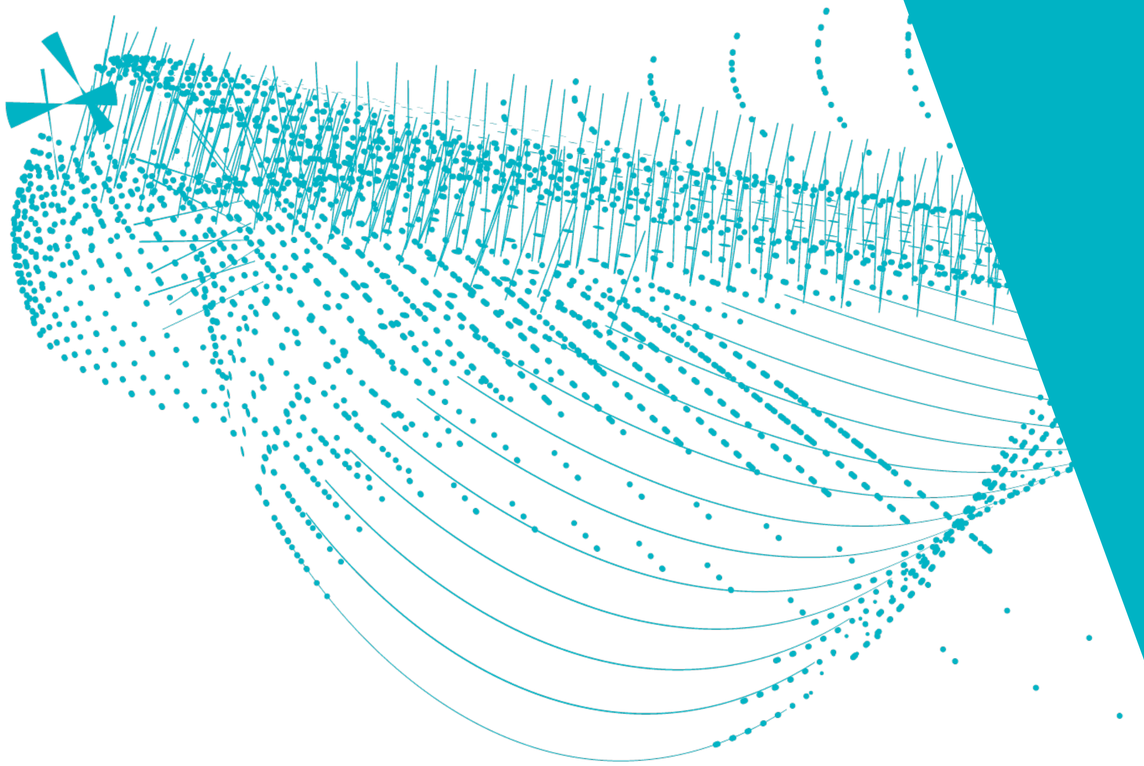
BERT SCHELLEKENS FEST

Nikhef



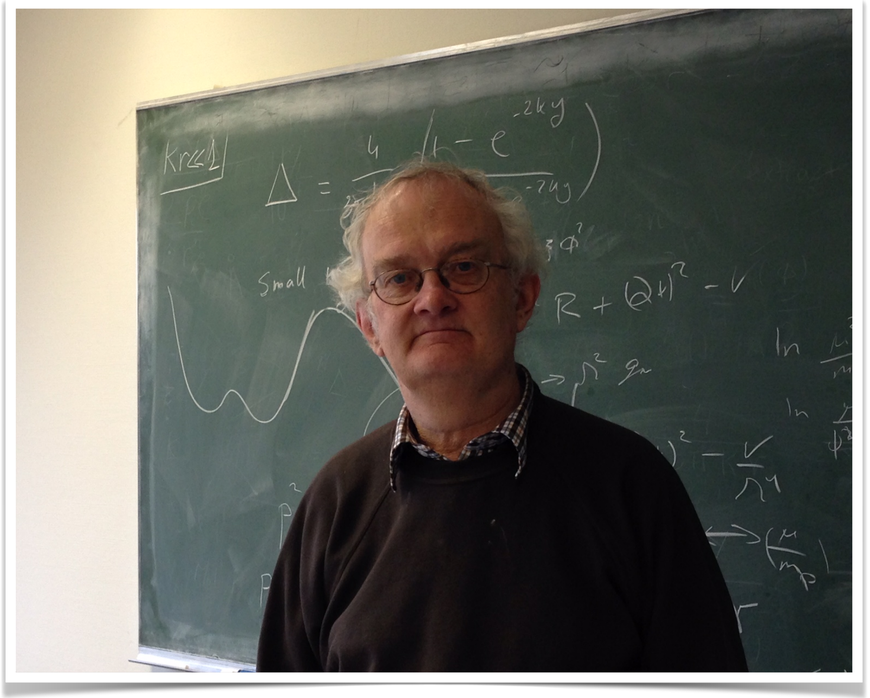
AMSTERDAM, 13 MAY 2022

BERT SCHELLEKENS FEST

Robert Fleischer

KEY STAGES OF BERT'S CAREER

- Born in Nijmegen on 4 March 1954
- 1972: start of physics studies at Radboud University Nijmegen
- 1977-1981PhD at Radboud University: "Perturbative QCD and lepton production" with Roger Van Royen/*Willy van Neerven*
- 1981-1983 Postdoc at Fermilab
- 1983-1985 Postdoc at Stony Brook



