Seshadri Nadathur

Personal Details

Institute of Cosmology and Gravitation
University of Portsmouth
Burnaby Road
Portsmouth PO1 3FX, UK

Office: +44 (0) 23 9284 5150
Mobile: +44 (0) 7763 783474
Email: seshadri.nadathur@port.ac.uk
Web: https://www.icg.port.ac.uk/author/nadathus/
Nationality: British

Research Fields

I am a theoretical astrophysicist, interested in using measurements of large-scale structure of the Universe to learn about dark energy and cosmology. I am best known for my work developing the use of cosmic voids as a precision tool for such studies. My work covers theory, simulation and observations of redshift-space distortions, baryon acoustic oscillations, gravitational lensing and secondary CMB anisotropies. I am a member of the Euclid, DESI, DES and eBOSS galaxy survey collaborations, and co-lead of the Voids Work Package in Euclid.

Academic Positions

STFC Ernest Rutherford Fellow	University College London	01/2021 –
Dennis Sciama Research Fellow	Institute of Cosmology and Gravitation, University of Portsmouth	10/2015 – 12/2020
Postdoctoral research fellow	University of Helsinki	10/2013 – 09/2015
Postdoctoral research fellow	University of Bielefeld	12/2011 – 09/2013
Lecturer in Physics	Trinity College, University of Oxford	10/2007 – 09/2011

Education

DPhil, Theoretical Physics *Supervisor: Prof. Subir Sarkar*	University of Oxford	10/2007 – 11/2011
MPhys Physics (*1st class*)	University of Oxford	10/2005 – 06/2007
BSc Hons Physics (*1st class*)	University of Delhi	07/2002 – 06/2005

Honours, Grants and Awards

STFC Ernest Rutherford Fellowship, PI (approx. £528K)	2020
Marie-Skłodowska Curie Individual Fellowship, PI (approx. €183K)	2015
Dennis Sciama Postdoctoral Fellowship, ICG Portsmouth	2015
Vice Chancellor's Award, University of Oxford	2011
Clarendon Domus Scholarship, Merton College, Oxford (approx. £40,000)	2007
Overseas Research Award, University of Oxford	2007
Rhodes Scholarship (India & Trinity) (approx. £39,000)	2005 – 2007
Peter Fisher Prize, Trinity College, Oxford	2007
Millard Scholarship, Trinity College, Oxford	2006
Summer Research Fellowship, Indian Academy of Sciences	2004

Teaching and Supervision

PhD supervision:

Slađana Radinović (Oslo)	2019 –
Alexander Woodfinden (Waterloo)	2019 –
Paul Carter (ICG Portsmouth)	2017 – 2019

Other research supervision:

Part supervision of PhD students Mikko Lavinto and Samuel Flender (both at Helsinki) on papers contributing to their thesis submissions	2012 – 2014
Virginia d'Emilio, SEPnet undergraduate research placement (ICG Portsmouth)	2017

Graduate teaching:

Invited lecturer, *Bayesian Methods for Galaxy Clustering*	Les Houches Advanced Euclid School	2020
Invited lecturer, *Bayesian Methods for Galaxy Clustering* (rescheduled due to Covid-19)	GOLD cosmology workshop, Pascal Institute, Paris-Saclay	2020
PhD lecture course, *MCMC techniques in cosmology*	ICG Portsmouth	2019
Core PhD lecture course, *Observational Cosmology*	ICG Portsmouth	2017 – 2019
PhD lecture course, *Statistical Methods for Cosmic Structure Formation*	ICG Portsmouth	2017

Undergraduate teaching:

Invited lecturer, University of Helsinki summer school Lectures on *Large-scale structure*	2015
Lecturer in Physics, Trinity College, Oxford Tutorial teaching for 1st year physics undergraduates, college examinations and assessments, admissions interviews. Topics taught: *Mathematical Methods 1 & 2, Waves, Optics* (c. 380 contact hours over 4 years)	2007 – 2011

PROFESSIONAL ACTIVITIES

Collaborations:

- Member of Euclid Consortium since 2018, working in Science Ground Segment (SGS) and Galaxy clustering Science Working Group (GC-SWG)
- **Co-lead of Voids work package** (WP:V) in Euclid GC-SWG (this work package has over 80 participating scientist members)
- **Lead for validation team for galaxy sample selection and spectroscopic visibility mask** development in Euclid SGS; both are key parts of Euclid data reduction pipeline
- Member of SDSS-IV eBOSS collaboration; contributed to eBOSS Data Release 16 analysis papers as part of the quasar and galaxy clustering working group
- **Led eBOSS DR16 void-galaxy correlation analysis**
- Member of DESI collaboration since 2018; working in GQC and C^3 working groups
- Committee member, DESI Speakers Board
- Member of DES collaboration since 2015; contributed to several papers from the Theory and Combined Probes working group

Scientific meeting organization:

Understanding Cosmological Observations biennial workshop	Benasque, Spain	2017 and 2019
South Coast Cosmology	ICG Portsmouth	2018
UKCosmo meeting	ICG Portsmouth	2017

Assessments and reviewing:

2020:	External censor for FYS110 physics examination, University of Stavanger
2019:	Grant reviewer, National Science Centre Poland
Since 2017:	Referee for Astrophysical Journal
Since 2016:	Referee for EPJC
Since 2014:	Referee for MNRAS, Astrophysics and Space Science

2013:	MSc thesis reviewer, A.-S. Balleier (University of Bielefeld)
2012:	MSc thesis reviewer, B. Kalus and BSc thesis reviewer, P. Niksa (both University of Bielefeld)

Public Outreach

TV:

Episode consultant and on-screen interview, *Hannah Fry's Mysterious World of Maths*, BBC4 and Open University (2018, link)

Radio:

Interviews for The Star Spot podcast (Toronto, 2019) and BBC Radio Solent (2018)

Print:

Writer for The Conversation (since 2016); interviews for Mercury Magazine (2019), Live Science (2019, link), New Scientist (2016, link)

Public lectures/talks:

Hampshire Astronomy Group	2019
Winchester Science Festival	2017
ICG 15th Anniversary celebrations	2017
Stargazing Live Portsmouth	2016 and 2017

Social Media:

ICG social media coordinator	2018 – 2019

Invited Academic Presentations

Seminar, Heidelberg ITP	2020
Colloquium, Maynooth University	2020
Cosmology Talks online seminar (YouTube link)	2020
Seminar, University of Sussex	2019
Seminar, Queen Mary University of London	2019
Cosmology Lunch talk, Princeton University	2019
Colloquium, University of Waterloo	2019
Keynote speaker, CINY Workshop, Beijing	2018
Invited speaker, GR Effects in LSS workshop, Sexten	2018
Seminar, University College London	2017
Seminar, University of the Western Cape	2017
Seminar, University of Cape Town	2017
Seminar, African Institute for Mathematical Sciences	2017
Seminar, Royal Observatory Edinburgh	2016
Colloquium, University of Hull	2016
Colloquium, IUCAA Pune	2016
Invited speaker, Multi-scale modelling for LSS workshop, ICTP Trieste	2015
Seminar, Leibniz AIP	2015
Seminar, ICC Durham	2014
Brown Bag Seminar, University of Oxford	2014
Seminar, University of Sussex	2014
Seminar, ICG Portsmouth	2014
Seminar, University of Helsinki	2013
Seminar, NBI Copenhagen	2012
Seminar, University of Göttingen	2012
Seminar, RWTH Aachen	2012

Publications Summary

42 journal papers/preprints (37 published or in press, 5 submitted and in peer review) and 2 conference proceedings
19 first-author or lead-author papers
6 second-author or equal-author papers
1455 total citations (source NASA ADS; as of 02/11/2020)
h-index = 23 (23 papers with >23 citations each)

PUBLICATIONS

*Journal papers sorted by level of personal contribution. Papers in the sub-field of particle cosmology conventionally have an alphabetical author list irrespective of level of contributions; these are indicated by a * after the title.*

FIRST- OR LEAD-AUTHOR PAPERS:

1. *The completed SDSS-IV extended Baryon Oscillation Spectroscopic Survey: geometry and growth from the anisotropic void-galaxy correlation function in the luminous red galaxy sample*
   Seshadri Nadathur, Alex Woodfinden, Will Percival, Marie Aubert *et al*.
   MNRAS 499, 4140 (2020), [arXiv:2008.06060]
2. *Testing late-time cosmic acceleration with large-scale structure*
   Seshadri Nadathur, Will Percival, Florian Beutler, Hans Winther
   Phys. Rev. Lett. 124, 221301 (2020), [arXiv:2001.11044] (*PRL Editors' Suggestion*)
3. *Beyond BAO: Improving cosmological constraints from BOSS data with measurement of the void-galaxy cross-correlation*
   Seshadri Nadathur, Paul Carter, Will Percival, Hans Winther, Julian Bautista
   Phys. Rev. D 100, 023504 (2019) [arXiv:1904.01030]
4. *A Zeldovich reconstruction method for measuring redshift space distortions using cosmic voids*
   Seshadri Nadathur, Paul Carter, Will Percival
   MNRAS 482, 2459 (2019) [arXiv:1805.09349]
5. *An accurate linear model for redshift space distortions in the void-galaxy correlation function*
   Seshadri Nadathur, Will Percival
   MNRAS 483, 3472 (2019) [arXiv:1712.07575]
6. *Tracing the gravitational potential using cosmic voids*
   Seshadri Nadathur, Shaun Hotchkiss, Robert Crittenden
   MNRAS 467, 4067 (2017) [arXiv:1610.08382]
7. *A detection of the integrated Sachs-Wolfe imprint of cosmic superstructures using a matched-filter approach*
   Seshadri Nadathur, Robert Crittenden
   ApJ 830, L19 (2016) [arXiv:1608.08638]
8. *Testing cosmology with a catalogue of voids in the BOSS galaxy surveys*
   Seshadri Nadathur
   MNRAS 461, 358 (2016) [arXiv:1602.04752]
9. *The nature of voids: II. Tracing underdensities with biased galaxies*
   Seshadri Nadathur, Shaun Hotchkiss
   MNRAS 454, 889 (2015) [arXiv:1507.00197]
10. *The nature of voids: I. Watershed void finders and their connection with theoretical models*
    Seshadri Nadathur, Shaun Hotchkiss
    MNRAS 454, 2228 (2015) [arXiv:1504.06510]
11. *Self-similarity and universality of void density profiles in simulation and SDSS data*
    S. Nadathur, S. Hotchkiss, J. M. Diego, I. T. Iliev, S. Gottlöber, W. A. Watson, G. Yepes
    MNRAS 449, 3997 (2015) [arXiv:1412.8372]
12. *Can a supervoid explain the Cold Spot?*
    Seshadri Nadathur, Mikko Lavinto, Shaun Hotchkiss, Syksy Räsänen
    Phys. Rev. D, 90, 103510 (2014) [arXiv:1408.4720]

13. *A robust public catalogue of voids and superclusters in the SDSS Data Release 7 galaxy surveys*
Seshadri Nadathur, Shaun Hotchkiss
MNRAS 440, 1248 (2014) [arXiv:1310.2791]

14. *Seeing patterns in noise: Gigaparsec-scale 'structures' that do not violate homogeneity*
Seshadri Nadathur
MNRAS 434, 398 (2013) [arXiv:1306.1700]

15. *The integrated Sachs-Wolfe imprints of cosmic superstructures: a problem for ΛCDM*
Seshadri Nadathur, Shaun Hotchkiss, Subir Sarkar
JCAP 2012, 042 (2012) [arXiv:1109.4126]

16. *The curvaton scenario in the MSSM and predictions for non-Gaussianity**
Anupam Mazumdar, **Seshadri Nadathur**
Phys. Rev. Lett. 108, 111302 (2012) [arXiv:1107.4078]

17. *Inflation with large supergravity corrections**
Anupam Mazumdar, **Seshadri Nadathur**, Philip Stephens
Phys. Rev. D 85, 045001 (2012) [arXiv:1105.0430]

18. *Inflection point inflation: WMAP constraints and a solution to the fine-tuning problem**
Shaun Hotchkiss, Anupam Mazumdar, **Seshadri Nadathur**
JCAP 2011, 002 (2011) [arXiv:1101.6046]

19. *Reconciling the local void with the CMB*
Seshadri Nadathur, Subir Sarkar
Phys. Rev. D 83, 063506 (2011) [arXiv:1012.3460]

SECOND- OR EQUAL-AUTHOR PAPERS:

20. *The Gravitational Lensing Signatures of BOSS Voids in the Cosmic Microwave Background*
Srinivasan Raghunathan, **Seshadri Nadathur**, Blake D. Sherwin, Nathan Whitehorn
ApJ 890, 168 (2020), [arXiv:1911.08475]

