International Centre for Theoretical Physics





ICTP and SUSY-2013

Fernando Quevedo ICTP and University of Cambridge SUSY 2013, ICTP



International Centre for Theoretical Physics



A successful model of international collaboration

- First and leading *global* institution for scientific research and education (emphasis developing countries!).
- Founded 1964 IAEA+Italian government (AS: Nobel Prize 1979)
- Since 1995: Tripartite: Italy+IAEA
 +UNESCO (85% Italy, 10% IAEA, 1.5%
 +administration UNESCO)



Steering Committee 2012







Scientific Council



Professor Luciano Maiani (Council Chairman) President, Consiglio Nazionale delle Ricerche (CNR Rome, Italy



New members::

Professor Renata Kallosh

Professor Juan M. Maldacena

Institute for Advanced Study Princeton, New Jersey

Department of Physics

Standford University

Standford, California

Sir Martin Rees Cosmology and Astrophys Institute of Astronomy University of Cambridge



Professor Carlos A. Aragão de Carvalho Filho Instituto de Física Universidade Federal do Rio de Janeiro Rio de Janeiro, Brasil



Professor F.K.A. Allotey Director, Institute of Mathematical Sciences (IMS Legon-Accra, Ghana



Professor William Bialek Department of Physics, Princeton University Princeton. New Jersev



Professor Edouard Brézin Laboratoire de Physique Théorique de l'ENS Paris, France



Professor José Antonio de la Peña Instituto de Matemáticas Universidad Nacional Autonoma de México México City, D.F. México



Professor Michele Parrinello Computational Science Laboratory Department of Chemistry & Applied Bioscience FTH Zurich Lugano, Switzerland

Professor S. George H. Philander Department of Geosciences Princeton University Princeton, New Jersey



Professor Valeri A. Rubakov Russian Academy of Sciences Institute for Nuclear Research Moscow, Russian Federation



Professor Ashoke Sen Harish-Chandra Research Institute Allahabad, India



Professor Gang Tian Department of Mathematics Princeton University Princeton, New Jersey



Professor Cumrun Vafa Center of the Fundamental Laws of Natu Harvard University **Department of Physics** Cambridge, Massachusetts



Professor Jean-Christophe Yoccoz College de France Department de Mathematiques Paris. France



Professor M. S. Narasimhan Centre for Applicable Mathematics Bangalore, India

Professor Elfatih A. B. Eltahir Department of Civil and Environmental Engineering Massachusetts Institute of Technology Cambridge, Massachusetts





High Energy Cosmology and Astroparticle Physics



Condensed Matters and Statistical Physics



Earth System Physics



Mathematics



Applied Physics



New areas



- Renewable energies
- Quantitative Biology
- High Performance Computing



Postgraduate Education

• Post-Graduate Diploma (1991, 1992, 2006)

• STEP (Sandwich PhD) (2002)

• PhD in main research areas (Trieste U. 2005, SISSA 2011)

• Master in Complex Systems (2011)



Fighting the 'BRAIN DRAIN'

- Associates and Federation Schemes (1964)
- Programmes at ICTP and developing countries (conferences, workshops, schools) (1964)
- TRIL (training and research in Italian laboratories) (1983)
- OEA (office of external activities) (1985)
- ICTP hosts: TWAS (1983), IAP (1993), OWSD (2005)

ICTP Programmes

ICTP

 Schools, Conferences, Workshops around the year (~ 60 at ICTP, ~25 hosted activities, ~15 in developing countries)

• Half of them on subjects related to 4 main research areas (core).

 The rest on many subjects: Medical physics, Optics, Nano-science, Plasma physics, Electronics, High performance computing, Biophysics, Satellite navigation, Science dissemination and e-learning, M-science, Entrepreneurship, Nuclear physics (IAEA), Teacher training, 3D printing, etc.

