

# Curriculum Vitæ

Leonardo Senatore

Physics Department and Slac, Stanford University  
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+1 617 309 8524; Citizenship: Italian, USA Green Card holder.

## Education and Training

Institute for Advanced Study and Harvard University, Member in Theoretical Physics,  
Sept. 2006 - Aug. 2010

Massachusetts Institute of Technology, Theoretical Physics, Ph.D. in Apr. 2006  
(Supervisors Prof.s Alan Guth and Nima Arkani-Hamed)

Scuola Normale Superiore of Pisa, Italy, Theoretical Physics, Undergrad. Diploma in 2003

University of Pisa, Italy, Theoretical Physics, Laurea in 2002

## Academic Positions

Associate Professor (with tenure), Physics Dept. and Slac, Stanford University, Sept. 2016-

Assistant Professor, Physics Department and Slac, Stanford University, Sept. 2010-Aug. 2016  
(after deferring one year)

Staff Member, CERN, Sept. 2012 - Aug. 2013

## Awards and Honors

2015: New Horizons in Physics Prize from the Breakthrough Prize Foundation

2012: Department of Energy Early Career Award

2010: Terman Award

2009: Distinguished Visitor at the University of Texas at Austin

2008: Distinguished Visitor at the University of Texas at Austin

2000-2002: National Scholarship Scuola Normale Superiore of Pisa

1997-2000: National Scholarship S. Anna School for Advanced Studies in Pisa

## Grants

2017: Simons Foundation Grant

2017: US National Science Foundation Grant

2011: US National Science Foundation Grant

## **Stanford Teaching**

Fall 2013, 2014, 2015, 2016, 2017, 2018: Quantum Field Theory 1 (Graduate level)

Spring 2010, 2011: Classical Electrodynamics 2 (Graduate level)

Winter 2011: Classical Electrodynamics 1 (Graduate level)

## **Invited Advanced Lectures**

July 2019: ‘Lecture on Novel Applications of Geometry to Early Universe Physics’, ICTP School on Geometry and Gravity, Trieste, Italy

Sept. 2018: ‘Lectures on the Effective Field Theory of Large-Scale Structure’, Cosmology and Gravity School, Prague, Czech Republic.

Aug. 2018: ‘Lectures on the Effective Field Theory of Large-Scale Structure’, ICTP Cosmology School, Trieste, Italy.

Aug. 2017: ‘Lectures on the Cosmic Microwave Background’, SLAC, Stanford, CA.

Aug. 2017: ‘Lectures on the Effective Field Theory of Large-Scale Structure’, IPM, Tehran, Iran.

Feb. 2017: ‘Lectures on the Effective Field Theory of Inflation’, Fudan University, Shanghai, China.

Feb. 2016: ‘Lectures on the Effective Field Theory of Inflation and Large-Scale Structures’, ICTP-SAIFR, San Paulo, Brazil.

Jun. 2015: ‘Lectures on Inflation’, TASI Summer School, Boulder, CO.

Aug. 2014: ‘Lectures on Inflation’, Traditional Summer School on Cosmology, ICTP, Trieste, Italy.

Jan. 2014: ‘Lectures on Recent Developments in Cosmology’, Asian String School, Puri, India.

Jul. 2013: ‘Lectures on Inflation’, Special Cosmology Summer School ‘New Lights on the CMB from Planck’, ICTP, Trieste, Italy.

Apr. 2013: ‘Lectures on the Effective Field Theory of Inflation’, Taiwan Spring School on Particle and Fields, Taiwan Normal University, Taiwan.

Jul. 2012: ‘Lectures on Inflation’, TASI Summer School, Boulder, CO.

Mar. 2012: ‘Lectures on Inflation’, PASI 2012 Summer School, Buenos Aires, Argentina.

## **Service**

- Reviewer and panelist of several research awards for NSF, DOE, NASA, European Research Council (ERC), Netherland Science Foundation, Swiss Science Foundation.
- Invited reviewer for PRL, PRD, JHEP and JCAP.

