

# Curriculum Vitae

Subodh P. Patil

## Contact & Personal

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**Nationality:** Indian, Hong Kong permanent resident

**Languages Spoken:** English, Marathi (native/bilingual)  
French (working proficiency)

## Research Interests

- Cosmology – Effective field theory on time dependent backgrounds; Features in primordial correlation functions as cosmological probes; Phenomenological aspects of inflation.
- Gravity – Semi-classical effects on curved spacetimes; gravity as an effective theory; aspects of dark energy.
- Related aspects of string and BSM phenomenology – Testing and constraining stringy models of spacetime and early universe physics; realizations of/ alternatives to inflation; implications of BSM scenarios for cosmology.

## Professional Appointments

- From 10/2016; Assistant Professor, Niels Bohr Institute, Copenhagen
- 03/2015- 10/2016; Maître-Assistant, University of Geneva
- 09/2012- 02/2015; Post-doctoral Fellow, CERN, Geneva; Marie Curie Intra-European Fellowship (09/2012-09/2014)
- 10/2009- 09/2012: Post-doctoral research physicist in String theory and Cosmology at the Ecole Polytechnique (CPHT), and (10/2009- 01/2012) Ecole Normale Supérieure (LPT), Paris
- 10/2007- 10/2009: Post-doctoral research physicist in String theory and Cosmology at the Institute for Physics, Humboldt University of Berlin

## References

- Prof. Ana Achúcarro, Instituut-Lorentz for Theoretical Physics  
Universiteit Leiden 2333 CA Leiden, The Netherlands  
email: achucar@lorentz.leidenuniv.nl
- Prof. Ignatios Antoniadis, UPMC Jussieu/ ITP Bern  
University of Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland  
email: Ignatios.Antoniadis@cpht.polytechnique.fr
- Prof. Robert H. Brandenberger, McGill University  
3600 University St., Montréal, QC H2V 3W7, Canada  
email: rhb@hep.physics.mcgill.ca

- Prof. Cliff Burgess, Perimeter Institute/ McMaster University  
31 Caroline Street North Waterloo, Ontario N2L 2Y5, Canada  
email: cburgess@perimeterinstitute.ca
- Prof. Ruth Durrer, University of Geneva  
24 quai Ernest Ansermet, CH 1211 Geneve-4, Switzerland  
email: Ruth.Durrer@unige.ch

## Education

- 2006 - 2007: **McGill University**, Ph.D. (conferred 2008; advisor: Robert H Brandenberger)  
Thesis– *Enhanced symmetries, duality invariance and moduli stabilization in String Gas Cosmology*
- 2001 - 2005: **Brown University**, MSc. (Ph.D candidate, subsequently transferred to McGill with my advisor, Robert Brandenberger)
- 2000 - 2001: **Imperial College London** (University of London), MSc.  
Thesis– *From  $N$  to infinity: the physics of infinite degrees of freedom*
- 1996 - 2000: **New York University**, B.A. Physics and Mathematics (hons.)
- 1989 - 1996: **South Island School**, Hong Kong, "A"-levels in Physics, Mathematics and Economics.

## Teaching Experience

### As Primary Instructor

- 2014: University of Geneva, Lecturer for Swiss-Romande 3e cycle doctoral school– 14 hour course on "Semi-classical and functional methods on curved space-time and applications to cosmology"
- 2008: Humboldt University of Berlin, Lecturer for graduate course "String Theory and Cosmology"
- 2003: Brown University instructor for summer course for advanced high school students on cosmology and string theory

### As Teaching Assistant

- 2017: Copenhagen University co-instructor for graduate course on advance quantum mechanics
- 2007: McGill University Teaching Assistant for graduate course on general relativity
- 2006: McGill University Teaching Assistant for undergraduate course on space, time and matter
- 2006: McGill University Teaching Assistant for graduate course on general relativity
- 2004: Brown University Teaching Assistant for introductory physics courses for pre-medical students
- 2003: Brown University Teaching Assistant for graduate course on experimental physics
- 2002-2003: Brown University Teaching Assistant for introductory physics courses for pre-medical students

### Student supervision

- Thesis supervisor – Aske Gammelgaard Ravnjebjerg, B.Sc. University of Copenhagen
- Thesis supervisor – Stavros Mouggiakakos, M.Sc. University of Copenhagen

### Schools and special topics lectures

- Feb 2013: Invited lecturer for NIMS winter school on Quantum Gravity and Cosmology, Daejeon, South Korea– 4 lectures on 'Topics in String Cosmology'

