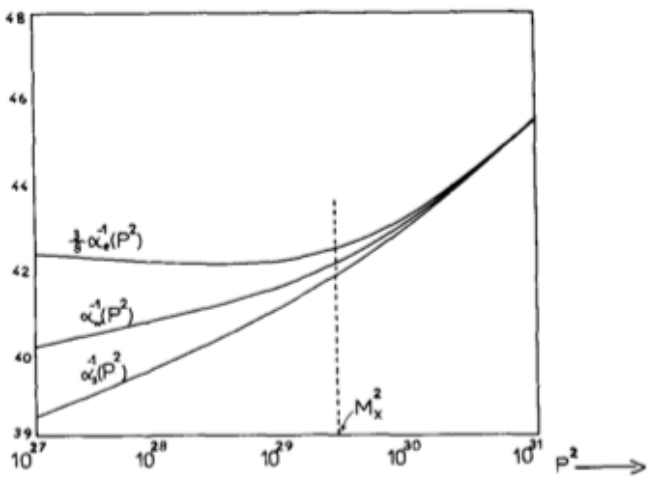


Fig. 8. Plot of the effective coupling constants α_A^{-1}, α_w^{-1}, α_s^{-1} in the M_X energy region $p^2 = 10^{27} - 10^{31}$ (GeV)^2.

Working with Ignatios

- **On the origin of symmetries**

Nuclear Physics B227 (1983) 447–461

ON THE INFRARED STABILITY OF GAUGE THEORIES

I. ANTONIADIS

Centre de Physique Théorique, Ecole Polytechnique, 91128 Palaiseau Cedex, France

J. ILIOPOULOS

*Laboratoire de Physique Théorique de l'Ecole Normale Supérieure**

T. TOMARAS**

California Institute of Technology, Pasadena CA 91125, USA

Received 6 June 1983

Is it possible that the observed symmetries are IR attractors of more general theories?

Ex.

$\mathcal{L} = \frac{1}{2}[(\partial_\mu \phi_1)^2 + (\partial_\mu \phi_2)^2 - m^2(\phi_1^2 + \phi_2^2)] - \lambda(\phi_1^4 + \phi_2^4) - 2g\phi_1^2\phi_2^2$

$\Rightarrow g \to \lambda$

Working with Ignatios

- **On quantum gravity**

Nuclear Physics B261 (1985) 157–171

ON THE STABILITY OF BACKGROUND SOLUTIONS IN CONFORMAL GRAVITY*

I ANTONIADIS[1]
Stanford Linear Accelerator Center, Stanford University, Stanford, CA 94305, USA
J ILIOPOULOS[2]
Laboratoire de Physique Théorique, Ecole Normale Supérieure, Paris, France
T N TOMARAS[3]
Physics Department, Rockefeller University, USA

Received 20 May 1985

Nuclear Physics B267 (1986) 497–508

GAUGE INVARIANCE IN QUANTUM GRAVITY*

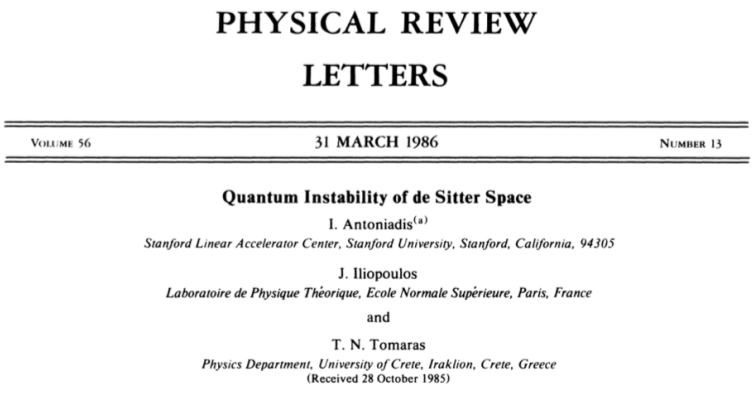
I. ANTONIADIS[1]
Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94305, USA
J. ILIOPOULOS[2]
Laboratoire de Physique Theorique, Ecole Normale Supérieure, Paris, France
T.N. TOMARAS
*Physics Department, Rockefeller University and Physics Department, University of Crete, Iraklion, Crete, Greece***

Received 1 October 1985

Some peculiar properties of perturbation theory in quantum gravity.