ICTP Scientific Visits, 1970-2012



- More than 130,000 visits since 1970
- 188 countries represented
- 20% of ICTP visiting scientists are women



Office of External Activities in 2011





Internet Science Dissemination & ICT





Example: Diploma student, associate, postdoc, affiliated centre (member of LHC/CMS)





Center for Theoretical Physics

Shaaban Khalil, CTP Director

Email: skhalil at zewailcity dot edu dot eg

My area of research is the theory of elementary particles, in particular the possible new physics beyond the Standard Model and the interface between particle physics and cosmology. Currently my work focuses on:

Particle Physics:

- Supersymmetric extensions of the Standard Model
- B-L extension of the Standard Model and Grand Unified Field Theory
- CP and Flavor violation

Cosmology and Astroparticle:

- Dark Matter and Dark Energy
- Inflation of Baryon asymmetry

String Phenomenology:

- · Extra dimensional theories and brane models
- Moduli stabilization and Flux compactification
- Phenomenological and Cosmological implications of string theories.



СТР

OVERVIEW
RESEARCH AREAS
STAFF
PUBLICATIONS
ABOUT THE DIRECTOR
SEMINARS AT CTP
JOBS AT CTP
CONTACT CTP

CITY DEVELOPMENTS

Zewail City of Science and Technology witnessed a number of developments in its landscaping and facilities since January 2012. Many future developments are expected as new facilities will be established, including a number of research centers, a laboratory building and a theater.

> learn more

BOARD OF TRUSTEES

MISSION & VALUES

CITY STRUCTURE





ASP2010 (South Africa) and ASP2012 (Ghana)



AFRICAN SCHOOL OF FUNDAMENTAL PHYSICS AND ITS APPLICATIONS

July 15-Aug 04, 2012

KNUST, Kumasi, Ghana africanschoolofphysics.web.cern.ch/AfricanSchoolOfPhysics/ In connection to APS2012, a dedicated Grid School will follow on August 6-8, 2012





Experi

.

(PAL

APS

æ

rators and Te

Application in Particle Physics Experiment

BROOKHAVEN

Jefferson Lab

ASP2012-registration@cern.ch

Deadline: Open for application from Dec 1, 2011 until March 1, 2012

Partial or full support to cover participation costs may be requested on the application form, please also provide a CV and a letter of motivation

ASP2012-IOC@CERN.CH

Fermilat **N** 1'15

ARDENT

National Research

Topics:	Intern
Lical Physics	B. Ac
undation of Nuclear and Particle Physics	K. As
andard Model of Particle Physics	C. Da
ryond The Standard Model	J. Elli
ktro-Particle Physics	S. Mu
neutal Sub-Atomic Physics	Local
avay Ion Physics	E. H. I
uclear and Particle Physics	Energ
rticle Detectors	B. Ag

arya (ICTP, IT) amagan (BNL,USA) ve (FNAL, USA) age & CERN, CH

DISY

ersity of Gha A. Allotey (IMS, Legon-Accra) Amoako-Yirenkyi (KNUST, Kumas nuor (Head of Physics, KNUS) ector of National IMS) ahu (KNUST) L. Mointyre (Unit rsity of Ghana, Gha ensah (University of Cape Coast) kum (Provost, College of Science, KNUST)

nell (U. of Jol A. Dabrowski (CERN, CH) R. Dastranj Tabrizi (SFU, CA) L. Elhouadriri (TJNAF, USA) Ekelőf (Unnsala Unive E. G. Ferreiro (USC, SP) Ferroni (INFN, IT) J. Govaerts (UCL. BE) . Holtkamp (SLAC, USA J. Huston (MSU, USA) M. Kado (CNRS, IN2P3, FR Y.-K. Kim (FNAL, USA) M. Lindroos (ESS, SE) G. Margaritondo (EPFL B. Masara (SAIP, SA) do (EPFL, O H. Montgomery (TJNAF, USA) F. Quevedo (ICTP, IT) L. Rivkin (PSI, CH)

AIMS

NF

. Tsesmelis (CERN, CH) Vickey (II. of the Witw Vigdor (BNL, USA) Vilakazi (Themba LABS, SA R. Voss (CERN, CH)

T.







Science diplomacy





ICTP Sister Institution, Sao Paulo, Brazil (in progress, Mexico, Turkey, China,..)





