



Leonardo Senatore

Associate Professor of Physics and of Particle Physics and Astrophysics

 Curriculum Vitae available Online

Bio

BIO

Leonardo Senatore began a joint appointment as Assistant Professor in the Department of Physics and the Department of Particle Physics and Astrophysics (PPA) at SLAC, with primary appointment in Physics, in September, 2010.

As an undergraduate in Italy, Senatore completed three years of a program in Aerospace Engineering at the Scuola Superiore S. Anna of Pisa, before switching to Physics and receiving his Laurea in Theoretical Physics from the Scuola Normale Superiore of Pisa in 2003. Senatore received his PhD from MIT in April 2006, and then was a postdoctoral researcher jointly at Harvard and the Institute for Advanced Study, Princeton.

ACADEMIC APPOINTMENTS

- Associate Professor, Physics
- Associate Professor, Particle Physics and Astrophysics

ADMINISTRATIVE APPOINTMENTS

- Associate Professor, Physics Department and SLAC, Stanford University, (2010- present)

HONORS AND AWARDS

- New Horizons in Physics Prize, Breakthrough Prize foundation (2015)
- Early Career Award, Department of energy (2012)
- Terman Award, Stanford (2010)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Reviewer, Grants for DOE, NSF, NASA, ERC, Swiss National Foundation, Netherlands Science Organization (2010)
- Peer reviewer, PRL, PRD, JHEP, JCAP (2007)

PROFESSIONAL EDUCATION

- Member, Institute for Advanced Study , Theoretical Physics (2006)
- Postdoctoral Scholar, Harvard University , Theoretical Physics (2006)
- Ph.D., Massachusetts Institute of Technology , Physics (2006)
- University Diploma, Scuola Normale Superiore of Pisa , Physics (2003)
- Laurea, University of Pisa , Physics (2002)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Professor Senatore is a theoretical physicist working to try to understand how the universe began and evolved to its present form. While this is a very interesting and fundamental question per se, from the understanding of how the universe evolved in the first few moments we can infer more about the laws of physics at the smallest distances and highest energies. Cosmological observations are providing us with a huge amount of data, which allows us to test our theories about inflation, eternal inflation and its alternatives, and about the growth of structures in our universe, to an unprecedented level. Senatore tries to bridge the gap between the speculative ideas about the early universe and their possible confirmation in the data.

Current areas of focus:

- Effective field theory of inflation
- Primordial non-Gaussianities
- Effective field theory of cosmological large scale structures
- Eternal inflation and quantum effects in inflation
- Analysis of cosmological data

Teaching

COURSES

2019-20

- Quantum Field Theory I: PHYSICS 330 (Aut)

2018-19

- Quantum Field Theory I: PHYSICS 330 (Aut)

2017-18

- Quantum Field Theory I: PHYSICS 330 (Aut)

2016-17

- Quantum Field Theory I: PHYSICS 330 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Advisor (AC)

Diogo Braganca

Orals Evaluator

Jae Hwan Kang

Publications

PUBLICATIONS

- **Tree-level bispectrum in the effective field theory of large-scale structure extended to massive neutrinos** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
de Belsunce, R., Senatore, L.
2019
- **Black Holes in an Effective Field Theory Extension of General Relativity** *PHYSICAL REVIEW LETTERS*
Cardoso, V., Kimura, M., Maselli, A., Senatore, L.

2018; 121 (25): 251105

- **Light Particles with Spin in Inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Bordin, L., Creminelli, P., Khmelnitsky, A., Senatore, L.
2018
- **On the IR-resummation in the EFTofLSS** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Trevisan, G.
2018
- **EFT of large scale structures in redshift space** *PHYSICAL REVIEW D*
Lewandowski, M., Senatore, L., Prada, F., Zhao, C., Chuang, C.
2018; 97 (6)
- **On the bispectra of very massive tracers in the Effective Field Theory of Large-Scale Structure** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Nadler, E. O., Perko, A., Senatore, L.
2018
- **The Supersymmetric Effective Field Theory of Inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Delacretaz, L. V., Gorbenko, V., Senatore, L.
2017
- **Boost breaking in the EFT of inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Delacretaz, L. V., Noumi, T., Senatore, L.
2017
- **Inhomogeneous anisotropic cosmology** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Kleban, M., Senatore, L.
2016
- **Linear response to long wavelength fluctuations using curvature simulations** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Baldauf, T., Seljak, U., Senatore, L., Zaldarriaga, M.
2016
- **Beginning inflation in an inhomogeneous universe** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
East, W. E., Kleban, M., Linde, A., Senatore, L.
2016
- **Precision comparison of the power spectrum in the EFTofLSS with simulations** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Foreman, S., Perrier, H., Senatore, L.
2016
- **The EFT of Large Scale Structures at all redshifts: analytical predictions for lensing** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Foreman, S., Senatore, L.
2016
- **Bias in the effective field theory of large scale structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L.
2015
- **The one-loop matter bispectrum in the Effective Field Theory of Large Scale Structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Angulo, R. E., Foreman, S., Schmittfull, M., Senatore, L.
2015
- **The cosmological Higgstory of the vacuum instability** *JOURNAL OF HIGH ENERGY PHYSICS*
Espinosa, J. R., Giudice, G. F., Morgante, E., Riotto, A., Senatore, L., Strumia, A., Tetradis, N.
2015
- **On the statistics of biased tracers in the Effective Field Theory of Large Scale Structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Angulo, R., Fasiello, M., Senatore, L., Vlah, Z.