KEY STAGES OF BERT'S CAREER

- 1985-1987 CERN Fellow
- 1987-1992 CERN Staff
- Since 1992 Nikhef
- 1997-2017 Extraordinary Professorship at Radboud University Nijmegen:

  PhD students:

  M. Maio, L. Huiszoon, T. Dijkstra, Nuno Sousa

[CERN Theory Christmas Play 1990]

[Nikhef Theory Day Out, June 2009]

IMPRESSIVE SPECTRUM OF RESEARCH

- Composite and technicolor models, proton decay, GUT models, mathematical aspects of the preon model, Kaluza-Klein theories, …
- String theory: relations between all known string theories [with Englert and Nicolai], anomaly cancellation and modular invariance in string theory, "Character Valued Partition Function", chiral four-dimensional heterotic strings [with Lerche and Lüst, *most cited paper* of Bert], argue against the Princeton point of view of string theory having a unique vacuum, which would correspond to the Standard Model …

IMPRESSIVE SPECTRUM OF RESEARCH

- May 1987: Bert came to the conclusion that *this was not just a bug, but an essential feature: pivotal moment in his career!*
- Landscape of string theory, anthropic reasoning, … Bert pointed this out in his inaugural speech in Nijmegen in 1998 about 5 years before Susskind's paper *"The Anthropic Landscape of String Theory".*
- Many more topics Bert has worked in his career:
  - Mathematical physics, orientifolds, conformal field theories, …
  - QFT: group theory factors for Feynman diagrams (with Vermaseren and van Ritbergen)
  - …

SOME IMPRESSIVE NUMBERS

- About 136 publications, with 25 proceedings contributions
- 5 reviews
- 28 publications as single author (excluding proceedings)
- *More than 40 collaborators, some of whom are present at this event!*

[Congress, Madrid, 2013]

More details: please see document on indico.

IMPRESSIVE SPECTRUM OF RESEARCH

REVIEWS OF MODERN PHYSICS, VOLUME 85, OCTOBER–DECEMBER 2013

Life at the interface of particle physics and string theory

A. N. Schellekens

Nikhef, 1098XG Amsterdam, The Netherlands, IMAPP, 6500 GL Nijmegen, The Netherlands, and IFF-CSIC, 28006 Madrid, Spain

(published 2 October 2013)

If the results of the first LHC run are not betraying us, many decades of particle physics are culminating in a complete and consistent theory for all nongravitational physics: the standard model. But despite this monumental achievement there is a clear sense of disappointment: many questions remain unanswered. Remarkably, most unanswered questions could just be environmental, and disturbingly to some the existence of life may depend on that environment. Meanwhile there has been increasing evidence that the seemingly ideal candidate for answering these questions, string theory, gives an answer few people initially expected: a large "landscape" of possibilities that can be realized in a multiverse and populated by eternal inflation. At the interface of "bottom-up" and "top-down" physics, a discussion of anthropic arguments becomes unavoidable. Developments in this area are reviewed, focusing especially on the last decade.

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PAPER

Constraints on extra dimensions from precision molecular spectroscopy

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E J Salumbides[1,2], A N Schellekens[3,4,5], B Gato-Rivera[3,5,6] and W Ubachs[1]

1 Department of Physics and Astronomy and LaserLaB, VU University, De Boelelaan 1081, 1081 HV Amsterdam, The Netherlands
2 Department of Physics, University of San Carlos, Cebu City 6000, Philippines
3 Nikhef, Science Park 105, 1098 XG Amsterdam, The Netherlands
4 Institute for Mathematics, Astrophysics, and Particle Physics, Radboud University, 6500 GL Nijmegen, The Netherlands
5 Instituto de Fisica Fundamental, CSIC, 28006 Madrid, Spain
6 Also known as B Gato.

