Sownak Bose

Curriculum Vitæ

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Employment

Sept 2017–Present **Harvard-Smithsonian Center for Astrophysics, Harvard University**, ITC Fellow.

Education

2013–2017 **Institute for Computational Cosmology, University of Durham**, PhD in Astrophysics, supervised by Prof. Carlos Frenk, Dr. Baojiu Li and Prof. Adrian Jenkins.

- Performing and analysing cosmological dark matter-only and hydrodynamical simulations. Experience in using semi-analytic models of galaxy formation, creating high resolution 'zoom-in' initial conditions and building dark matter merger trees. Extensive use of GADGET, AREPO and RAMSES numerical codes.
- Organiser of two weekly student journal clubs.
- Postgraduate student representative at the institute's staff meetings.

2009–2013 **St. Catherine's College, University of Oxford**, Master of Physics (MPhys).

- Master's thesis titled 'Gauge theories and *dessins d'enfants*: beyond the torus' under the supervision of Prof. Yang-Hui He.

Awards and scholarships

2013–2017 STFC PhD studentship

2016 Keith Nicholas postgraduate prize for 'outstanding overall performance' by a postgraduate student in the Physics department

2012 Master's Book Prize (college award for undergraduate performance)

2012 IoP/Nuffield bursary for undergraduate research

2011 Master's Book Prize

2011 Voted 'best student talk' at St. Catherine's College undergraduate physics seminar

Publications

First author

1 **Speeding up N-body simulations of modified gravity: Chameleon screening models**.

Bose, S., Li, B., Barreira, A., He, J., Hellwing, W. A., Koyama, K., Llinares, C., & Zhao, G. B. 2017, *Journal of Cosmology and Astro-Particle Physics*, 2, 050.

2 **Substructure and galaxy formation in the Copernicus Complexio warm dark matter simulations**.

Bose, S., Hellwing, W. A., Frenk, C. S., Jenkins, A., Lovell, M. R., Helly, J. C., Li, B., Gonzalez-Perez, V., & Gao, L., *Monthly Notices of the Royal Astronomical Society*, 464, 4520.

3 **Reionization in sterile neutrino cosmologies**.

Bose, S., Frenk, C. S., Jun, H., Lacey, C. G., & Lovell, M. R., *Monthly Notices of the Royal Astronomical Society*, 463, 3848.

4 **The Copernicus Complexio: statistical properties of warm dark matter haloes**.

Bose, S., Hellwing, W. A., Frenk, C. S., Jenkins, A., Lovell, M. R., Helly, J. C., & Li, B., *Monthly Notices of the Royal Astronomical Society*, 455, 318.

5 **Testing the quasi-static approximation in $f(R)$ gravity simulations**.

Bose, S., Hellwing, W. A., & Li, B. 2015, *Journal of Cosmology and Astro-Particle Physics*, 2, 034.

6 **Gauge theories and dessins d'enfants: beyond the torus**.

Bose, S., Gundry, J., & He, Y.-H. 2015, *Journal of High Energy Physics*, 1, 135.

N-th author

7 **Properties of Local Group galaxies in hydrodynamical simulations of sterile neutrino dark matter cosmologies**.

Lovell, M. R., **Bose, S.**, Boyarsky, A., Crain, R. A., Frenk, C. S., Hellwing, W. A., Ludlow, A. D., Navarro, J. F., Ruchayskiy, O., Sawala, T., Schaller, M., Schaye, J., & Theuns, T. 2017, *Monthly Notices of the Royal Astronomical Society*, 468, 4285.

8 **Satellite galaxies in semi-analytic models of galaxy formation with sterile neutrino dark matter**.

Lovell, M. R., **Bose, S.**, Boyarsky, A., Cole, S., Frenk, C. S., Gonzalez-Perez, V., Kennedy, R., Ruchayskiy, O., & Smith, A. 2016, *Monthly Notices of the Royal Astronomical Society*, 461, 60.

9 **The mass-concentration-redshift relation of cold and warm dark matter haloes**.

Ludlow, A. D., **Bose, S.**, Angulo, R. E., Wang, L., Hellwing, W. A., Navarro, J. F., Cole, S., & Frenk, C. S. 2016, *Monthly Notices of the Royal Astronomical Society*, 460, 1214.

