Grigor Aslanyan

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Summary

I am a Computational Data Science Fellow at the Berkeley Center for Cosmological Physics. I develop statistical and numerical methods for analyzing the exponentially growing amount of observational data in modern and future cosmological surveys. I use Bayesian statistics, sampling and optimization methods for very high dimensional parameter spaces, and machine learning. I am an avid C++ programmer and a python enthusiast, with many years of experience in industry and science. I am the author of the powerful numerical library COSMO++.

Experience

Berkeley Center for Cosmological Physics   BERKELEY, CALIFORNIA

Computational Data Science Fellow   *Nov '15 – Present*
Theoretical Research in Cosmology and Data Science.

University of Auckland   AUCKLAND, NEW ZEALAND

Postdoctoral Research Fellow   *Sep '12 – Oct '15*
Theoretical Research in Early Universe Cosmology.

Ponté Solutions (acquired by Mentor Graphics in 2008)   YEREVAN, ARMENIA

Software Engineer   *Dec '05 – May '07*

Junior Engineer   *Nov '04 – Dec '05*
Worked in the Physical Design department, focusing on geometric algorithms. Developed and implemented a state-of-the-art C++ template library for geometric operations on large scales.

Yerevan Physics Institute   YEREVAN, ARMENIA

Research Assistant   *Sep '04 – Jun '07*
Worked in the HERMES group. HERMES was a high energy physics experiment at DESY in Germany.

Education

University of California, San Diego   SAN DIEGO, CALIFORNIA

Ph.D. in Physics   *2007-2012*

Yerevan State University   YEREVAN, ARMENIA

Master of Science in Physics and Computer Science   *2005-2007*

Yerevan State University   YEREVAN, ARMENIA

Bachelor of Science in Physics and Computer Science   *2001-2005*

Skills

Technical: C++ (advanced knowledge with 3 years of industrial and 8 years of scientific application), **algorithms and data structures** (advanced knowledge), **object oriented design** (good knowledge), **python** (good knowledge, including numpy, scipy, matplotlib, pandas, scikit-learn), **git** (good knowledge), **linux/unix** (good knowledge), **shell scripting** (good knowledge), **High performance computing**

(parallel programming with MPI, openMP, C++11 multithreading, working knowledge of CUDA), **html/javascript** (working knowledge), **sql** (working knowledge), **swift** (working knowledge)

Machine Learning and Data Science: Supervised Learning (Linear/Logistic Regression, Gaussian Processes, k-nearest neighbors, Decision Trees and Random Forests, Neural Networks), Unsupervised Learning (Dimensionality Reduction - Principal Component Analysis, Clustering), Bayesian Statistics, Sampling Methods (Markov Chain Monte Carlo, Nested Sampling, Hamiltonian Monte Carlo), Optimization Methods (L-BFGS, SGD, Conjugate Gradient, Gauss-Newton)

Mathematics: Real and Complex Analysis, Graph Theory, Group Theory, Probability Theory, Algebraic Topology, Differential Geometry.

Languages: Armenian *(native)*, English *(fluent)*, Russian *(fluent)*, French *(working knowledge)* .

Software Released

Cosmo++   *Dec '13*

Cosmo++ is an object oriented C++ library for scientific computing, focused on cosmology. Mathematical tools include a Markov Chain Monte Carlo sampler, a conjugate gradient solver, special function calculators, curve fitting and interpolation. Cosmological tools include likelihood calculation, sky map simulation, mask apodization, and wrappers to Planck and WMAP likelihood codes, CLASS, and MultiNest. Fully developed and implemented by myself. Latest Version 3.2 released in November, 2015.

Referee/Reviewer

- Referee for *Journal of Cosmology and Astroparticle Physics*, *Physics Letters B*
- Book Reviewer for *Microsoft Azure Machine Learning*, **Packt Publishing** (2015)
- Book Reviewer for *Linux Shell Scripting Essentials*, **Packt Publishing** (2015)

Publications

- N. Canac, **G. Aslanyan**, K. N. Abazajian, R. Easther, L. C. Price, *Testing for New Physics: Neutrinos and the Primordial Power Spectrum* arXiv:1606.03057

- **G. Aslanyan**, L. C. Price, J. Adams, T. Bringmann, H. A. Clark, R. Easther, G. F. Lewis, P. Scott, *Ultracompact minihalos as probes of inflationary cosmology*, arXiv:1512.04597

- **G. Aslanyan**, R. Easther, L. C. Price, *Learn-As-You-Go Acceleration of Cosmological Parameter Estimates*, **JCAP 09 (2015) 005**, arXiv:1506.01079

- **G. Aslanyan**, R. Easther, *Signatures of the Very Early Universe: Inflation, Spatial Curvature and Large Scale Anomalies*, **Phys. Rev. D 91, 123523 (2015)**, arXiv:1504.03682

- K. N. Abazajian, **G. Aslanyan**, R. Easther, L. C. Price, *The Knotted Sky II: Does BICEP2 require a nontrivial primordial power spectrum?*, **JCAP 08 (2014) 053**, arXiv:1403.5922

- **G. Aslanyan**, L. C. Price, K. N. Abazajian, R. Easther, *The Knotted Sky I: Planck constraints on the primordial power spectrum*, **JCAP 08 (2014) 052**, arXiv:1403.5849