2015

- **Analytic prediction of baryonic effects from the EFT of large scale structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Lewandowski, M., Perko, A., Senatore, L.
2015
- **Inflation after false vacuum decay: Observational prospects after Planck** *PHYSICAL REVIEW D*
Bousso, R., Harlow, D., Senatore, L.
2015; 91 (8)
- **Inflation physics from the cosmic microwave background and large scale structure** *ASTROPARTICLE PHYSICS*
Abazajian, K. N., Arnold, K., Austermann, J., Benson, B. A., Bischoff, C., Bock, J., Bond, J. R., Borrill, J., Buder, I., Burke, D. L., Calabrese, E., Carlstrom, J. E., Carvalho, et al
2015; 63: 55-65
- **Gravitational waves and the scale of inflation** *PHYSICAL REVIEW D*
Mirbabayi, M., Senatore, L., Silverstein, E., Zaldarriaga, M.
2015; 91 (6)
- **The IR-resummed Effective Field Theory of Large Scale Structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Zaldarriaga, M.
2015
- **Inflation after false vacuum decay: new evidence from BICEP2** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Bousso, R., Harlow, D., Senatore, L.
2014
- **New natural shapes of non-Gaussianity from high-derivative interactions and their optimal limits from WMAP 9-year data** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Behbahani, S. R., Mirbabayi, M., Senatore, L., Smith, K. M.
2014
- **New sources of gravitational waves during inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Silverstein, E., Zaldarriaga, M.
2014
- **The Effective Field Theory of Large Scale Structures at two loops** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Carrasco, J. J., Foreman, S., Green, D., Senatore, L.
2014
- **The 2-loop matter power spectrum and the IR-safe integrand** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Carrasco, J. J., Foreman, S., Green, D., Senatore, L.
2014
- **The Lagrangian-space Effective Field Theory of large scale structures** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Porto, R. A., Senatore, L., Zaldarriaga, M.
2014
- **The physical squeezed limit: consistency relations at order $q(2)$** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., Perko, A., Senatore, L., Simonovic, M., Trevisan, G.
2013
- **Anomalous dimensions and non-gaussianity** *JOURNAL OF HIGH ENERGY PHYSICS*
Green, D., Lewandowski, M., Senatore, L., Silverstein, E., Zaldarriaga, M.
2013
- **Optimal analysis of azimuthal features in the CMB** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Osborne, S., Senatore, L., Smith, K.
2013
- **The constancy of zeta in single-clock Inflation at all loops** *JOURNAL OF HIGH ENERGY PHYSICS*

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- Senatore, L., Zaldarriaga, M.
2013
- **On loops in inflation II: IR effects in single clock inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Senatore, L., Zaldarriaga, M.
2013
 - **(Small) resonant non-gaussianities: signatures of a discrete shift symmetry in the effective field theory of inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Behbahani, S. R., Dymarsky, A., Mirbabayi, M., Senatore, L.
2012
 - **The effective field theory of cosmological large scale structures** *JOURNAL OF HIGH ENERGY PHYSICS*
Carrasco, J. J., Hertzberg, M. P., Senatore, L.
2012
 - **A note on the consistency condition of primordial fluctuations** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Zaldarriaga, M.
2012
 - **Cosmological non-linearities as an effective fluid** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Baumann, D., Nicolis, A., Senatore, L., Zaldarriaga, M.
2012
 - **On loops in inflation III: time independence of zeta in single clock inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Pimentel, G. L., Senatore, L., Zaldarriaga, M.
2012
 - **Universality of the volume bound in slow-roll eternal inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Dubovsky, S., Senatore, L., Villadoro, G.
2012
 - **The effective field theory of multifield inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Senatore, L., Zaldarriaga, M.
2012
 - **Dissipative effects in the effective field theory of inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Lopez Nacir, D., Porto, R. A., Senatore, L., Zaldarriaga, M.
2012
 - **Galaxy bias and non-linear structure formation in general relativity** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Baldauf, T., Seljak, U., Senatore, L., Zaldarriaga, M.
2011
 - **Scale-invariance and the strong coupling problem** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Baumann, D., Senatore, L., Zaldarriaga, M.
2011
 - **Primordial non-Gaussianity in the bispectrum of the halo density field** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Baldauf, T., Seljak, U., Senatore, L.
2011
 - **A naturally large four-point function in single field inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Zaldarriaga, M.
2011
 - **On loops in inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Senatore, L., Zaldarriaga, M.
2010

