Selim Can Hotinli

Personal details

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Professional

Horizon Fellow in Cosmology and Gravitation February 2021 –
Johns Hopkins University

Postdoctoral Fellow* October 2020 – 2021
Imperial College London
*A post-doctorate position until my delayed start at Johns Hopkins due to COVID19 travel restrictions.

Education

Imperial College London 2016-2020
PhD in Physics, Thesis Advisor: Andrew Jaffe
Thesis Subject: Modern Cosmology in the post-Planck era.

Imperial College London 2014-2016
MSc in Physics (Distinction), Thesis Advisor: Andrew Jaffe
Thesis Subject: Effects of quenched disorder in the early Universe.

Bosphorus University 2009-2014
BSc in Physics (First Class), Advisor: Erkcan Ozcan (CERN)

Positions Held

Co-lead-editor: 'Review of the new discoveries in the era of low noise high resolution CMB experiments' June 2022 –
Co-leading an ambitious review project–to be published at the Elsevier, Physics Reports–with over 25 contributing authors.

Organizer: Johns Hopkins University theory group seminars
Co-organizer: Space Telescope Institute Colloqium May 2022 –
Johns Hopkins University, Baltimore, MD 21218, USA

Representative: Equality, Diversity and Inclusion Committee February 2021 –
Johns Hopkins University, Baltimore, MD 21218, USA

Visitor, Aspen Centre of Physics August 2021-September 2021
Aspen, CO 81611, United States

Graduate Fellow, Perimeter Institute of Theoretical Physics October 2019-February 2020
Waterloo, ON N2L 2Y5, Canada

Visiting JRF, Johns Hopkins University (JHU) February 2019
Baltimore, MD 21218, USA

Consultant, Center for Computational Astrophysics (CCA) Summer 2018
Flatiron Institute, 162-5th Ave, New York, NY 10010

Visitor, Canadian Institute of Theoretical Astrophysics (CITA) Summer 2018
60 St George St, Toronto, ON M5S 3H8, Canada

Visitor, Canadian Institute of Theoretical Astrophysics (CITA) Summer 2017

Research assistant in cosmology, Imperial College London Summer 2015
Blackett Building, Imperial College London, London, UK, SW7 2BX

Summer research assistant, Deutsches Elektronen-Synchrotron (DESY) Summer 2013
Notkestraße 85, 22607 Hamburg, Germany

Group member and research assistant, Cavendish Laboratory Summer 2012
Atomic, Mesoscopic and Optical Physics Group (AMOP), Rutherford Building,
JJ Thomson Ave, Cambridge CB3 0HE, United Kingdom

Notable Awards and Grants

Johns Hopkins Horizon Fellowship 2021 –
Prize Fellowship.

Aspen Center of Physics 2021
stipend for travel and *full coverage* for accommodation from Simons Foundation and Aspen Center of Physics.

Perimeter Institute Visiting Graduate Fellowship 2019-2020
stipend and accommodation from Perimeter Institute
Hosts: Prof. Matthew Johnson and Prof. Kendrick Smith

Balzan Foundations Fellowship 2019
stipend from New-College-Oxford/Johns-Hopkins Centre for Cosmological Studies
Equivalent to a visiting Junior Research Fellowship (JRF)
Host: Prof. Marc Kamionkowski

Imperial College President's Scholarship 2016-2020
Prize Scholarship.

Memberships

CMB-S4 member 2021 –
Active independent member. Contributing to the analysis pipelines on subjects of weak gravitational lensing reconstruction, delensing and bispectra analysis as well as co-leading the detection pipeline for the weak lensing, moving-lens and Sunyaev Zeldovich effects.

Simons Observatory member 2018 –
Active member. Contributing to the analysis pipelines, co-leading the detection pipeline for the weak lensing, moving-lens and Sunyaev Zeldovich effects.

GAMBIT community member 2017 –
Contributed to the cosmology sub-module of GAMBIT (a global fitting code for generic beyond the Standard Model theories, designed to allow fast and easy definition of new models, observables, likelihoods, scanners and backend physics codes).

Co-advising

Nanoom Lee (PhD candidate NYU) nanoom.lee@nyu.edu 2022 –
Papers produced: [2207.05687] (PRD).
NYU co-supervisors: Prof. Yacine Ali-Haïmoud and Prof. Roman Scoccimarro.

Neha Anil Kumar (PhD candidate, JHU) nanilku1@jhu.edu 2022 –
Papers produced: [2205.03423] and [2208.02829] (PRD).
JHU co-supervisor: Prof. Marc Kamionkowski.