Funded by UNESP-FAPESP-ICTP www.ictp-saifr.org



ICTP and SUSY-2013



Nuclear Physics B70 (1974) 39-50. North-Holland Publishing Company

lear Physics B76 (1974) 477-482 North-Holland Publishing Company

SUPERGAUGE TRANSFORMATIONS IN FOUR DIMENSIONS

J. WESS Karlsruhe University

> B. ZUMINO CERN, Geneva

Received 5 October 1973

SUPER-GAUGE TRANSFORMATIONS

Abdus SALAM International Centre for Theoretical Physics, Trieste, Italy and Imperial College, London, England

J STRATHDEE International Centre for Theoretical Physics, Trieste, Italy

Received 26 February 1974

Introducing: SUPERFIELDS AND SUPERSPACE!!!

PHYSICAL REVIEW D

VOLUME 11, NUMBER 6

15 MARCH 1975

Superfields and Fermi-Bose symmetry

Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, and Imperial College, London, England

> J. Strathdee International Centre for Theoretical Physics, Trieste, Italy (Received 12 June 1974)

Extended Supersymmetry



Nuclear Physics B80 (1974) 499-505. North-Holland Publishing Company

UNITARY REPRESENTATIONS OF SUPER-GAUGE SYMMETRIES

Abdus SALAM

International Centre for Theoretical Physics, Trieste, Italy, and Imperial College, London, England

J. STRATHDEE

International Centre for Theoretical Physics, Trieste, Italy

Received 14 June 1974

Abstract: A method is given for constructing some of the unitary irreducible representations of the Wess-Zumino super-gauge symmetry. Application of this symmetry to the analysis of S-matrix elements is considered. A new super-gauge symmetry which includes isospin is introduced and some of its representations are constructed.

The Name: SUPERSYMMETRY!!!



Volume 51B, number 4

PHYSICS LETTERS

19 August 1974

SUPER-SYMMETRY AND NON-ABELIAN GAUGES

A. SALAM

International Centre for Theoretical Physics, Trieste, Italy and Imperial College, London, England

and

J. STRATHDEE

International Centre for Theoretical Physics, Trieste, Italy

Received 6 June 1974

* These authors [1], following the usage in dual model theory where the concept originated [2], designate this Fermi-Bose symmetry by the expression "super-gauge". Since the word "gauge" has come to be associated more commonly with "gauges of the second kind" or local symmetries, it is confusing to use super-gauge to describe what is indeed a global symmetry of fermions and bosons. We suggest therefore that the expression "super-symmetry" might be more appropriate for the global concept and reserve the word "gauge" for local symmetries.

Kaluza-Klein, SUSY, Supergravity,...

On Kaluza-Klein Theory

ABDUS SALAM

International Centre for Theoretical Physics, Trieste, Italy, and Imperial College, London, England

AND

J. STRATHDEE

International Centre for Theoretical Physics, Trieste, Italy

Received December 8, 1981

ON KALUZA-KLEIN COSMOLOGY

S. RANDJBAR-DAEMI¹ International Centre for Theoretical Physics, Trieste, Italy and Institute for Theoretical Physics, University of Bern, Bern, Switzerland

Abdus SALAM International Centre for Theoretical Physics, Trieste, Italy and Imperial College, London, England

and

J. STRATHDEE International Centre for Theoretical Physics, Trieste, Italy

Volume 105B, number 4

PHYSICS LETTERS

8 October 1981

SUPERGRAVITIES

VOLUME 1

Edited by Abdus Salam Ergin Sezgin

MASS HIERARCHIES IN SUPERSYMMETRIC THEORIES

Edward WITTEN¹ International Centre for Theoretical Physics, Trieste, Italy

Received 27 July 1981

North-Holland / World Scientific

Introducing Super-Membranes

Volume 189, number 1,2

PHYSICS LETTERS B

30 April 1987

SUPERMEMBRANES AND ELEVEN-DIMENSIONAL SUPERGRAVITY

E. BERGSHOEFF¹, E. SEZGIN

International Centre for Theoretical Physics, I-34100 Trieste, Italy

and

P.K. TOWNSEND DAMPT, University of Cambridge, Silver Street, Cambridge CB3 9EW, UK

Received 6 February 1987

We construct an action for a supermembrane propagating in d=11 supergravity background. Using the constraints of d=11 curved superspace, we show that the action is invariant under Siegel-type transformations recently generalized by Hughes, Li and Polchinski. The transformation parameter is a world-volume scalar and d=11 spacetime spinor. We also discuss the general problem of the coupling of *n*-dimensional extended objects to *d*-dimensional supergravity.

