

# Kaloian Dimitrov Lozanov

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## ACADEMIC CAREER

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**University of Illinois at Urbana-Champaign**  
Postdoctoral fellow in the HEP and Cosmology Group  
Main collaborator: Peter Adshead

**Illinois, USA**  
Oct 2020-present

**Max-Planck-Institute for Astrophysics**  
Postdoc in the Physical Cosmology Group  
Main collaborator: Eiichiro Komatsu  
Supervised students: Leila Mirzaghali and Angelo Caravano

**Garching, Germany**  
Oct 2017-Oct 2020

## EDUCATION

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**University of Cambridge**  
PhD in Theoretical Cosmology  
PhD advisor: Mustafa Amin  
Institute of Astronomy  
Project title: ‘Reheating after Inflation’

**Cambridge, United Kingdom**  
2013-2017

The main aim of the project was to gain a better understanding of the theoretical, phenomenological and observational aspects of reheating. The most important achievements include:

- The discovery of a universal result for the equation of state after inflation in *all* observationally consistent single-field models of inflation, significantly reducing the uncertainties in key inflationary observables such as  $n_s$  and  $r$ .
- Showing how the short-scale nonlinear dynamics of reheating can impact global observables such as the baryon-to-photon ratio,  $\eta$ .
- The first analysis of realistic (post-)inflationary models featuring a charged inflaton coupled to Abelian and non-Abelian gauge fields.
- **GFIRE** – a *Gauge Field integrator for Reheating*. A lattice code to simulate the nonlinear stage of reheating with gauge fields, taking advantage of high performance computing.

**University of Cambridge**  
Masters of Science and BA in Natural Sciences  
Theoretical and Experimental Physics

**Cambridge, United Kingdom**  
2009-2013

- Grades: 1<sup>st</sup> Class in all 4 years. Thesis advisor: Dr. Jonathan Gair.

**National High School of Mathematics and Natural Sciences**  
Advanced class for Physical sciences

**Sofia, Bulgaria**  
2004-2009

- Grades: Obtained A in the overall diploma with A\* in the Bulgarian A-Level equivalent in Physics.

## SELECTED HONOURS

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### Awards

- 2011: Top of the Year for the Natural Sciences Tripos (ranked 1<sup>st</sup> of 592 overall), University of Cambridge.
- 2010: Cavendish Part IA Prize (ranked 1<sup>st</sup> in Physics overall), University of Cambridge.
- 2009: Silver Medal, participant at the International Physics Olympiad in Mexico.
- 2008: Bronze Medal, participant at the International Physics Olympiad in Vietnam.

### Scholarships

- 2013: Graduate Scholar, Trinity College.
- 2012: Summer Research Studentship, Trinity College.
- 2011: Senior Scholar, Trinity College.

## RECENT & UPCOMING TALKS

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### Invited talks

- 07/2021: Fermilab, Cosmology Seminar
- 04/2021: CERN, Cosmology Seminar
- 04/2021: Imperial College, Astro/HEP Seminar
- 04/2021: IAS/Princeton, Cosmology Lunch Seminar
- 03/2021: Johns Hopkins, Cosmology/GW group JC
- 10/2020: UCSC, Santa Cruz Institute for Particle Physics, Theory Seminar
- 07/2020: Max Planck Institute for Astrophysics, Institute Seminar
- 01/2020: UCSB, KITP, From Inflation to the Hot Big Bang, Blackboard talk
- 12/2019: Leiden Institute of Physics, Cosmology Seminar
- 11/2019: University of Illinois at Urbana-Champaign, HEP Seminar
- 10/2019: Rice University, Cosmology and Astro-particle Physics Workshop
- 10/2019: Brown University, Department of Physics, Astrophysics Seminar Series
- 10/2019: Harvard, Center for the Fundamental Laws of Nature, HET Group Seminar
- 05/2019: Kyoto University, YITP, Workshop on resonant instabilities in cosmology
- 03/2018: Max Planck Institute for Astrophysics, Cosmology Lecture Series
- 01/2017: University of Portsmouth, ICG, Theoretical Cosmology Seminar
- 11/2016: University of Swansea, Theoretical Group Seminar
- 02/2015: University of Cambridge, IoA Wednesday Colloquium