## Referees

1. Professor Nima Arkani-Hamed,  
Institute for Advanced Studies  
Princeton, NJ 08540  
+1-609-734-8058  
arkani@ias.edu
2. Professor Matias Zaldarriaga,  
Institute for Advanced Studies  
Princeton, NJ 08540  
+1-609-734-8198  
matiasz@ias.edu
3. Professor Alan Guth,  
Center for Theoretical Physics  
Massachusetts Institute of Technology  
77 Massachusetts Ave, 6-322  
Cambridge, MA 02139  
+1-617-253-6265  
guth@ctp.mit.edu

## Selected Publications

### **Inflation, Early Universe, and Its Signatures**

1. C. Cheung, P. Creminelli, A. L. Fitzpatrick, J. Kaplan and L. Senatore, “The Effective Field Theory of inflation,” *JHEP* **0803** (2008) 014
2. L. Senatore and M. Zaldarriaga, “The Effective Field Theory of Multifield Inflation,” *JHEP* **1204** (2012) 024
3. L. V. Delacretaz, V. Gorbenko and L. Senatore, “The Supersymmetric Effective Field Theory of Inflation,” arXiv:1610.04227 [hep-th].
4. W. E. East, M. Kleban, A. Linde and L. Senatore, “Beginning inflation in an inhomogeneous universe,” *JCAP* **1609** (2016) no.09, 010
5. M. Kleban and L. Senatore, “Inhomogeneous Anisotropic Cosmology,” *JCAP* **1610** (2016) no.10, 022
6. P. Creminelli, L. Senatore and A. Vasy, “Asymptotic Behavior of Cosmologies with  $\Lambda > 0$  in 2+1 Dimensions,” arXiv:1902.00519 [hep-th].
7. D. L. Nacir, R. A. Porto, L. Senatore and M. Zaldarriaga, “Dissipative effects in the Effective Field Theory of Inflation,” *JHEP* **1201** (2012) 075
8. L. Senatore, E. Silverstein and M. Zaldarriaga, “New Sources of Gravitational Waves during Inflation,” *JCAP* **1408** (2014) 016

9. L. Senatore and M. Zaldarriaga, “A Naturally Large Four-Point Function in Single Field Inflation,” JCAP **1101** (2011) 003
10. D. Baumann, L. Senatore and M. Zaldarriaga, “Scale-Invariance and the Strong Coupling Problem,” JCAP **1105** (2011) 004
11. P. Creminelli and L. Senatore, “A smooth bouncing cosmology with scale invariant spectrum,” JCAP **0711** (2007) 010
12. P. Creminelli, M. A. Luty, A. Nicolis and L. Senatore, “Starting the universe: stable violation of the null energy condition and non-standard cosmologies,” JHEP **0612** (2006) 080

### **CMB data analysis**

1. K. M. Smith, L. Senatore and M. Zaldarriaga, “Optimal analysis of the CMB trispectrum,” arXiv:1502.00635 [astro-ph.CO].
2. S. Osborne, L. Senatore and K. Smith, “Collisions with other Universes: the Optimal Analysis of the WMAP data,” arXiv:1305.1964 [astro-ph.CO].
3. L. Senatore, K. M. Smith and M. Zaldarriaga, “Non-Gaussianities in Single Field inflation and their Optimal Limits from the WMAP 5-year Data,” JCAP **1001** (2010) 028
4. P. Creminelli, A. Nicolis, L. Senatore, M. Tegmark and M. Zaldarriaga, “Limits on non-Gaussianities from WMAP data,” JCAP **0605**, 004 (2006)