- **Contributions to the dark matter 3-Point function from the radiation era** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Fitzpatrick, A. L., Senatore, L., Zaldarriaga, M.
2010
- **Spherical collapse in quintessence models with zero speed of sound** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., D'Amico, G., Norena, J., Senatore, L., Vernizzi, F.
2010
- **Non-Gaussianities in single field inflation and their optimal limits from the WMAP 5-year data** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Smith, K. M., Zaldarriaga, M.
2010
- **Trapped inflation** *PHYSICAL REVIEW D*
Green, D., Horn, B., Senatore, L., Silverstein, E.
2009; 80 (6)
- **Non-gaussianities from perturbing recombination** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Tassev, S., Zaldarriaga, M.
2009
- **Optimal limits on $f(NL)(local)$ from WMAP 5-year data** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Smith, K. M., Senatore, L., Zaldarriaga, M.
2009
- **Cosmological perturbations at second order and recombination perturbed** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Senatore, L., Tassev, S., Zaldarriaga, M.
2009
- **The volume of the universe after inflation and de Sitter entropy** *JOURNAL OF HIGH ENERGY PHYSICS*
Dubovsky, S., Senatore, L., Villadoro, G.
2009
- **Probing Inflation with CMB Polarization** *CMB Polarization Workshop*
Baumann, D., Jackson, M. G., Adshead, P., Amblard, A., Ashoorioon, A., Bartolo, N., Bean, R., Beltran, M., De Bernardis, F., Bird, S., Chen, X., Chung, D. J., Colombo, et al
AMER INST PHYSICS.2009: 10–120
- **CMBPol Mission Concept Study: Probing Inflation with CMB Polarization** *AIP Conf. Proc*
Baumann, D., Senatore, L.
2009: 10
- **The phase transition to eternal inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Creminelli, P., Dubovsky, S., Nicolis, A., Senatore, L., Zaldarriaga, M.
2008
- **(No) Eternal inflation and precision Higgs physics** *JOURNAL OF HIGH ENERGY PHYSICS*
Arkani-Hamed, N., Dubovsky, S., Senatore, L., Villadoro, G.
2008
- **The effective field theory of inflation** *JOURNAL OF HIGH ENERGY PHYSICS*
Cheung, C., Fitzpatrick, A. L., Kaplan, J., Senatore, L., Creminelli, P.
2008
- **On the consistency relation of the three-point function in single-field inflation** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Cheung, C., Fitzpatrick, A. L., Kaplan, J., Senatore, L.
2008
- **The Phase Transition to Slow-roll Eternal Inflation** *JHEP*
Creminelli, P., Dubovsky, S., Nicolis, A., Senatore, L., Zaldarriaga, M.

2008; 0809: 036

- **A smooth bouncing cosmology with scale invariant spectrum** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., Senatore, L.
2007
- **Estimators for local non-Gaussianities** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., Senatore, L., Zaldarriaga, M.
2007
- **Limits on f(NL) parameters from Wilkinson microwave Anisotropy Probe three-year data** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., Senatore, L., Zaldarriaga, M., Tegmark, M.
2007
- **Limits on fNL parameters from WMAP 3yr data** *JCAP*
Creminelli, P., Senatore, L., Zaldarriaga, M., Tegmark, M.
2007; 0703: 005
- **Starting the Universe: stable violation of the null energy condition and non-standard cosmologies** *JOURNAL OF HIGH ENERGY PHYSICS*
Creminelli, P., Luty, M. A., Nicolis, A., Senatore, L.
2006
- **Limits on non-gaussianities from WMAP data** *JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS*
Creminelli, P., Nicolis, A., Senatore, L., Tegmark, M., Zaldarriaga, M.
2006
- **Hierarchy from baryogenesis** *PHYSICAL REVIEW D*
Senatore, L.
2006; 73 (4)
- **Minimal model for dark matter and unification** *PHYSICAL REVIEW D*
Mahubani, R., Senatore, L.
2006; 73 (4)
- **Isocurvature constraints on gravitationally produced superheavy dark matter** *PHYSICAL REVIEW D*
Chung, D. J., Kolb, E. W., Riotto, A., Senatore, L.
2005; 72 (2)
- **Tilted ghost inflation** *PHYSICAL REVIEW D*
Senatore, L.
2005; 71 (4)
- **How heavy can the fermions in split SUSY be? A study on gravitino and extradimensional LSP** *Phys. Rev. D*
Senatore, L.
2005; 71: 103510