21. *Constraints on decaying dark matter from weak lensing and cluster counts**
Kari Enqvist, **Seshadri Nadathur**, Toyokazu Sekiguchi, Tomo Takahashi
JCAP 2020, 015 (2020) [arXiv:1906.09112]

22. *Decaying dark matter and the tension in σ_8**
Kari Enqvist, **Seshadri Nadathur**, Toyokazu Sekiguchi, Tomo Takahashi
JCAP 2015, 067 (2015) [arXiv:1505.05511]

23. *The Jubilee ISW Project II: observed and simulated imprints of voids and superclusters on the cosmic microwave background*
S. Hotchkiss, **S. Nadathur**, S. Gottlöber, I. T. Iliev, A. Knebe, W. A. Watson, G. Yepes
MNRAS 446, 1321 (2015) [arXiv:1405.3552]

24. *The stacked ISW signal of rare superstructures in ΛCDM**
Samuel Flender, Shaun Hotchkiss, **Seshadri Nadathur**
JCAP 2013, 013 (2013) [arXiv:1212.0776]

25. *Observable gravitational waves from inflation with small field excursions**
Shaun Hotchkiss, Anupam Mazumdar, **Seshadri Nadathur**
JCAP 2012, 008 (2012) [arXiv:1110.5389]

MULTI-AUTHOR PAPERS WITH SIGNIFICANT CONTRIBUTIONS:

Level of personal contribution indicated in each case.

26. *Environmental dependence of X-ray and optical properties of galaxy clusters*

M. Manolopoulou, B. Hoyle, R. G. Mann, M. Sahlén, **S. Nadathur**
MNRAS in press (2020), [arXiv:2010.12671]
(Contributed to data analysis, interpretation of results, drafting and editing manuscript)

27. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: Cosmological Implications from two Decades of Spectroscopic Surveys at the Apache Point observatory*
[eBOSS Collaboration] Shadab Alam *et al.* (99 authors including **Seshadri Nadathur**, alphabetical author list)
Submitted to Phys. Rev. D, [arXiv:2007.08991]
(Contributed directly to cosmological interpretation of results and to drafting and editing of the paper; contributed indirectly via effort in supporting DR16 papers)

28. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: Growth rate of structure measurement from cosmic voids*
Marie Aubert, Marie-Claude Cousinou, Stéphanie Escoffier, Adam J. Hawken, **Seshadri Nadathur**, Shadab Alam *et al.* (17 authors)
Submitted to MNRAS, [arXiv:2007.09013]
(Contributed to data analysis, interpretation of results and editing of paper)

29. *Reconstructing the radial velocity profile of cosmic voids with kinematic Sunyaev-Zeldovich effect*
Yi-Chao Li, Yin-Zhe Ma, **Seshadri Nadathur**
Submitted to Phys. Rev. D, [arXiv:2002.01689]
(Contributed to data analysis and editing of paper draft)

30. *More out of less: an excess integrated Sachs-Wolfe signal from supervoids mapped out by the Dark Energy Survey*
A. Kovacs, C. Sanchez, J. Garcia-Bellido, J. Elvin-Poole, N. Hamaus, V. Miranda, **S. Nadathur**, *et al.* (72 authors)
MNRAS 484, 5267 (2019) [arXiv:1811.07812]
(Contributed to data analysis, science interpretation and editing of paper draft)

31. *Imprint of DES super-structures on the Cosmic Microwave Background*
A. Kovacs, C. Sanchez, J. Garcia-Bellido, **S. Nadathur** *et al.* (64 authors)
MNRAS 465, 4166 (2017) [arXiv:1610.00637]
(Contributed to data analysis, science interpretation and editing of paper draft)

32. *Cosmic Voids and Void Lensing in the Dark Energy Survey Science Verification Data*
C. Sanchez, J. Clampitt, A. Kovacs, B. Jain, J. Garcia-Bellido, **S. Nadathur** *et al.* (73 authors)
MNRAS 465, 746 (2017) [arXiv:1605.03982]
(Contributed to data analysis, science interpretation and editing of paper draft)

33. *The Jubilee ISW Project I: simulated ISW and weak lensing maps and initial power spectra results*
W. A. Watson, J. M. Diego, S. Gottlöber, I. T. Iliev, A. Knebe, E. Martinez-Gonzalez, G. Yepes, R. B. Barreiro, J. Gonzalez-Nuevo, S. Hotchkiss, A. Marcos-Caballero, **S. Nadathur**, P. Vielva
MNRAS 438, 412 (2014) [arXiv:1307.1712]
(Contributed to data analysis, science interpretation and drafting of paper)

COLLABORATION PAPERS:

Level of personal contribution indicated in each case.