- Feb 2011, CPHT Ecole Polytechnique; 2 part special topics lecture series on CMB observations and cosmological perturbation theory
- Feb 2010, LPT Ecole Normale Supérieure; 3 part special topics lecture series on CMB observations and cosmological perturbation theory

## Professional Responsibilities & Engagements

### Refereeing

- Referee, Phys. Rev. D. (APS); 2008 -
- Referee, Phys. Rev. Lett (APS); 2008 -
- Referee, Journal of High Energy Physics (IoP and SISSA); 2009 -
- Referee, Journal of Cosmology and Astroparticle Physics (IoP and SISSA); 2013 -
- Referee, International Journal of Modern Physics A (World Scientific); 2013 -
- Referee, European Physical Journal C (Springer); 2014 -
- Referee, Modern Physics Letters A (World Scientific); 2014 -
- Referee, Computational and Applied Mathematics (Springer); 2014
- Referee, General Relativity and Gravitation (Springer); 2016 -
- Reviewer, Mathematical Reviews (AMS); 2008 - 2010

### Organizational

- Seminar Organizer, CPHT Ecole Polytechnique; 2011-2012
- Seminar Organizer, Cosmology group University of Geneva; 2015 - 2016
- Organizer, CERN/EPFL/UniGe cosmology meetings; 2015-2016
- Scientific Organizing Committee: workshop on 21 cm global signal and spectral distortions, Raman Research Institute, Bangalore July 11 - 16 2016
- Scientific Organizing Committee: CERN Theory Institute on Probing fundamental physics with CMB spectral distortions, March 12 - 16 2018

### Working groups

- Cosmology working group member, (e)LISA consortium 2015 -
- Inflation working group member, CORe satellite ESA M5 proposal 2016 -

### External reviewer/ examiner

- External Reviewer: Netherlands Organisation for Scientific Research (NWO) VIDI grants 2015
- External Reviewer: Chilean National Science and Technology Commission (CONICYT) grants 2015
- External Examiner: Thesis defense of Vicente Atal, Leiden University 08/03/2016

### Professional Memberships

- Nominated Member: Foundational Questions Institute (FQXi)

## Honors and Awards

- Marie Curie Intra-European Fellowship, 2011

- Brown University Fellow, 2001-2002
- Elected to Sigma Pi Sigma (Physics Honor Society), 2000
- International Scholar, New York University, 1996-2000

## Selected Outreach

### Public engagements

- Science inspiration partner for CERN's 2013 artist in residence, Bill Fontana.
- Public lecture on Cosmology at CERN's globe of Innovation and Science, July 4 2013, <http://www.youtube.com/watch?v=0mCkKDTBQao>
- SwissNex sponsored public talk and discussion at San Francisco Exploratorium, March 3 2014.
- Talk for high school students on Mathematics and its relation to the Physical Universe, King George V Secondary School, Hong Kong, May 28 2014.
- Talks for high school students and teachers visiting CERN from Jordan, Kazakhstan and the Ukraine, 04/08/14; from Israel 27/08/14, 21/10/14, 25/02/15, 15/04/15, 29/04/15 and 31/05/16; from Cayman Islands 31/07/15; from the United Kingdom 22/10/15; From India 07/06/15, 22/06/15.
- Guide, virtual visit to CMS experiment for students from Cayman Islands 26/11/15, from Hong Kong 07/06/16 <https://indico.cern.ch/event/457726/page/5505-virtual-guides>
- Invited speaker, LIFT Conference, Geneva Feb 10-12 2016

### Popular articles (disclaimer – not responsible for editor's final article titles;)

- Article on the workings of the LHC, and maintaining beam stability, for Nautilus magazine – [http://nautil.us/blog/listen-to-the-lhcs-weird-whale\\_like-sounds](http://nautil.us/blog/listen-to-the-lhcs-weird-whale_like-sounds)
- Listicle of great experiments that have yet to discover what they set out to look for, for Nautilus magazine – <http://nautil.us/blog/7-major-experiments-that-still-havent-found-what-theyre-looking-for>

## Talks and Seminars since 2010

- Oct 2017, Fundamental Physics in the Cosmos workshop, DESY Hamburg; speaker
- May 2017, Origins of Mass workshop, CP3 Odense; speaker
- April 2017, Hong Kong U. of Science and Technology IAS; theory seminar
- March 2017, Columbia University; theory seminar
- Oct 2016, LPTHE Jussieu; theory seminar
- Sep 2016, New England Cosmology Workshop; speaker
- Sep 2016, Workshop on String Inflation after Planck, Liverpool; speaker
- Jul 2016, ICTS Bangalore; theory seminar
- Jul 2016, Workshop on spectral distortions, Raman Research Institute; speaker
- Jun 2016, ETH Zurich; Astronomy dept seminar
- Nov 2015, BCTP Bonn; theory seminar
- Oct 2015, Windows on Quantum Gravity Workshop, IFT Madrid; speaker

