

Assoc. Prof. Dr. Dieter Van den Bleeken

Boğaziçi University Physics Department
34342 Bebek / Istanbul; Turkey
North Campus, KB Building Floor 3-4

Email: dieter.van@boun.edu.tr
Nationality: Belgian

Phone: +90 212 359 44 68
Date of Birth: 3 October 1982

Academic Career

- 2019-Present Associate professor
Physics Department, Boğaziçi University, Turkey
- 2017-Present Visiting professor
Insitute for Theoretical Physics, Leuven University, Belgium
- 2013-2019 Assistant professor
Physics Department, Boğaziçi University, Turkey
- 2012 Postdoctoral researcher
Physics Department, Boğaziçi University, Turkey
- Fall 2011 Postdoctoral researcher
Department of Mathematics, Galatasaray University, Turkey
- 2008-2011 Postdoctoral fellow
New High Energy Theory Center, Rutgers University, USA

Education

- 2004-2008 Ph.D. in Science: Physics
Advisors: Frederik Denef and Walter Troost
Institute for Theoretical Physics, University of Leuven, Belgium
- Thesis: "Multicenter black holes in string theory."
One semester visit: High Energy Theory Group, Harvard University, USA
- 2002-2004 Master in Physics (Licentiaat) - Summa cum laude
University of Leuven, Belgium
- 2000-2002 Bachelor in Physics (Kandidaat)- Magna cum laude
University of Leuven, Belgium

Theses supervised

PhD theses

- *Perturbative and non-perturbative physics from singularities*, Cihan Pazarbaşı, 2022
- *Adiabatic solutions in general relativity and boundary symmetries.*, Emine Seyma Kutluk, 2020
- *Scaling solutions of $N=2$ supergravity and holography*, Delaram Mirfendereski, 2020

Master theses

- *The inverse scattering method in general relativity*, Erdem Eygi, 2022
- *Aspects of nonrelativistic strong gravity*, Efe Hamamcı, 2020
- *On the large c expansion of general relativity*, Mert Ergen, 2019
- *Symmetries, Global, Local and Asymptotic, Applications of Noether's and Covariant Phase Methods*, Ceyda Şimşek, 2017
- *Instanton methods and the dyonic atom*, Cihan Pazarbaşı, 2015
- *Aspects of supersymmetric mechanics*, Zürbiye Çapkü, 2014

Currently supervising 1 Master and 2 PhD students.

Selected publications

(For a complete list of publications see [here](#).)

- 1) *Renormalons in quantum mechanics*
C. Pazarbaşı and D. Van den Bleeken
JHEP 08 (2019) 096 (arXiv:1906.07198)

Renormalons are divergences of perturbation theory originating in logarithmic momentum dependence due to renormalization. For more than 50 years since their inception it was standard lore that they existed only in quantum field theory and not in one-particle quantum mechanics. In this paper we are the first to present an example to the contrary, based on a Dirac-delta potential known to require renormalization in quantum mechanics. In addition we show how the model can be exactly solved which allows to resolve the Borel-ambiguity associated to the renormalon. How to resolve this ambiguity in QFT remains an open problem and our work opens a new avenue towards a possible solution.

- 2) *Scaling BPS Solutions and pure-Higgs States*
I. Bena, M. Berkooz, J. de Boer, S. El-Showk and D. Van den Bleeken
JHEP 1211 171 (2012) (arXiv:1205.5023)

The entropy of BPS black holes of 4d $N = 2$ supergravity has been famously accounted for by D-brane states in a Calabi-Yau compactification of type II string theory. It remains however unclear what the physical interpretation of these states is when the gravitational coupling is not vanishingly small. In this work we were the first to spell out in detail how some D-brane states develop into known gravitational configurations (fuzzballs) while at the same time an exponential majority of states - the pure-Higgs states - retains its stringy nature. This work identifies the key states responsible for the black hole entropy but also reveals an inherent problem with their gravitational interpretation, putting strong constraints on the fuzzball proposal.

3) *Torsional Newton-Cartan gravity from the large c expansion of General Relativity*

D. Van den Bleeken

Class.Quant.Grav. 34 (2017) no.18, 185004 (arXiv:1703.03459)

In this paper I extend work by Dautcourt on a manifestly covariant nonrelativistic expansion of general relativity by relaxing an unnecessary assumption, which leads to the inclusion of an extra strong gravitational potential related to time dilation. It is shown how the effective theory generalizes standard Newton-Cartan gravity (the covariant version of Newtonian gravity) by the addition of a particular type of torsion. This work reveals an interesting corner of GR where gravity is non relativistic but strong, that had previously not received much attention.

4) *Semiclassical framed BPS states*

G. W. Moore, A. B. Royston and D. Van den Bleeken

JHEP 1607 (2016) 071 (arXiv:1512.08924)

In this rather extensive paper (238 pages) we generalize the moduli space approximation for non-abelian BPS monopoles to the case where a prescribed abelian point source is present. This provides a semiclassical formulation of so called framed BPS states and allowed us to translate some physically motivated wall-crossing conjectures into precise mathematical conjectures for indices of a Dirac operator on a particular set of hyper-Kähler manifolds.

5) *Strolling along gravitational vacua*

E. Ş. Kutluk, A. Seraj and D. Van den Bleeken

JHEP 01 (2020) 184 (arXiv:1904.12869)

Inspired by a recent revival in the study of asymptotic symmetries and soft modes we investigated their interpretation in terms of spontaneous symmetry breaking by identifying a space of (classical) vacua for GR and a natural metric on it. We rigorously show how, when considered on a space-time region of finite spatial volume in a slow velocity limit, the vacuum Einstein equations reduce to geodesic motion on the space of boundary diffeomorphisms.