34. *DES Y1 results: Splitting growth and geometry to test ΛCDM*
J. Muir *et al.* (102 authors including **S. Nadathur**)
Submitted to Phys. Rev. D, [arXiv:2010.05924]

(Contributed to science interpretation and editing of paper draft)

35. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: measurement of the BAO and growth rate of structure of the luminous red galaxy sample from the anisotropic correlation function between redshifts 0.6 and 1.0*
Julian E. Bautista, Romain Paviot *et al.* (33 authors including **Seshadri Nadathur**)
MNRAS in press (2020), [arXiv:2007.08993]
(Contributed to development of reconstruction code used for BAO analysis)

36. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: measurement of the BAO and growth rate of structure of the luminous red galaxy sample from the anisotropic power spectrum between redshifts 0.6 and 1.0*
Hector Gil-Marin, Julian E. Bautista *et al.* (40 authors including **Seshadri Nadathur**)
MNRAS 498, 2492 (2020), [arXiv:2007.08994]
(Contributed to development of reconstruction code used for BAO analysis, and editing of paper)

37. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: Large-scale Structure Catalogues and Measurement of the isotropic BAO between redshift 0.6 and 1.1 for the Emission Line Galaxy Sample*
Anand Raichoor, Arnaud de Mattia *et al.* (40 authors including **Seshadri Nadathur**)
MNRAS in press (2020), [arXiv:2007.09007]
(Contributed to development of reconstruction code used for BAO analysis)

38. *The Completed SDSS-IV Extended Baryon Oscillation Spectroscopic Survey: measurement of the BAO and growth rate of structure of the emission line galaxy sample from the anisotropic power spectrum between redshift 0.6 and 1.1*
Arnaud de Mattia, Vanina Ruhlmann-Kleider *et al.* (36 authors including **Seshadri Nadathur**)
Submitted to MNRAS, [arXiv:2007.09008]
(Contributed to development of reconstruction code used for BAO analysis)

39. *The Sixteenth Data Release of the Sloan Digital Sky Surveys: First Release from the APOGEE-2 Southern Survey and Full Release of eBOSS Spectra*
[SDSS-IV Collaboration] Romina Ahumada, Carlos Allende Prieto, *et al*. (312 authors including **Seshadri Nadathur**, alphabetical author list)
ApJS 249, 3 (2020), [arXiv:1912.02905]
(Authorship based on contribution of >1 month FTE to DR16 science analyses)

40. *Constraints on the growth of structure around cosmic voids in eBOSS DR14*
Adam J. Hawken, Marie Aubert, Alice Pisani, Marie-Claude Cousinou, Stephanie Escoffier, **Seshadri Nadathur**, Graziano Rossi, Donald P. Schneider
JCAP 2020, 012 (2020) [arXiv:1909.04394]
(Contributed to interpretation of science results, editing of paper)

41. *Dark Energy Survey Year 1 Results: the lensing imprint of cosmic voids on the Cosmic Microwave Background*
P. Vielzeuf, A. Kovács, U. Demirbozan *et al*. (65 authors including **Seshadri Nadathur**)
MNRAS in press (2020), [arXiv:1911.02951]
(Contributed to science interpretation and editing of paper draft)

42. *Beyond ΛCDM: Problems, solutions, and the road ahead*
Philip Bull, Yashar Akrami *et al.* (41 authors including **Seshadri Nadathur**)
Physics of the Dark Universe, 12, 56 (2016) [arXiv:1512.05356]
(Wrote one section of multi-author review paper)

CONFERENCE PROCEEDINGS:

43. *Universal void density profiles from simulation and SDSS*

S. Nadathur, S. Hotchkiss, J. M. Diego, I. T. Iliev, S. Gottlöber, W. A. Watson, G. Yepes
The Zeldovich Universe: Genesis and Growth of the Cosmic Web, 308, 542 (2016)
[arXiv:1412.8372]

44. *The ISW imprints of voids and superclusters on the CMB*
S. Hotchkiss, **S. Nadathur**, S. Gottlöber, I. T. Iliev, A. Knebe, W. A. Watson, G. Yepes
The Zeldovich Universe: Genesis and Growth of the Cosmic Web, 308, 580 (2016)