- Oct 2015, DESY, Hamburg; theory seminar
- Oct 2015, NIKHEF, Amsterdam; theory seminar
- Sep 2015, NBI Copenhagen; Theory seminar
- May 2015, IIT Indore; Astronomy dept seminar
- Apr 2015, Humboldt U. of Berlin; QFT group seminar
- Mar 2015, University of Chile, Santiago; Cosmology seminar
- Nov 2014, EPFL Lausanne; Theory seminar
- Aug 2014, IUCAA Pune; CMB group seminar
- Aug 2014, IIT Chennai; Cosmology seminar
- Jun 2014, Peyresq 19, meeting on issues in quantum gravity; speaker
- May 2014, Workshop on New Perspectives on Cosmology, Hong Kong IAS; speaker
- Mar 2014, Rencontres de Moriond, La Thuile, Cosmology; speaker
- Jan 2014, Workshop on initial conditions in Inflation, APC Paris; speaker
- Dec 2013, AEI Golm; cosmology seminar
- Dec 2013, Oxford University; particle theory seminar
- Oct 2013, NBIA Copenhagen; theory seminar
- Oct 2013, ICC U. of Barcelona; cosmology seminar
- Aug 2013, Leiden, Workshop on new challenges for early universe cosmologists; speaker
- Jun 2013, CERN Theory Institute; speaker
- May 2013, IGC Portsmouth; cosmology seminar
- May 2013, Imperial College, cosmology seminar
- Jan 2013, ITP Heidelberg; seminar
- Nov 2012, Geneva University; cosmology seminar
- Oct 2012, CERN; cosmo coffee
- Jul 2012, Leiden, Workshop on Effective theory of inflation; speaker
- May 2012, Kosmologietag 7, Bielefeld; talk
- May 2012, Göttingen University; cosmology seminar
- Mar 2012, PCCP workshop on Tests and Theories of Lorentz Violation, Paris; speaker
- Oct 2011, Princeton University; cosmology lunch seminar
- Sep 2011, Scuola Normale Superiore, Pisa; theory seminar
- Sep 2011, LPTHE, Jussieu; Workshop on hierarchies and symmetries
- May 2011, APC, Paris; theory seminar
- May 2011, CEFIPRA/IFCPAR thematic workshop, Paris; speaker
- May 2011, CP3, Louvain-la-Neuve; cosmology seminar
- Apr 2011, IAP, Paris; gravity and cosmology seminar

- Mar 2011, Crete University, theoretical physics seminar
- Nov 2010, Stanford University, KIPAC; cosmology seminar
- Oct 2010, Hebrew University, Jerusalem; theory seminar
- Jun 2010, ASC, LMU Munich; seminar
- May 2010, Columbia University, ISCAP; seminar
- May 2010, Princeton University; cosmology seminar
- Apr 2010, Perimeter Institute; seminar
- Apr 2010, LUTH Meudon, Paris Observatory; seminar
- Mar 2010, CERN, Geneva; cosmo coffee
- Jan 2010, CPHT, Ecole Polytechnique; seminar

## Workshops and Conferences since 2010

- Fundamental Physics in the Cosmos, DESY Hamburg; Sep 26-29 2017
- Understanding Cosmological Observations, Benasque, Spain; July 30 - Aug 11 2017
- Origins of Mass, CP3 Odense; May 1-4 2017
- LISA Cosmology working group meeting, DESY Hamburg; Oct 17-21 2016
- New England Cosmology and Gravity workshop, Providence; Sep 17 2016
- String Inflation after Planck, Liverpool; Sept 7-9 2016
- Workshop on CMB spectral distortions, Raman Research Institute, Bangalore; Jul 11-16 2016
- Iberian Cosmology meeting, Vila do Conde, Portugal; Mar 29-31 2016
- Workshop on Double Field Theory, ITS Zurich; Jan 20-22 2016
- Texas Symposium on Relativistic Astrophysics, Geneva; Dec 14-18 2015
- Windows on Quantum Gravity, IFT Madrid; Oct 28-30 2015
- COSMO 2015, Warsaw; Sep 7-11 2015
- Peyresq 19 meeting, Issues in Quantum Gravity, Jun 15-20 2014
- APCTP/ HKIAS workshop on New Perspectives on Cosmology, May 19-23 2014
- Rencontres de Moriond, Cosmology, Mar 22-29 2014
- PCCP & APC workshop on Initial Conditions in Inflation, Jan 23-24 2014
- Lorentz Centre workshop on New Challenges for Early Universe Cosmologists, Aug 5-9 2013
- CERN Theory Institute on Cosmology and Fundamental physics with PLANCK, Jun 12-28 2013
- Workshop on Effective Field theory in Inflation, Lorentz Centre, Leiden; Jul 16-20 2012
- 17th Itzykson Meeting on Dark Energy and Modified Gravity, Saclay; Jun 18-20 2012
- 7<sup>th</sup> Kosmologietag, Bielefeld; May 3-4 2012
- PCCP & APC Workshop on Tests and Theories of Lorentz Violation, Paris; Mar 2 2012
- Workshop on Hierarchies and Symmetries, LPTHE, Jussieu, Paris; Sep 17-18 2011
- COSMO 2011, Porto; Aug 21-26 2011
- Cosmological Frontiers in Fundamental Physics, APC, Paris; Jun 14-17 2011