Large Extra Dimensions



The Hierarchy Problem and New Dimensions at a Millimeter

Nima Arkani–Hamed^{*}, Savas Dimopoulos^{**} and Gia Dvali[†] ^{*} SLAC, Stanford University, Stanford, California 94309, USA ^{**} Physics Department, Stanford University, Stanford, CA 94305, USA [†] ICTP, Trieste, 34100, Italy



ELSEVIER

24 September 1998

PHYSICS LETTERS E

Physics Letters B 436 (1998) 257-263

New dimensions at a millimeter to a fermi and superstrings at a TeV

Ignatios Antoniadis ^a, Nima Arkani-Hamed ^b, Savas Dimopoulos ^c, Gia Dvali ^d

^a Centre de Physique Theorique, Ecole Polytechnique, F-91128 Palaiseau, France
 ^b Stanford Linear Accelerator Center, Stanford University, Stanford, CA 94309, USA
 ^c Physics Department, Stanford University, Stanford, CA 94309, USA
 ^d ICTP, Trieste 34100, Italy

PHYSICAL REVIEW D, VOLUME 59, 086004

Phenomenology, astrophysics, and cosmology of theories with submillimeter dimensions and TeV scale quantum gravity

> Nima Arkani-Hamed SLAC, Stanford University, Stanford, California 94309

Savas Dimopoulos Physics Department, Stanford University, Stanford, California 94305

> Gia Dvali ICTP, Trieste, 34100, Italy (Received 22 July 1998; published 23 March 1999)

Current HEP Scientists@ICTP





Plus 10 postdocs+PhD students + affiliated scientists

- New formal (string) theorist being hired now!
- New junior staff (HEP-phenomenologist) just opened!!!!

Udine-ICTP ATLAS Group 1





Udine-ICTP ATLAS Group 2









ICTP has played a vital role in making the benefits of scientific research available to improve human health, prosperity and wellbeing. It has been a reliable partner for the IAEA in helping developing countries use nuclear science and technology for peaceful purposes. ICTP can take pride in its considerable achievements.

Yukiya Amano, Director General International Atomic Energy Agency



As a fully-fledged UNESCO Institute, ICTP is a flagship of UNESCO's sciences programmes. It is a leading international centre that fosters access by scientists, from both developing and developed countries, to scientific excellence in physics and mathematics – including in the cutting-edge area of climate change modelling. ICTP embodies the ideals of UNESCO in education, science and culture. With visits of scientists from over 184 countries in the past 45 years to conduct and discuss research, ICTP has advanced science in a unique multicultural context.

Irina Bokova, Director General United Nations Educational, Scientific and Cultural Organization

ICTP 50th Anniversary Campaign





Over the years, ICTP has left a deep legacy in performing and promoting outstanding fundamental scientific research. In particular, it has had a major impact supporting science in developing countries. Investing in science is the most efficient long-term way to address the major challenges facing humankind.

Stephen Hawking University of Cambridge

ICTP has abundantly fulfilled the vision of Abdus Salam and the others who brought it into existence 50 years ago. It is hard to imagine that any institution could be more costeffective in stimulating world-class science around the world. It deserves the resources and security that would enable it to sustain and expand its programmes.

> Martin Rees Trinity College, University of Cambridge (Photo courtesy of The Boyal Society)





ICTP has played a unique role in bringing physicists from developing countries into the circle of front-line scientific research. But even apart from that special mission, it stands out as a centre of research of the highest quality. Steven Weinberg, Nobel Laureate in Physics 1979 University of Texas at Austin (Photo courtesy of the University of Texas at Austin)





If interested to be involved with ICTP activities to support scientists in developing countries please contact:

ictp_ambassadors@ictp.it, ambassadors@ictp.it

Thank you and Enjoy SUSY-2013 !!