Mesut Caliskan (PhD candidate, JHU) caliskan@jhu.edu 2022 –
JHU co-supervisor: Prof. Marc Kamionkowski.

Avery Tishue (PhD candidate, Dartmouth) avery.tishue.gr@dartmouth.edu 2022 –
Dartmouth co-supervisor: Prof. Robert Caldwell.

Jaxon North (Undergraduate student, JHU) jnorth8@jhu.edu 2021 –

Talks and Seminars

Invited **Talk, USC** September 2022
'*Fundamental physics from remote velocity and quadrupole reconstruction with the cosmic microwave background and galaxy surveys*'

Conferences July 2022
Simons Observatory F2F meeting, UCSD
Reionization cross-correlations workshop, Montreal

Conference June 2022
Invited talk, moderator, Flatiron Institute, NY

4 *Invited* Talks October 2021 – February 22
Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) at Stanford, Max Planck Institute, Munich, Germany, Cornell University, University of Maryland College Park.

Invited **Talk** September 2021
Columbia University

Invited **Talks** November 2019
Perimeter Institute for Theoretical Physics, Columbia University, UC Berkeley

2 seminars given at the CMB-S4 meeting September 2019

Invited **Talk, University of Sussex, Sussex, United Kingdom** September 2019
'*A new window into the largest scales: Transverse velocities with the moving lens effect*'

2 talks at COSMO 19 conference, Aachen, Germany September 2019

9 seminars given in USA and Canada February-August 2019

Talk, NanoGrav meeting April 2019
'*The search for anisotropy in the gravitational wave background with pulsar timing arrays*'

Seminar, UCL, London, UK April 2019
'*The late-time effects (secondaries) on the CMB and the moving lens effect*'

Seminar, DAMTP, Cambridge, UK. March 2019
'*The moving lens effect*'

Talk, CMB in high definition workshop, CCA, Flatiron Institute, NYC. December 2018

'*The moving lens effect*'

Co-organizer, Imperial College London weekly cosmology seminars. 2016-2019

5 seminars given in Canada and United Kingdom 2017-2018

Coding and High Performance Computing

C/C++,Python,Fortran,Mathematica Advanced

Public softwares

ReCCo ReCCO

ReCCO consists on a collection of tools to calculate CMB secondary anisotropies (kSZ,tSZ,moving lens, CMB lensing) and reconstruct cosmological fields on our past lightcone (radial velocity fields and transverse velocity field).

class_delens class_delens

Code produces delensed CMB spectra (TT, TE, EE and BB) and lensing-reconstruction noise for given CMB experiment specifications and cosmology.

FisherLens FisherLens

This code provides a wrapper for the class_delens code to facilitate Fisher forecasting of cosmological parameter constraints from CMB spectra.

References*

Prof. Gilbert P. Holder University of Illinois at Urbana-Champaign
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gholder@illinois.edu +1 (217) 300-4612

Prof. Andrew H. Jaffe Imperial College London, HoG, Astrophyiscs Group
1018B Blackett, London, SW7 2BX, UK
a.jaffe@imperial.ac.uk +44 (0)20-7594-7526

Prof. Matthew Johnson Perimeter Institute of Theoretical Physics
31 Caroline St N, Waterloo, ON N2L 2Y5, Canada
mjohnson@perimeterinstitute.ca +1 (519)-569-7600 (6561)

Prof. Marc Kamionkowski Johns Hopkins University, Dept of Physics and Astronomy
Bloomberg 439, 3400 N. Charles St., Baltimore, MD 21218
kamion@jhu.edu +1 (410)-516-0373

Prof. Joel Meyers Southern Methodist University (SMU)
Dallas, TX 75205, USA
joelmeyers@utexas.edu +1 (214)-768-1048

Prof. Kendrick Smith Perimeter Institute of Theoretical Physics
31 Caroline St N, Waterloo, ON N2L 2Y5, Canada
kmsmith@perimeterinstitute.ca +1 (519) 569-7600 (7571)

*In alphabetical order.

Publications

As of September 2022, I have authored over 27 research papers that contributed to the science case of the upcoming CMB and LSS surveys in novel ways. Limiting to my papers with less than 10 authors; I have collaborated with over 34 academics, while with over 10, I have produced two or more papers. My h-index as of September 2022 is 13.