- **G. Aslanyan**, *Cosmo++: An Object-Oriented C++ Library for Cosmology*, **Computer Physics Communications 185 (2014), pp. 3215 – 3227**, arXiv:1312.4961

- **G. Aslanyan**, R. Easther, *Large Scale Anomalies in the Microwave Background: Causation and Correlation*, **Phys. Rev. Lett. 111, 261301 (2013)**, arXiv:1308.6593

- **G. Aslanyan**, A. V. Manohar, A. P. S. Yadav, *The topology and size of the universe from CMB temperature and polarization data*, **JCAP 08 (2013) 009**, arXiv:1304.1811
- **G. Aslanyan**, A. V. Manohar, A. P. S. Yadav, *Limits on semiclassical fluctuations in the primordial universe*, **JCAP 02 (2013) 040**, arXiv:1301.5641
- C. Feng, **G. Aslanyan**, A. V. Manohar, B. Keating, H. P. Paar, O. Zahn, *Measuring Gravitational Lensing of the Cosmic Microwave Background using cross-correlation with large scale structure*, **Phys. Rev. D 86, 063519 (2012)**, arXiv:1207.3326
- **G. Aslanyan**, A. V. Manohar, *Constraints on the global topology and size of the universe from the cosmic microwave background*, **JCAP 06 (2012) 003**, arXiv:1104.0015
- N. Akopov, Z. Akopov, **G. Aslanyan**, L. Grigoryan, *A-dependence of coherent electroproduction of ρ^0 mesons on nuclei in forward direction*, arXiv:0707.3530 (2007)

Conference and Seminar Presentations

Optimization Methods

Astro Hack Week, UC Berkeley	*Sep '16*

Sampling Versus Optimization in Very High Dimensional Parameter Spaces

Statistical Challenges in Modern Astronomy VI, Carnegie Mellon University	*Jun '16*

Constraining the Primordial Power Spectrum from Large to Very Small Scales

The McWilliams Center for Cosmology, Carnegie Mellon University	*Apr '16*
Center for Cosmology and Astro Particle Physics, Ohio State University	*Apr '16*

Constraining the Primordial Power Spectrum and Cosmological Parameters

Lawrence Berkeley National Laboratory	*Mar '16*

Learn-As-You-Go Acceleration of Parameter Estimation

Sampling and Non-Sampling Methods in Cosmology Workshop, UC Berkeley	*Jan '16*

COSMO++ and Constraints on Inflation

Lawrence Berkeley National Laboratory	*Dec '15*

Parameter Space Sampling, Constraints on Inflation

UC Irvine	*Nov '15*

Signatures of the Very Early Universe: Inflation, Spatial Curvature and Large Scale Anomalies

CosPA 2014 Conference, Auckland, New Zealand	*Dec '14*

Machine Learning and Gaussian Processes

Mathematics and Physics PhD Lecture, University of Auckland	*Sep '14*

Primordial Power Spectrum pre – and post – BICEP

CFA, Harvard University	*Apr '14*
Tufts/MIT Joint Cosmology Seminar	*Apr '14*
Institute for Advanced Study	*Apr '14*
Yale University	*Apr '14*
Stony Brook/Brookhaven Joint Cosmology Seminar	*Apr '14*
UC San Diego	*May '14*

Cosmic Microwave Background Anomalies and the Physics of the Early Universe
University of Canterbury *Feb '14*

From Classical to Quantum Computing
Mathematics and Physics PhD Lecture, University of Auckland *Jul '13*

Probing the Large Scale Anisotropies of the Universe from the CMB Temperature and Polarization Data
TAPIR Seminar, California Institute of Technology *Mar '13*

UC Irvine *Apr '13*

UC Santa Cruz *Apr '13*

The Topology and Size of the Universe from the Cosmic Microwave Background
UC San Diego *Apr '11*

Grants and Fellowships

Microsoft Azure for Research Grant *2014*
Microsoft Azure cloud computing resources for the project "Studying Very Early Universe Physics with Cosmic Microwave Background Anomalies".

Summer Graduate Teaching Scholarship *2011*
UC San Diego, San Diego, CA

Awards and Honors

Alan Alda's Flame Challenge Finalist *2014*
Explaining science to an 11-year old.

Presidential Award in the Field of Information Technologies *2005*
Prize of the President of Armenia as best student in Computer Science.

Yerevan State University Best Student *2005*
Yerevan, Armenia

Bronze Medal in International Mathematics Olympiad *2001*
Washington DC, USA.

Honorable Mention in International Physics Olympiad *2001*
Antalya, Turkey.

Summer Training

Cosmology Summer School *Jul '10*
ICTP, Trieste, Italy

Particle Physics and Astronomy International Summer School *Jun '06*
University of Sheffield, Sheffield, UK.
Got the **Best Presenation** prize for the project "Solitons: The method of inverse scattering for the KdV equation".

DESY Summer School *Jul '05 – Sep '05*
DESY, Hamburg, Germany.
Performed the project "Search for the Θ^+ pentaquark in the missing mass spectrum of the reaction $\gamma^* D \to \Lambda(1520)X$ at HERMES".