### **The Effective Field Theory of Cosmological Large-Scale Structures**

1. J. J. M. Carrasco, M. P. Hertzberg and L. Senatore, “The Effective Field Theory of Cosmological Large Scale Structures,” JHEP **1209** (2012) 082
2. R. A. Porto, L. Senatore and M. Zaldarriaga, “The Lagrangian-space Effective Field Theory of Large Scale Structures,” JCAP **1405** (2014) 022
3. J. J. M. Carrasco, S. Foreman, D. Green and L. Senatore, “The Effective Field Theory of Large Scale Structures at Two Loops,” JCAP **1407** (2014) 057
4. L. Senatore and M. Zaldarriaga, “The IR-resummed Effective Field Theory of Large Scale Structures,” JCAP **1502** (2015) 02, 013
5. M. Lewandowski, A. Perko and L. Senatore, “Analytic Prediction of Baryonic Effects from the EFT of Large Scale Structures,” JCAP **1505** (2015) 05, 019
6. L. Senatore and M. Zaldarriaga, “The Effective Field Theory of Large-Scale Structure in the presence of Massive Neutrinos,” arXiv:1707.04698 [astro-ph.CO].
7. T. Baldauf, U. Seljak, L. Senatore and M. Zaldarriaga, “Galaxy Bias and non-Linear Structure Formation in General Relativity,” JCAP **1110** (2011) 031
8. D. Baumann, A. Nicolis, L. Senatore and M. Zaldarriaga, “Cosmological Non-Linearities as an Effective Fluid,” JCAP **1207** (2012) 051

## Quantum Effects in Inflation and Eternal Inflation

1. L. Senatore and M. Zaldarriaga, “On Loops in Inflation,” JHEP **1012** (2010) 08
2. L. Senatore and M. Zaldarriaga, “On Loops in Inflation II: IR Effects in Single Clock Inflation,” JHEP **1301** (2013) 109
3. G. L. Pimentel, L. Senatore and M. Zaldarriaga, “On Loops in Inflation III: Time Independence of zeta in Single Clock Inflation,” JHEP **1207** (2012) 166
4. L. Senatore and M. Zaldarriaga, “The constancy of  $\zeta$  in single-clock Inflation at all loops,” JHEP **1309** (2013) 148
5. P. Creminelli, S. Dubovsky, A. Nicolis, L. Senatore and M. Zaldarriaga, “The Phase Transition to Slow-roll Eternal inflation,” JHEP **0809** (2008) 036
6. S. Dubovsky, L. Senatore and G. Villadoro, “The Volume of the Universe after Inflation and de Sitter Entropy,” JHEP **0904** (2009) 118
7. S. Dubovsky, L. Senatore and G. Villadoro, “Universality of the Volume Bound in Slow-Roll Eternal Inflation,” JHEP **1205** (2012) 035

## Gravitational Waves from Compact Objects

1. S. Endlich, V. Gorbenko, J. Huang and L. Senatore, “An effective formalism for testing extensions to General Relativity with gravitational waves,” JHEP **1709**, 122 (2017)

## Colloquia, Plenary Talks

- July 2019: plenary talk at ‘European Physical Society Conference on High Energy Physics’, Ghent, Belgium.
- July 2019: plenary talk at ‘Dynamics of Large-Scale Structure Formation’, Munich, Germany.
- June 2019: plenary talk at Itzykson Conference on ‘Effective Field Theory in Gravity, Cosmology and Particle Physics’, Paris, France.
- June 2019: plenary talk at ‘The nature of Dark Matter and Large Scale Structure’, Cyprus.
- May 2019: geometry talk at Department of Mathematics, Stanford University.
- Mar. 2019: plenary talk at ‘Accelerating Universe in the Dark’, Kyoto, Japan.
- Oct. 2018: plenary talk at ‘Current challenges in cosmology’, Bogota, Colombia.
- Jul. 2018: plenary talk at ‘The non-linear Universe’, Slovenia.
- Dec. 2017: plenary talk at ‘SUSY 2017’, Mumbai, India.
- Oct. 2017: “Effective Field Theory in Cosmology”, colloquium of the Physics Department, Brown University, Providence, RI.

Oct. 2017: keynote talk at ‘New England Cosmology Meeting’, MIT, Boston, MA.

Sept. 2017: plenary talk at ‘DARKMOD’ conference, CEA, Paris, France.