## Contributed talks

- 11/2021: Stony Brook, Workshop: Ending Inflation and the Hot Big Bang
- 07/2021: University of Basel, Cosmology Seminar
- 06/2021: McGill University, HEP Seminar
- 03/2020: EPFL, Lausanne, HEP Seminar
- 12/2019: Portsmouth, Texas Symposium on relativistic astrophysics
- 10/2019: Stanford, SITP Monday Colloquium
- 09/2019: University of Cambridge, DAMTP, Workshop on the non-Gaussian Universe
- 02/2018: Max Planck Institute for Astrophysics, Institute Seminar
- 02/2017: UCL, Cosmology Seminar
- 01/2017: Max Planck Institute for Astrophysics, Cosmology Seminar
- 01/2017: University of Cambridge, DAMTP, Cosmology Lunch Seminar
- 12/2016: King's College London, Theoretical Particle Physics and Cosmology Seminar
- 12/2016: Imperial College, HEP, Theory and Astrophysics Groups Joint Seminar
- 11/2016: University of Nottingham, Astronomy and Particle Theory Group Seminar
- 08/2016: MIT, CTP Density Perturbation Group Seminar
- 08/2016: COSMO-16, Ann Arbor, MI, U.S.
- 08/2016: Texas A & M University, High Energy Physics Group Seminar
- 04/2016: Les Houches Physics School ‘Cosmology after Planck: what is next?’

## SELECTED PUBLICATIONS

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1. P. Adshead and **K. D. Lozanov**: *Axion anomalies*, [arXiv:2112.07645].
2. A. Caravano, E. Komatsu, **K. D. Lozanov** and J. Weller: *Lattice Simulations of Abelian Gauge Fields coupled to Axion during Inflation*, [arXiv:2110.10695].
3. P. Adshead, **K. D. Lozanov** and Z. J. Weiner: *Non-Gaussianity and the induced gravitational wave background*, JCAP **080**, 10 (2021) [arXiv:2105.01659].
4. A. Caravano, E. Komatsu, **K. D. Lozanov** and J. Weller: *Lattice Simulations of Inflation*, JCAP **010**, 12 (2021) [arXiv:2102.06378].
5. JiJi Fan, **K. D. Lozanov** and Qianshu Lu: *Spillway Preheating*, JHEP **05**, 069 (2021), [arXiv:2101.11008].
6. P. Adshead and **K. D. Lozanov**: *Self-gravitating Vector Dark Matter*, Phys. Rev. D **103**, 103501 (2021) [arXiv:2101.07265].
7. R. Allahverdi, M. A. Amin, A. Berlin, N. Bernal, C. T. Byrnes, M. S. Delos, A. L. Erickcek, M. Escudero, D. G. Figueroa, K. Freese, T. Harada, D. Hooper, D. I. Kaiser, T. Karwal, K. Kohri, G. Krnjaic, M. Lewicki, **K. D. Lozanov**, et. al.: *The First Three Seconds: a Review of Possible Expansion Histories of the Early Universe* [arXiv:2006.16182].