I co-developed two public forecasting codes for improved calculation of CMB spectra [12] a public software that generates cosmological simulations and utilises quadratic estimators for reconstructing cosmological fields from small-scale LSS-CMB cross-correlation [11], and a public software framework for exploring connections between cosmology and particle physics [19]. The first three of these codes are now becoming parts of the analysis pipelines of upcoming CMB experiments.

My research so far contributed to the demonstration of the detectability and scientific value of a multitude of CMB signals including the weak gravitational lensing [12], kinetic and polarised Sunyaev Zel'dovich effects [4,7,11,14-18,20] and the moving-lens effect [2,5,9], providing robust tools and formalism to analyse CMB-LSS cross-correlations and open new windows of observation into unexplored epochs of structure formation such as the epoch of helium reionization, which has significant implications of early galaxy formation, quasar astrophysics and cosmology [17].

Leading or major contribution:

[1] **S. C. Hotinli**, J. Frazer, A. H. Jaffe, J. Meyers, L. C. Price and E. R. M. Tarrant, "*Effect of reheating on predictions following multiple-field inflation*," Phys. Rev. D **97**, no. 2, 023511 (2018) doi:10.1103/PhysRevD.97.023511, `arXiv:1710.08913 [astro-ph.CO]`.

[2] **S. C. Hotinli** and Meyers, Joel and Dalal, Neal and Jaffe, Andrew H. and Johnson, Matthew C. and Mertens, James B. and Münchmeyer, Moritz and Smith, Kendrick M. and van Engelen, Alexander, "*Transverse Velocities with the Moving Lens Effect*," Phys. Rev. Lett. **123**, no. 6, 061301 (2019) doi:10.1103/PhysRevLett.123.061301, `arXiv:1812.03167 [astro-ph.CO]`.

[3] **S. C. Hotinli**, M. Kamionkowski and A. H. Jaffe, "*The search for anisotropy in the gravitational-wave background with pulsar-timing arrays*," doi:10.21105/astro.1904.05348, `arXiv:1904.05348 [astro-ph.CO]`.

[4] **S. C. Hotinli**, James B. Mertens, Matthew C. Johnson and Marc Kamionkowski, "*Probing correlated compensated isocurvature perturbations using scale-dependent galaxy bias*," doi:10.1103/PhysRevD.100.103528, `arXiv:1908.08953 [astro-ph.CO]`.

[5] **S. C. Hotinli**, M. C. Johnson and J. Meyers, "*Optimal filters for the moving lens effect,*" Phys. Rev. D **103**, no.4, 043536 (2021) doi:10.1103/PhysRevD.103.043536 [arXiv:2006.03060 [astro-ph.CO]].

[6] **S. C. Hotinli**, "*New directions in cosmology and astrophysics,*" doi:10.25560/85382

[7] **S. C. Hotinli** and M. C. Johnson, Phys. Rev. D **105**, no.6, 063522 (2022) doi:10.1103/PhysRevD.105.063522 [arXiv:2012.09851 [astro-ph.CO]].

[8] **S. C. Hotinli**, T. Binnie, J. B. Muñoz, B. R. Dinda and M. Kamionkowski, "*Probing compensated isocurvature with the 21-cm signal during cosmic dawn,*" Phys. Rev. D **104**, no.6, 063536 (2021) doi:10.1103/PhysRevD.104.063536 [arXiv:2106.11979 [astro-ph.CO]].

[9] **S. C. Hotinli**, K. M. Smith, M. S. Madhavacheril and M. Kamionkowski, "*Cosmology with the moving lens effect,*" Phys. Rev. D **104**, no.8, 083529 (2021) doi:10.1103/PhysRevD.104.083529 [arXiv:2108.02207 [astro-ph.CO]].

[10] L. Ji, **S. C. Hotinli** and M. Kamionkowski, "*Cross-correlation of the Polarizations of the 21-cm and Cosmic Microwave Backgrounds,*" [arXiv:2110.01619 [astro-ph.CO]]. (to be published at PRD)

[11] J. Cayuso, R. Bloch, **S. C. Hotinli**, M. C. Johnson and F. McCarthy, "*Velocity reconstruction with the cosmic microwave background and galaxy surveys,*" [arXiv:2111.11526 [astro-ph.CO]].

[12] **S. C. Hotinli**, J. Meyers, C. Trendafilova, D. Green and A. van Engelen, "*The benefits of CMB delensing,*" JCAP **04** (2022) no.04, 020 doi:10.1088/1475-7516/2022/04/020 [arXiv:2111.15036 [astro-ph.CO]].