Sept. 2017: external invitee at ‘Berkeley Center for Theoretical Physics Tahoe Summit’, Lake Tahoe, CA.

Jul. 2017: plenary talk at ‘Advances in Theoretical Cosmology in Light of Data’ conference, Nordita, Stockholm, Sweden.

Jul. 2017: plenary talk at ‘The Non-Linear Universe’ conference, Smartno, Slovenia.

Apr. 2017: plenary talk at ‘String Cosmology’ workshop, University of Michigan, Ann Arbor.

Mar. 2017: “Field Theory in Cosmology”, colloquium of the Physics Department of the University of Washington, Seattle.

Mar. 2017: “Effective Field Theory in Cosmology”, theory colloquium of ETH, Zurich.

Jan. 2017: “Effective Field Theory in Cosmology”, colloquium of the Ecole Normale Supérieure, Paris.

Oct 2016: “Inhomogeneous Anisotropic Cosmology”, plenary talk at Workshop on ‘Theoretical Advances in Particle Cosmology’ at the University of Chicago.

July 2016: “Bias in the Effective Field Theory of Cosmological Large Scale Structures”, plenary talk at Workshop on ‘Theoretical Challenges in Precision Galaxy Clustering’ at the Sexten Center for Astrophysics, Sexten, Italy.

July 2016: “Bias in the Effective Field Theory of Cosmological Large Scale Structures”, plenary talk at Workshop on ‘Biased Tracers of Large-Scale Structure’ at the Lorentz Center, Leiden, Netherlands.

Jun. 2016: “Inhomogeneous Anisotropic Cosmology”, plenary talk at conference ‘Cosmological Frontiers in Fundamental Physics’ at the Perimeter Institute, Canada.

May 2016: “On the perturbative approaches to LSS and the EFT of LSS”, plenary talk at Workshop on ‘Theory Meets Paris’ at Institute d’astrophysique de Paris.

Sept. 2015: “Bias in the Effective Field Theory of Cosmological Large Scale Structures”, plenary talk at Workshop on ‘Unbiased Constraints from Biased Tracers’ at the Institute for Advanced Study, Princeton, NJ.

Aug. 2015: “The Effective Field Theory of Cosmological Large Scale Structures”, Colloquium of the Perimeter Institute, Ontario, CA.

Jul. 2015: “Recent Developments from the Effective Field Theory of Large Scale Structures”, plenary talk at the Conference on ‘Theoretical and Observational Progress on Large-scale Structure of the Universe’, Munich, Germany.

Jul. 2015: “The Effective Field Theory of Large Scale Structures”, plenary talk at the PASCOS conference, ICTP, Trieste, Italy.