8. H.-Y. Zhang, M. A. Amin, E. Copeland, P. Saffin and **K. D. Lozanov**: *Classical Decay Rates of Oscillons*, JCAP **055**, 07 (2020) [arXiv:2004.01202].
9. L. Mirzaghali, E. Komatsu, **K. D. Lozanov** and Y. Watanabe: *Effects of Gravitational Chern-Simons during*, JCAP **024**, 06 (2020) [arXiv:2003.05931].
10. A. Barreira, G. Cabass, **K. D. Lozanov** and F. Schmidt: *Compensated Isocurvature Perturbations in the Galaxy Power Spectrum*, JCAP **049** 07 (2020) [arXiv:2002.12931].
11. **K. D. Lozanov** and M. A. Amin: *GFIRE – a Gauge Field integrator for Reheating*, JCAP **058**, 04 (2020) [arXiv:1911.06827].
12. **K. D. Lozanov**: *Lectures on Reheating after Inflation*, ISBN: 978-3-030-56809-2, Springer Briefs in Physics (2020) [arXiv:1907.04402].
13. Leila Mirzaghali, Azadeh Maleknejad and **K. D. Lozanov**: *Production and Backreaction of Fermions from Axion-SU(2) Gauge Fields during Inflation*, Phys. Rev. D **101**, 083528 (2019) [arXiv:1905.09258].
14. **K. D. Lozanov** and M. A. Amin: *Gravitational perturbations from oscillons and transients after inflation*, Phys. Rev. D **99**, 123504 (2019) [arXiv:1902.06736].
15. **K. D. Lozanov**, A. Maleknejad and E. Komatsu: *Schwinger Effect by an SU(2) Gauge Field during Inflation*, JHEP **1902**, 041 (2019), [arXiv:1805.09318].
16. M. A. Amin, JiJi Fan, **K. D. Lozanov** and Matthew Reece: *Cosmological dynamics of Higgs potential fine tuning*, Phys. Rev. D **99**, 035008 (2019) [arXiv:1802.00444].
17. **K. D. Lozanov** and M. A. Amin: *Self-resonance after inflation: oscillons, transients and radiation domination*, Phys. Rev. D **97**, 023533 (2018) [arXiv:1710.06851].
18. **K. D. Lozanov** and M. A. Amin: *The Equation of State and Duration to Radiation Domination After Inflation*, Phys. Rev. Lett. **119**, 061301 (2017) [arXiv:1608.01213].
19. **K. D. Lozanov** and M. A. Amin: *The charged inflaton and its gauge fields: preheating and initial conditions for reheating*, JCAP **1606**, 032 (2016) [arXiv:1603.05663].
20. **K. D. Lozanov** and M. A. Amin: *End of inflation, oscillons and matter-antimatter asymmetry*, Phys. Rev. D **90**, 083528 (2014) [arXiv:1408.1811].
21. A.C. Fabian, E. Kara, D. Walton, D. Wilkins, R.R. Ross, **K. Lozanov**, et. al.: *Long XMM observation of the Narrow-Line Seyfert 1 galaxy IRAS13224-3809: rapid variability, high spin and a soft lag*, MNRAS, **429**, 2917 (2013) [arXiv:1208.5898].

## TEACHING & OUTREACH

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- 2020-present: Graduate co-supervisor of Angelo Caravano, based at the Max-Planck Institute for Astrophysics in Garching, Germany.

Project title: ‘Non-Gaussian gravitational waves from Axion-SU(2) Gauge Field Models of Inflation’

- 2018-2020: Graduate co-supervisor of Leila Mirzaghali at the Max-Planck Institute for Astrophysics in Garching, Germany.

Thesis title: ‘Chern-Simons Gravity and Fermions in Axion-SU(2) Gauge Field Models of Inflation’

- 2013-2017: Undergraduate supervisor at University of Cambridge. Courses: 3<sup>rd</sup> year Advanced Quantum Mechanics, Astrophysical Fluid Dynamics, Electrodynamics and Optics, Relativity; 1<sup>st</sup> year Physics.
- 2014: Participant at COSMOLOGY@KICC: outreach event at Kavli Institute for Cosmology Cambridge aimed at sixth form students to meet experts in cosmology.
- 2010: Leader of the Bulgarian national team, International Young Physicist Tournament in Vienna, Austria.

## **INTERNSHIPS & WORK EXPERIENCE**

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- 2016-present: referee in Journal of Mathematical Physics, Physical Review, JCAP, JHEP and ApJ.
- 2012: Summer project with Prof. Andrew Fabian: ‘Ray tracing around black holes’, X-ray group, Institute of Astronomy, University of Cambridge.
- 2011: Summer student of Dr. Jason Robinson at the Device Materials Group, Department of Materials Science & Metallurgy, University of Cambridge.