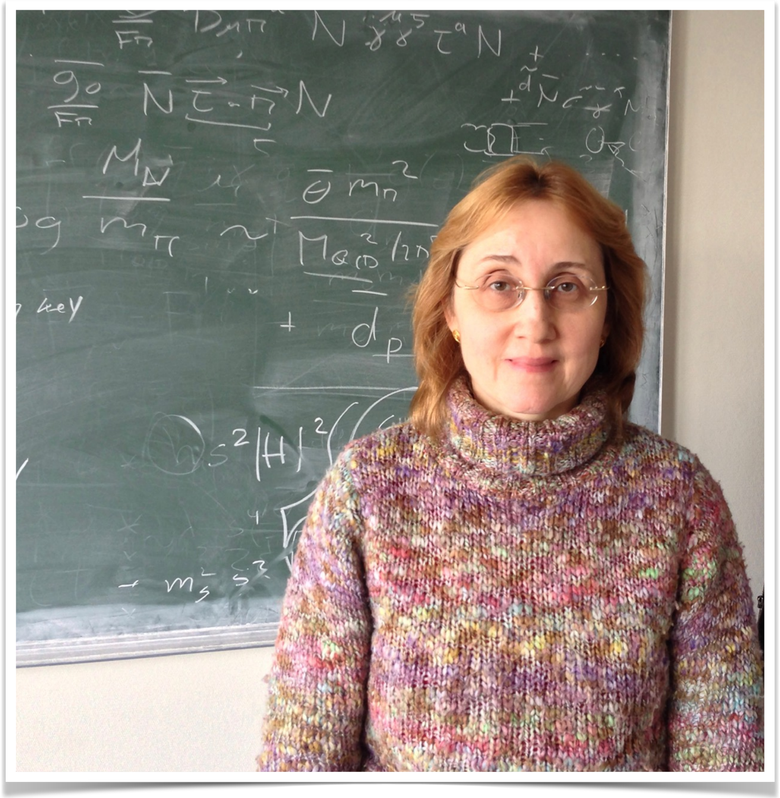
Keywords: higher-dimensional gravity, molecular spectroscopy, QED in molecules

Abstract

Accurate investigations of quantum-level energies in molecular systems are shown to provide a testing ground to constrain the size of compactified extra dimensions. This is made possible by recent progress in precision metrology with ultrastable lasers on energy levels in neutral molecular hydrogen (H_2, HD, and D_2) and molecular hydrogen ions (H_2^+, HD^+, and D_2^+). Comparisons between experiment and quantum electrodynamics calculations for these molecular systems can be interpreted in terms of probing large extra dimensions, under which conditions gravity will become much stronger. Molecules are a probe of spacetime geometry at typical distances where chemical bonds are effective (i.e., at length scales of an Å). Constraints on compactification radii for extra dimensions are derived within the Arkani-Hamed-Dimopoulos-Dvali framework, while constraints for curvature or brane separation are derived within the Randall-Sundrum framework. Based on the molecular spectroscopy of D_2 molecules and HD^+ ions, the compactification size for seven extra dimensions (in connection to M-theory defined in 11 dimensions) of equal size is shown to be limited to $R_7 < 0.6\ \mu$m . While limits on compactification sizes of extra dimensions based on other branches of physics are compared, the prospect of further tightening constraints from the molecular method is discussed.

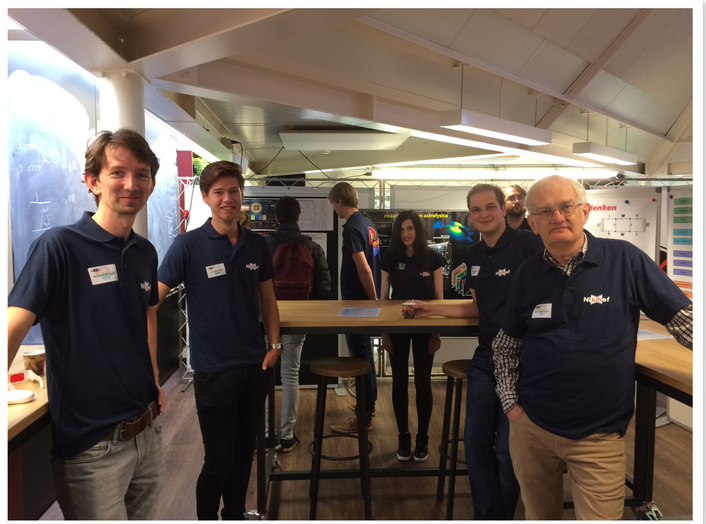
BEATRIZ

- In 1990, Bert met Beatriz Gato Rivera, his wife since August 1991.
- She is by now his most frequent collaborator.
- They have 14 papers together!
- Beatriz will give us more information in her presentation in the afternoon :)



BERT @ NIKHEF

- Fantastic member of the Nikhef family and the theory group!
- Served on various committees and organised our “Theory Day Meetings” for years.
- Such a pleasure to interact with Bert!
- Always fun and very inspiring to talk with Bert about physics…



[Nikhef Open Day 2016]

[Frank Linde Fest Video 2014]

BERT @ NIKHEF

- Many congratulations to your “retirement” from Nikhef.
- You and Beatriz are most welcome to come to Nikhef and join our activities and share your wisdom with us!
- Looking forward to our future interactions …

BEST WISHES!