- Apr. 2015: “The Effective Field Theory of Large Scale Structures”, plenary talk at the LSST Dark Energy Working Group meeting, Pittsburgh.
- Apr. 2015: “On Quantum Effects in Single Field Inflation”, plenary talk at the ‘Workshop on Quantum Gravity Foundations: from UV to IR’, KITP, Santa Barbara.
- Nov. 2014: “The Effective Field Theory of Large Scale Structures”, plenary talk at the ‘The 24th Workshop on General Relativity and Gravitation’ conference, IMPU, Tokyo, Japan.
- Nov. 2014: “The Effective Field Theory of Large Scale Structures”, plenary talk at the ‘X Latin American Symposium on High Energy Physics’ conference, Medellin, Colombia.
- Aug. 2014: “The Effective Field Theory of Large Scale Structures: the way to go for Inflation”, talk at the ‘Cosmology after Planck’ Workshop, MIAPP, Munich, Germany.
- Aug. 2014: “The Effective Field Theory of Large Scale Structures: the way to go for Inflation”, talk at the ‘Status and future of inflationary theory’ Workshop, KICP, Chicago, IL.
- Jul. 2014: “Inflation physics from the CMB and LSS”, plenary talk at the ‘Frontiers of Fundamental Physics’ Cosmology conference, Marseille, France.
- Jun. 2014: “Theoretical Aspects of  $B$ -modes and Inflation”, Workshop on Frontiers of New Physics: Colliders and Beyond, ICTP, Trieste, Italy
- May. 2014: “Theoretical Aspects of  $B$ -modes and Inflation”, talk at Workshop on Primordial Gravitational Waves and Cosmology, Caltech, CA.
- Feb. 2014: “The Effective Field Theory of Large Scale Structures”, Opening and Introductory talk at the workshop on the ‘Effective Field Theory of Large Scale Structures’, Princeton, NJ.
- Feb. 2014: “Effective Field Theory in Cosmology”, Colloquium at DAMPT, Cambridge University, Cambridge, UK.
- Feb. 2014: “The Effective Field Theory of Large Scale Structures”, plenary talk at the Swiss Cosmology Day, Zurich, Switzerland.
- Jan. 2014: “The Effective Field Theory of Cosmological Large Scale Structures”, plenary talk at the ‘Quantum Fields beyond Perturbation Theory ’ conference, KITP, Santa Barbara, CA.
- Nov. 2013: “Overview of Inflation”, opening and plenary talk of the conference CoSPA 2013, Hawaii.
- Jul. 2013: “Lessons on Inflation from Planck”, talk at Workshop ‘Beyond the Standard Model after the first run of the LHC’ Galileo Galilei Institute, Florence, Italy.
- Jun. 2013: “Review of the bottom-up approach to Inflation”, plenary talk at the ‘Primordial Cosmology’ conference, KITP, Santa Barbara, CA.

- Apr. 2013: “The Effective Field Theory of Large Scale Structures at two loops”, Workshop on ‘The Large-Scale Structure of the Universe at Next-to-Leading Order : COSMO@NLO’, Cargese, France.
- Mar. 2013: “The Effective Field Theory of Large Scale Structures”’, Workshop on ‘Dark Energy’, PCCP, Paris, France.
- Mar. 2013: “On Quantum and IR effects in Single Field Inflation”’, Invited Speaker at Theoretical Physics Meeting of the Paris area.
- Feb. 2013: “Effective Field Theory in Cosmology”, Landelijk Seminarium and Nikhef Colloquium, Amsterdam University, Netherlands
- Dec. 2012: “Effective Field Theory in Cosmology”, colloquium at CERN, Geneva, Switzerland.
- Sep. 2012: Invited Seminars at the KITPC 2012 Cosmology School, Beijing, China on the Effective Field Theory of inflation and the Effective Field Theory of Large Scale Structures.
- Sep. 2012: “Inflation and its tests”, Invited Opening Plenary Speaker at the 2012 COSMO conference, Beijing, China.
- Jul. 2012: “The Effective Field Theory of Inflation”, Invited Plenary Speaker at the Workshop on “Effective Field Theory in Inflation”, Leiden, the Netherlands.
- Feb. 2012: Invited Review on “Non-Gaussianities in the Early Universe”, in progress.
- Jan. 2012: Invited Review on “Inflation in the Early Universe”, in progress.
- Nov. 2011: “On the Effective Field Theory of Inflation and on the Effective Field Theory of the Long Distance Universe”, Workshop ‘Effective Field Theory and Gravitational Physics Conference’, Perimeter Institute, Waterloo, ON.
- Nov. 2011: “Exploring the beginning of the Universe”, colloquium of the Physics Department of Sacramento State University.
- Jul. 2011: “The Effective Field Theory of Inflation and of Multifield Inflation”, plenary talk at PASCOS conference, Cambridge, UK.
- Jul. 2011: “On Slow Roll Eternal Inflation”, Workshop on ‘Challenges for Early Universe Cosmology’, Perimeter Institute, Waterloo, ON.
- Apr. 2011: “Inflation and Its Signatures”, opening talk of the conference “Old and New Themes in Cosmology”, Avignon, France.
- Mar. 2011: “The Effective Field Theory of Inflation”, unique talk of the “Theoretical Cosmology in the Netherlands” meeting, Amsterdam, Netherlands.
- Feb. 2011: “Exploring the Beginning of the Universe”, colloquium of the Kavli Institute for Cosmological Physics, University of Chicago, IL.