[13] **S. C. Hotinli**, D. J. E. Marsh and M. Kamionkowski, Phys. Rev. D **106**, no.4, 043529 (2022) doi:10.1103/PhysRevD.106.043529 [arXiv:2112.06943 [astro-ph.CO]].

[14] **S. C. Hotinli**, G. P. Holder, M. C. Johnson and M. Kamionkowski, "*Cosmology from the kinetic polarized Sunyaev Zel'dovich effect,*" [arXiv:2204.12503 [astro-ph.CO]]. (to be published at JCAP)

[15] N. Anil Kumar, G. Sato-Polito, M. Kamionkowski and **S. C. Hotinli**, "*Primordial trispectrum from kSZ tomography,*" [arXiv:2205.03423 [astro-ph.CO]]. (to be published at PRD)

[16] N. Lee, **S. C. Hotinli** and M. Kamionkowski, "*Probing Cosmic Birefringence with Polarized Sunyaev Zel'dovich Tomography,*" [arXiv:2207.05687 [astro-ph.CO]]. (to be published at PRD)

[17] **S. C. Hotinli**, S. Ferraro, G. P. Holder, M. C. Johnson, M. Kamionkowski and P. La Plante, "*Probing helium reionization with kinetic Sunyaev Zel'dovich tomography,*" [arXiv:2207.07660 [astro-ph.CO]]. (to be published at PRL)

[18] N. A. Kumar, **S. C. Hotinli** and M. Kamionkowski, "Uncorrelated Compensated Isocurvature Perturbations from kSZ Tomography," [arXiv:2208.02829 [astro-ph.CO]]. (to be published at PRD)

[19] S. Foreman, **S. C. Hotinli**, M. S. Madhavacheril, A. van Engelen and C. D. Kreisch, "De-kSZing the cosmic microwave background with surveys of large-scale structure," [arXiv:2209.03973 [astro-ph.CO]]. (submitted to PRD)

Significant contribution:

[20] J. J. Renk *et al.* [GAMBIT Cosmology Workgroup], "*CosmoBit: A GAMBIT module for computing cosmological observables and likelihoods,*" JCAP **02**, 022 (2021) doi:10.1088/1475-7516/2021/02/022 [arXiv:2009.03286 [astro-ph.CO]].

[21] S. Aiola *et al.* [CMB-HD], "*Snowmass2021 CMB-HD White Paper,*" [arXiv:2203.05728 [astro-ph.CO]].

Minor contribution:

[22] K. Basu *et al.*, "A Space Mission to Map the Entire Observable Universe using the CMB as a Backlight," arXiv:1909.01592 [astro-ph.CO]. Science White Paper submitted in response to the ESA Voyage 2050 call, 20 pages + title page + references. Contribution: Edited part of Section 2.1.3 titled '*Cosmic velocity fields with the kSZ and moving lens effects*'. Provided the analysis that produced Figure 4, and produced Figure 4.

[23] W. R. Coulton, P. D. Meerburg, D. G. Baker, **S. C. Hotinli**, A. J. Duivenvoorden and A. van Engelen, "Minimizing gravitational lensing contributions to the primordial bispectrum covariance," arXiv:1912.07619 [astro-ph.CO].

[24] P. Stöcker *et al.* [GAMBIT Cosmology Workgroup], "*Strengthening the bound on the mass of the lightest neutrino with terrestrial and cosmological experiments,*" Phys. Rev. D **103**, no.12, 123508 (2021) doi:10.1103/PhysRevD.103.123508 [arXiv:2009.03287 [astro-ph.CO]].

[25] S. S. AbdusSalam, F. J. Agocs, B. C. Allanach, P. Athron, C. Balázs, E. Bagnaschi, P. Bechtle, O. Buchmueller, A. Beniwal and J. Bhom, *et al.* "*Simple and statistically sound strategies for analysing physical theories,*" [arXiv:2012.09874 [hep-ph]].

[26] K. Abazajian *et al.* [CMB-S4], "*Snowmass 2021 CMB-S4 White Paper,*" [arXiv:2203.08024 [astro-ph.CO]].

[27] C. L. Chang, K. M. Huffenberger, B. A. Benson, F. Bianchini, J. Chluba, J. Delabrouille, R. Flauger, S. Hanany, W. C. Jones and A. J. Kogut, *et al.* "*Snowmass2021 Cosmic Frontier: Cosmic Microwave Background Measurements White Paper,*" [arXiv:2203.07638 [astro-ph.CO]].

Please see arXiv and inpsire for a more complete list.