# List Of Publications

Subodh P. Patil

\* **Denotes publications where I am corresponding author.** *Citation Summary as of 29/10/17: 1485 citations, h-index = 20, three 100+ topcites and ten 50+ topcites; average citations per publication: 43.7.*

- \* I. Antoniadis and S. P. Patil, “Fierz, Pauli, Kaluza and Klein” *in preparation*
- \* A. del Rio, R. Durrer and S. P. Patil, “CMB bounds on the hidden universe ” *to appear*
- \* Y. Bar-Yam and S. P. Patil, “Renormalization of Sparse Disorder in the Ising Model” *to appear*
- G. Baym, S. P. Patil, C. Pethick, “Damping of gravitational waves by matter,” *Phys. Rev. D* **96**, no. 8, 084033 (2017) [arXiv:1707.05192 [gr-qc]].
- J. Delabrouille *et al.* [CORE Collaboration], “Exploring Cosmic Origins with CORE: Survey requirements and mission design,” arXiv:1706.04516 [astro-ph.IM]. *in press*
- F. Finelli *et al.* [CORE Collaboration], “Exploring Cosmic Origins with CORE: Inflation,” arXiv:1612.08270 [astro-ph.CO]. *to appear in JCAP*
- C. P. Burgess, J. J. H. Enns, P. Hayman and S. P. Patil, “Goldilocks Models of Higher-Dimensional Inflation (including modulus stabilization)” *JCAP* **1608**, no. 08, 045 (2016) [arXiv:1605.03297 [gr-qc]].
- P. Adshead, C. P. Burgess, D. Blas, P. Hayman and S. P. Patil, “Magnon Inflation: slow roll with steep potentials” *JCAP* **1611**, no. 11, 009 (2016) [arXiv:1604.06048 [hep-th]].
- \* I. Antoniadis, S. P. Patil, “The Effective Strength of Gravity, the Scale of Inflation, KK gravitons and the Higuchi Bound” arXiv:1510.06759 [hep-th] *in press*
- \* S. P. Patil and P. Schwaller, “Relaxing the Electroweak Scale: the Role of Broken dS Symmetry”, *JHEP* **1602**, 077 (2016), [arXiv:1507.08649 [hep-ph]].
- \* J. Chluba, J. Hamann and S. P. Patil, “Features and New Physical Scales in Primordial Observables: Theory and Observation,” *Invited review IJMPD Vol. 24*, No. 8 (2015) 1530023; arXiv:1505.01834 [astro-ph.CO]
- \* I. Antoniadis and S. P. Patil, “The Effective Planck Mass and the Scale of Inflation,” *Eur. Phys. J. C* **75**, no. 5, 182 (2015) arXiv:1410.8845 [hep-th].
- \* R. H. Brandenberger, A. Nayeri and S. P. Patil, “Closed String Thermodynamics and a Blue Tensor Spectrum,” *Phys. Rev. D* **90**, 067301 (2014) arXiv:1403.4927 [astro-ph.CO].
- C. P. Burgess, S. P. Patil and M. Trott, “On the predictiveness of single field inflationary models,” *JHEP* **1406**, 010 (2014) arXiv:1402.1476 [hep-ph]
- \* R. H. Brandenberger, C. Kounnas, H. Partouche, S. P. Patil and N. Toumbas, “Fluctuations in a Non-Singular Bouncing Cosmology from Type II Superstrings,” *JCAP* **1403**, 015 (2014) [arXiv:1312.2524 [hep-th]]
- \* A. Achucarro, J. -O. Gong, G. A. Palma and S. P. Patil, “Correlating features in the primordial spectra,” *Phys. Rev. D* **87**, 121301 (2013) [arXiv:1211.5619 [astro-ph.CO]].
- \* C. P. Burgess, M. W. Horbatsch and S. .P. Patil, “Inflating in a Trough: Single-Field Effective Theory from Multiple-Field Curved Valleys,” *JHEP* **1301**, 133 (2013) [arXiv:1209.5701 [hep-th]].
- A. Achucarro, V. Atal, S. Cespedes, J. -O. Gong, G. A. Palma and S. P. Patil, “Heavy fields, reduced speeds of sound and decoupling during inflation,” *Phys. Rev. D* **86**, 121301 (2012) [arXiv:1205.0710 [hep-th]].
- \* E. Dudas, N. Kitazawa, S. P. Patil and A. Sagnotti, “CMB Imprints of a Pre-Inflationary Climbing Phase,” *JCAP* **1205**, 012 (2012) [arXiv:1202.6630 [hep-th]].
- A. Achucarro, J. -O. Gong, S. Hardeman, G. A. Palma and S. P. Patil, “Effective theories of single field inflation when heavy fields matter,” *JHEP* **1205**, 066 (2012) [arXiv:1201.6342 [hep-th]].