- Feb. 2011: “Exploring the Beginning of the Universe”, colloquium of the Physics Department of UC Davis, CA.
- Feb. 2011: “When Cosmology becomes non-Linear”, colloquium of the Kavli Institute for Astroparticle Physics and Cosmology, Stanford, CA.
- Oct. 2010: “On IR effects in single field inflation”, Workshop on ‘IR issues and loops in de Sitter space’, Perimeter Institute, Waterloo, ON.
- Oct. 2010: “Inflation and Its Signatures”, plenary talk at the COSMO/COSPA conference in Tokyo, Japan.
- Jul. 2010: “On Loops in Inflation”, opening talk of the conference “Cosmology and Fundamental Physics” at the Perimeter Institute for Theoretical Physics, Waterloo, On.
- Jun. 2010: “Inflation, Effective Field Theory and Non-Gaussianities”, opening talk of the workshop “The Almost Gaussian Universe”, CEA-Saclay, Paris, France.
- Jun. 2010: “On loops in Inflation”, Conference on ‘Cosmological Frontiers in Fundamental Physics’, Perimeter Institute, Waterloo, ON.
- Apr. 2010: “Observable Effects of Primordial Inflation”, colloquium of the Physics Departments of Embry-Riddle University, AZ.
- Jul. 2009: “The Volume of the Universe after Inflation and de Sitter Entropy”, talk at the “Holographic Cosmology Workshop” at the Perimeter Institute for Theoretical Physics, Waterloo, On.
- May. 2009: “Non-Gaussianities: Probing High Energy Physics with Cosmological Observation”, colloquium of the Stanford Linear Accelerator Laboratory, Stanford, CA.
- Jan. 2009: “Acceleration in our Past and our Present”, colloquium of the Physics Department at the University of Texas at Austin.
- Oct. 2008: “Non-Gaussianity of the Primordial Density Perturbations”, colloquium of the Physics Department at the University of Texas at Austin.
- Gives invited talks, sometimes multiple times, at Physics Departments in the United States (Stanford, Princeton, IAS, Harvard, MIT, Berkeley, Caltech, SLAC, Johns Hopkins, UT Austin, Boston U., Yale, Columbia, NYU, KITP, UCSB, UCSD, UCSC, UC Davis, UPenn, Perimeter Institute, U. of Chicago, U. of Michigan, Texas A&M, Pittsburgh), Europe (CERN, ICTP, Cambridge, Oxford, EPFL, Basel, Zurich, Munich, CEA, Berlin, Normale, ENS, IAP, Leiden, Amsterdam) and Asia (IPMU, Tokyo, Japan; Ewha Woman University, Seoul, Korea; Postech, Pohang, Korea).

## Miscellanea

Travels: Visited Africa: Mauritania, Morocco, Tunisia; Asia: Japan, Korea, China, India, Taiwan, Iran; South America: Argentina, Colombia; Europe: Spain, France, Great Britain (England, Scotland, Wales), Luxemburg, Belgium, Netherlands, Denmark, Germany, Austria, Hungary, Czech Republic, Switzerland, Greece, Island, Ireland,

Sweden, Turkey; North America: United States (New England, California, New York, New Jersey, Pennsylvania, Illinois, Arizona, DC, Utah, Missouri, Nevada, New Mexico, Texas, Washington, Wyoming), Canada (British Columbia, Ontario, Quebec).

Sports: Tennis (used to practice at competition level), field and track (Boston and New York Marathons), likes to mountain climb (Matterhorn, Hornli Ridge; Mont Blanc: Trois Monts Blanc, Arete the Cosmique; Drei Zinnen: Dibona edge, yellow edge; Tofana: first edge, torre Dibona; Breithorn, half traverse; Langkofel, Pichl edge; Funffinger-spitze, traverse; Bernina, normal route) and ski.

Leonardo Senatore

Stanford, CA, Aug. 1<sup>st</sup>, 2019.