10 **Weak lensing by galaxy troughs with modified gravity**.

Barreira, A., **Bose, S.**, Li, B., & Llinares, C. 2017, *Journal of Cosmology and Astro-Particle Physics*, 2, 031.

11 **Speeding up N-body simulations of modified gravity: Vainshtein screening models**.

Barreira, A., **Bose, S.**, & Li, B. 2015, *Journal of Cosmology and Astro-Particle Physics*, 12, 059.

12 **Planes of satellite galaxies: when exceptions are the rule**.

Cautun, M., **Bose, S.**, Frenk, C. S., Guo, Q., Han, J., Hellwing, W. A., Sawala, T., & Wang, W. 2015, *Monthly Notices of the Royal Astronomical Society*, 452, 3838.

13 **Addressing the too big to fail problem with baryon physics and sterile neutrino dark matter**.

Lovell, M. R., Gonzalez-Perez, V., **Bose, S.**, Boyarsky, A., Cole, S., Frenk, C. S., & Ruchayskiy, O. 2017, *Monthly Notices of the Royal Astronomical Society*, 468, 2836.

14 **RAY-RAMSES: a code for ray tracing on the fly in N-body simulations**.

Barreira, A., Llinares, C., **Bose, S.**, & Li, B. 2016, *Journal of Cosmology and Astro-Particle Physics*, 5, 001.

15 **The Santiago-Harvard-Edinburgh-Durham void comparison I: SHEDding light on chameleon gravity tests**.

Cautun, M., Paillas, E., Cai, Y.-C., **Bose, S.**, Armijo, J., Li, B., Padilla, N. 2017, *ArXiv e-prints*, arXiv:1710.01730.

16 **The Copernicus Complexio: a high-resolution view of the small-scale Universe**.

Hellwing, W. A., Frenk, C. S., Cautun, M., **Bose, S.**, Helly, J., Jenkins, A., Sawala, T., & Cytowski, M. 2016, *Monthly Notices of the Royal Astronomical Society*, 457, 3492.

17 **Constraints on the identity of the dark matter from strong gravitational lenses**.

Li, R., Frenk, C. S., Cole, S., Gao, L., **Bose, S.**, & Hellwing, W. A. 2016, *Monthly Notices of the Royal Astronomical Society*, 460, 363.

18 **Constraining SN feedback: a tug of war between reionization and the Milky Way satellites**.

Hou, J., Frenk, C. S., Lacey, C. G., & **Bose, S.** 2016, *Monthly Notices of the Royal Astronomical Society*

19 **Modified gravity N-body code comparison project**.

Winther, H. A., Schmidt, F., Barreira, A., Arnold, C., **Bose, S.**, Llinares, C., Baldi, M., Falck, B., Hellwing, W. A., Koyama, K., Li, B., Mota, D. F., Puchwein, E., Smith, R. E., & Zhao, G.-B. 2015, *Monthly Notices of the Royal Astronomical Society*, 454, 4208.

20 **The Extraordinary Amount of Substructure in the Hubble Frontier Fields Cluster Abell 2744**.

Jauzac, M., Eckert, D., Schwinn, J., Harvey, D., Baugh, C. M., Robertson, A., **Bose, S.**, Massey, R., Owers, M., Ebeling, H., Shan, H. Y., Jullo, E., Kneib, J.-P., Richard, J., Atek, H., Clément, B., Egami, E., Israel, H., Knowles, K., Limousin, M., Natarajan, P., Rexroth, M., Taylor, P., & Tchernin, C. 2016, *Monthly Notices of the Royal Astronomical Society*, 463, 3876.