Working with Ignatios

- **Quantum field theory in de Sitter space**

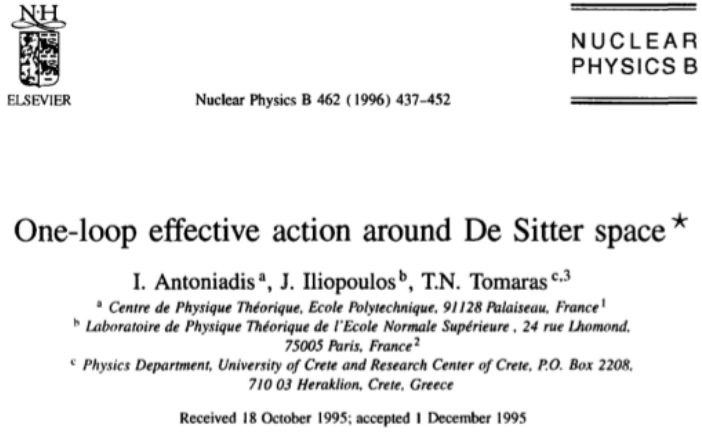


PHYSICAL REVIEW
LETTERS

VOLUME 56 | 31 MARCH 1986 | NUMBER 13

Quantum Instability of de Sitter Space

I. Antoniadis[(a)]
Stanford Linear Accelerator Center, Stanford University, Stanford, California, 94305
J. Iliopoulos
Laboratoire de Physique Théorique, Ecole Normale Supérieure, Paris, France
and
T. N. Tomaras
Physics Department, University of Crete, Iraklion, Crete, Greece
(Received 28 October 1985)



ELSEVIER

Nuclear Physics B 462 (1996) 437–452

NUCLEAR PHYSICS B

One-loop effective action around De Sitter space ★

I. Antoniadis [a], J. Iliopoulos [b], T.N. Tomaras [c,3]
[a] *Centre de Physique Théorique, Ecole Polytechnique, 91128 Palaiseau, France* [1]
[b] *Laboratoire de Physique Théorique de l'Ecole Normale Supérieure , 24 rue Lhomond, 75005 Paris, France* [2]
[c] *Physics Department, University of Crete and Research Center of Crete, P.O. Box 2208, 710 03 Heraklion, Crete, Greece*

Received 18 October 1995; accepted 1 December 1995

The graviton propagator in de Sitter space has IR singularities. What, if any, are their physical consequences?

Working with Ignatios

- **Algebraic theory of membranes**

Nuclear Physics B300 [FS22] (1988) 549–558
North-Holland, Amsterdam

NEW REALIZATIONS OF THE VIRASORO ALGEBRA AS MEMBRANE SYMMETRIES

I. ANTONIADIS[1]*, P. DITSAS[2], E. FLORATOS[3] and J. ILIOPOULOS[4]

[1] *Theory Division, CERN, Geneva*
[2] *Physics Dept., University of Crete, Iraklion, Crete*
[3] *Physics Dept., University of Crete and Research Center of Crete, Iraklion, Crete*
[4] *Laboratoire de Physique Théorique, Ecole Normale Supérieure, Paris*

Received 11 April 1988

Gauge theories as field theories on surfaces.

-A simple algebraic result:

At large N

The $SU(N)$ algebra $\rightarrow$ The algebra of the area preserving diffeomorphisms of a closed surface. (sphere or torus).

-The structure constants of $[SDiff(S^2)]$ are the limits for large N of those of $SU(N)$.

- Given an $SU(N)$ Yang-Mills theory in a $d-$dimensional space

$$A_\mu(x) \;=\; A^a_\mu(x)\; t_a$$

- Given an $SU(N)$ Yang-Mills theory in a $d-$dimensional space

  $A_\mu(x) \;=\; A^a_\mu(x)\; t_a$

- there exists a reformulation in $d+2$ dimensions

  $A_\mu(x) \to \mathcal{A}_\mu(x, z_1, z_2) \qquad F_{\mu\nu}(x) \to \mathcal{F}_{\mu\nu}(x, z_1, z_2)$
  such that
  $N[A_\mu, A_\nu] \to \quad \{A_\mu(x, z_1, z_2), A_\nu(x, z_1, z_2)\}$

  $\Rightarrow$ The d-dim. $SU(N)$ Yang-Mills theory for $N \to \infty$
  $\equiv$
  A classical theory on a $d+2$-dim space.

  The quantum theory??

An analogous result holds also for finite N but the two dimensional surface has a non-commutative geometry:

$$[z_1, z_2] = \frac{2i}{N}$$

$$[A_\mu(x), A_\nu(x)] \to \{\mathcal{A}_\mu(x, z_1, z_2), \mathcal{A}_\nu(x, z_1, z_2)\}_{Moyal}$$

$$\int d^4x \ Tr\left(F_{\mu\nu}(x)F^{\mu\nu}(x)\right) \quad \to \quad \int d^4x dz_1 dz_2 \ \mathcal{F}_{\mu\nu}(x, z_1, z_2) * \mathcal{F}^{\mu\nu}(x, z_1, z_2)$$

These expressions are defined for *all* N!

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