- \* A. Achúcarro, S. Hardeman, J-O. Gong, G. A. Palma and S. P. Patil, “Features of heavy physics in the CMB power spectrum” JCAP **1101**, 030 (2011). [arXiv:1010.3693 [hep-ph]].
- A. Achúcarro, S. Hardeman, J-O. Gong, G. A. Palma and S. P. Patil, “Mass hierarchies and non-decoupling in multi-scalar field dynamics” Phys. Rev. **D84**, 043502 (2011). [arXiv:1005.3848 [hep-th]].
- \* S. P. Patil, “On semi-classical degravitation and the cosmological constant problems” [arXiv:1003.3010 [hep-th]]
- G. A. Palma and S. P. Patil, “UV/IR mode mixing and the CMB,” Phys. Rev. D **80**, 083010 (2009) [arXiv:0906.4727 [hep-th]].
- \* G. A. Palma and S. P. Patil, “Inflation with a stringy minimal length, reworked.” JHEP **0904**, 005 (2009) [arXiv:0810.5532 [hep-th]].
- \* S. P. Patil, “Degravitation, Inflation and the Cosmological Constant as an Afterglow,” JCAP **0901**, 017 (2009) [arXiv:0801.2151 [hep-th]].
- R. H. Brandenberger, S. Kanno, J. Soda, D. A. Easson, J. Khoury, P. Martineau, A. Nayeri, S. P. Patil, “More on the spectrum of perturbations in string gas cosmology,” JCAP **0611**, 009 (2006) arXiv:hep-th/0608186.
- \* R. H. Brandenberger, A. Nayeri, S. P. Patil and C. Vafa, “String gas cosmology and structure formation,” Int.J.Mod.Phys. **A22**:3621-3642 (2007) arXiv:hep-th/0608121.
- R. H. Brandenberger, A. Nayeri, S. P. Patil and C. Vafa, “Tensor modes from a primordial Hagedorn phase of string cosmology,” Phys. Rev. Lett **98**:231302 (2007) arXiv:hep-th/0604126.
- \* S. P. Patil, “Exponential inflation with  $\rho = +p$ ,” arXiv:hep-th/0509088.
- T. J. Battefeld, S. P. Patil and R. H. Brandenberger, “On the transfer of metric fluctuations when extra dimensions bounce or stabilize,” Phys. Rev. D **73**, 086002 (2006) arXiv:hep-th/0509043.
- \* S. P. Patil, “Moduli (dilaton, volume and shape) stabilization via massless F and D string modes,” arXiv:hep-th/0504145.
- \* S. P. Patil and R. H. Brandenberger, “The cosmology of massless string modes,” JCAP **0601**, 005 (2006) arXiv:hep-th/0502069.
- \* S. P. Patil, “D0 matrix mechanics: Topological dynamics of fuzzy spaces,” arXiv:hep-th/0407182.
- \* S. P. Patil, “D0 matrix mechanics: New fuzzy solutions at large N,” JHEP **0501**, 007 (2005) arXiv:hep-th/0406219.
- \* S. P. Patil and R. Brandenberger, “Radion stabilization by stringy effects in general relativity,” Phys. Rev. D **71**, 103522 (2005) arXiv:hep-th/0401037.
- T. J. Battefeld, S. P. Patil and R. Brandenberger, “Perturbations in a bouncing brane model,” Phys. Rev. D **70**, 066006 (2004) arXiv:hep-th/0401010.