Journal referee

Since May 2017 Referee for the International Journal of Modern Physics, D. (IJMPD)

Since Aug 2016 Referee for the Monthly Notices of the Royal Astronomical Society (MNRAS)

Conference talks (contributed and invited)

Nov 2017 **ITC luncheon**, Cambridge, MA, USA.
The Small-Scale Structure of Cold Dark Matter

Nov 2017 **CosmoFest**, Cambridge, MA, USA.
On-the-fly Ray Tracing in N-body Simulations

Jan 2017 **Special Cosmology Seminar**, Munich, Germany, (invited).
Cosmology with Sterile Neutrinos

Oct 2016 **Towards Accurate Lightcones for Cosmology**, Munich, Germany.
On-the-fly Ray Tracing in N-body Simulations

Jun 2016 **National Astronomy Meeting**, Nottingham, UK.
Faster Simulations of Modified Gravity

Mar 2016 **Theoretical Cosmology Seminar**, Portsmouth, UK, (invited).
Cosmological Simulations & Tests of Gravity

Dec 2015 **Virgo Consortium Meeting**, Leiden, The Netherlands.
Structure Formation Near the Free-streaming Scale of Warm Dark Matter

Sep 2015 **RAMSES Users' Meeting**, *Oxford, UK*.
A New Ray Tracing Algorithm in RAMSES

Aug 2015 **1$^{\text{st}}$ Roman Juszkiewicz Symposium**, *Warsaw, Poland*.
Reionisation in Sterile Neutrino Cosmologies

Jun 2015 **National Astronomy Meeting**, *Llandudno, Wales, UK*.
Cosmology with Sterile Neutrinos

Jan 2015 **Beyond ΛCDM**, *Oslo, Norway*.
The Copernicus Complexio: The Warm Dark Matter Universe

Dec 2014 **Virgo Consortium Meeting**, *Munich, Germany*.
The Copernicus Complexio: The Warm Dark Matter Universe

Jul 2014 **νMSM workshop**, *Amsterdam, The Netherlands*.
The Copernicus Complexio: The Warm Dark Matter Universe

Apr 2014 **Modified Gravity workshop**, *Munich, Germany*.
Testing the Quasi-static Approximation in $f(R)$ Gravity Simulations

Programming skills

Python, Fortran90, C, UNIX, LaTeX, Mathematica

Teaching and supervision

2016–2017 Workshop demonstrator for 3rd year course on Planets & Cosmology

2011–Present Teacher in higher level Physics and Mathematics for Lanterna Education

2015–2016 Co-supervisor of a 4th year student's master's (equivalent to MSc.) thesis titled 'Astrophysical Constraints on the Nature of Dark Matter'

2015–2016 Workshop demonstrator for 2nd year Theoretical Physics course on Classical & Quantum Mechanics

2014–2015 Workshop demonstrator for 2nd year Theoretical Physics course on Classical & Quantum Mechanics

2013–2014 Marker for 4th year Theoretical Astrophysics course on Large Scale Structure & General Relativity

Media & outreach

Mar 2017 **Gravity And Me: The Force That Shapes Our Lives**, BBC4.
Contributor to BBC science programme on the nature of gravity in our Universe

Feb 2017 **This is Durham: Place of Light**, House of Commons, Westminster, UK.
Represented the Institute for Computational Cosmology at the invitation of MP Kevan Jones

Oct 2016 **Celebrate Science**, Durham, UK.
Demonstrator for the 'Galaxy Makers' exhibit

Jul 2016 **Royal Society Summer Exhibition**, London, UK.
Co-developer of the Oculus Rift fly-through of the simulated universe

Jan 2016 **Durham University Space Day**, Durham, UK.
Team leader for a group of schoolchildren

Nov 2015 **Lumiere Light Festival**, Durham, UK.
Core team member responsible for projecting the EAGLE cosmological simulations on Durham Cathedral

Oct 2015 **Celebrate Science**, Durham, UK.
Demonstrator for gravitational lensing demo

Apr 2015 **Schools' Science Festival**, Durham, UK.
Demonstrator for 'How to build a spectrograph'

Oct 2014 **Celebrate Science**, Durham, UK.
Demonstrator for gravitational lensing demo

Dec 2013 **Stockholm Science Event**, Stockholm, Sweden.
Invited by the British Council to talk about dark matter in Stockholm Central Station

Oct 2013 **Celebrate Science**, Durham, UK.
Demonstrator for gravitational lensing demo

References

Prof. Carlos S. Frenk
Ogden Professor of Fundamental Physics
Institute for Computational Cosmology, University of Durham
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Dr. Baojiu Li
Reader in Physics
Institute for Computational Cosmology, University of Durham
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Prof. Adrian R. Jenkins

Professor of Physics
Institute for Computational Cosmology, University of Durham
a.r.jenkins@durham.ac.uk