Andrija Kostić — Curriculum Vitae

✉ andrii.kostic@gmail.com   •   🌐 cosmicstring.github.io   •   ⌗ Cosmicstring

Education

DeepL	**Munich, Germany**
Research scientist	*Nov. 2023 - present*
Max Planck Institute for Astrophysics	**Garching, Germany**
Postdoc	*Aug. 2023 - Nov. 2023*
Max Planck Institute for Astrophysics	**Garching, Germany**
PhD, International Max Planck Research School, Bayesian forward modelling of LSS	*Oct. 2020 – Jul. 2023*
Ludwig Maximilians University	**Munich, Germany**
Master in Theoretical Physics	*Sep. 2018 – Oct. 2020*
`GPA: 1.19/1.0`	
University of Belgrade, Faculty of Mathematics, Department of Astronomy	**Belgrade, Serbia**
Bachelor in Astronomy and Astrophysics	*Sep. 2014 – Jul. 2018*
`GPA: 9.78/10.00`	
Gymnasium "Svetozar Marković"	**Niš, Serbia**
Grammar school class for students gifted in physics	*Sep. 2010 – Jun. 2014*
Music high school "Vojislav Vučković"	**Niš, Serbia**
Guitar, Piano, Music Theory, Choir, Composing	*Sep. 2010 - Jun. 2012*

Publications and Conference Proceedings

No evidence for p- or d-wave dark matter annihilation from local large-scale structure :

Kostić A., Bartlett J. D., Desmond, H.; arXiv preprint arXiv:2304.10301 – submitted to Physical Review D

Consistency tests of the field level inference with the EFT likelihood:

Kostić A., Nguyen M., Schmidt F., Reinecke M.; arXiv preprint arXiv:2212.07875 – submitted to JCAP

Constraints on dark matter annihilation and decay from the large-scale structure of the nearby universe:

Bartlett J. D., *Kostić A.*, Desmond H., Jasche J., Lavaux G.; Accepted for publication in Physical Review D

Optimal machine-driven acquisition of future cosmological data:

Kostić A., Jasche J., Ramanah K.D., Lavaux G.; A&A 657, L17 (2022)

Towards Moment-Constrained Causal Modeling:

Guardiani M., Frank P., *Kostić A.*, Enßlin T.; Proceedings of the 41st MaxEnt2022 conference

Non-parametric Bayesian Causal Modeling of the SARS-CoV-2 Viral Load Distribution vs. Patient's Age:

Guardiani M., Frank P., *Kostić A.*, Edenhofer G., Roth J., Uhlmann B., Enßlin T.; Accepted for publication in PLOS

Programming the LED cube with the Raspberry-Pi microcomputer:

Kostić A.; Aleksić D.; Proceedings of the IEEESTEC 7th Student project conference; Niš, Serbia; 2014; 131-136

Dynamical evolution of dust particles ejected from the surface of comets C/2012 S1 (ISON) and C/2011 W3(Lovejoy):

Kostić. A.; Mentored by Smolić. I. and Bošković. M.; Proceedings of the 13th Petnica's annual conference for high school students; Petničke sveske; Petnica Science Center, Serbia; 2014;

Deep Learning Research Experience

In my current role as a Research scientist I am part of the RL team focusing on improving all the NLP aspects of our internally trained LLMs, personally mostly focusing on translation tasks and speech-to-speech capabilities. This requires staying up-to-date with the SoTA research, reading papers weakly and discussing with the team as well as implementing the novel techniques within our framework. Technologies I use are Python, PyTorch, FastAPI, CI/CD (Docker, K8s, Git), nowadays mostly coding in PyCharm + Cursor.

Throughout my MSc and PhD theses I have been implementing differentiable Bayesian hierarchical forward models using C/C++, python, jupyter, pybind11, JAX with deployment of my codes onto large CPU clusters. The nature of the models I have been developing so far is very close to the standard Deep Learning frameworks, both in conceptual and architecture sense, with sizes ranging between 10^6 to 10^7 degrees of freedom. In the next section, I list main results of these endeavors and link to my (publically available) codes and papers. Alongside, in my spare time, I learned the fundamentals of the PyTorch framework (projects available on my github repo)

Work Experience

DeepL   **Munich, Germany**

Research scientist   *November 2023 - present*

○ Part of the RL team, responsible for adapting our internally trained LLMs to various tasks we're providing to our customers (translation, voice services and text adaption).

○ Staying up-to-date with current SoTA methods for alignment, implementing them into our framework, proposing / testing new ideas and providing guidence for other parts of the wider research team on alignment for their particular use case

Max Planck Institute for astrophysics   **Garching, Germany**

Postdoc thesis research   *August 2020 - November 2023*

○ Research topics: **Bayesian forward modelling, bias expansion, sampling techniques** mentored by Fabian Schmidt
  - Integration between the existing C++ code-base and python / JAX through the use of pybind11
  - Automation of chain convergence diagnostics
  - Coding done mostly in C/C++, python, bash and some R
  - Results: papers are available on my arXiv page here

Max Planck Institute for astrophysics   **Garching, Germany**

PhD thesis research   *October 2020 - July 2023*

○ Research subject: **Bayesian forward modelling of galaxy clustering and large-scale structure** mentored by Fabian Schmidt
  - Developing differentiable forward models using lagrangian perturbation theory, effective field theory for modelling biased tracers of the large-scale structure
  - Extensive use of FFTs, Hamiltonian Monte Carlo, slice-sampling techniques and OpenMP optimization
  - Side projects:
    · Extending the code for simulating dark-matter annihilation from the large-scale structure called clumpy
    · Bakend binding of our C/C++ operators into JAX using pybind11
  - Coding done mostly in C/C++, python and some parts in R
  - Results: papers are available on my arXiv page here

Max Planck Institute for astrophysics   **Garching, Germany**

Master thesis research   *September 2019 - October 2020*

○ Research subject: **Application of information field theory concepts to causal inference, quasi periodic signal reconstruction and variational inference algorithms** mentored by Torsten Ensslin and Reimar Leike
  - Developing differentiable forward models within NIFTy package
  - Extensive use of gaussian processes, variational inference, conjugate gradient methods for sampling and minimization
  - Code: github repo link
  - Results: MSc thesis is available here

Leiden Observatory   **Leiden, Netherlands**

Research Internship   *5th June - 11th August, 2017*

○ Research subject: **Galaxy image modeling using Shapelets and sparse techniques** mentored by Arun Kannawadi and Henk Hoekstra
  - Producing a code for image feature extraction using shapelets as decomposition basis
  - Making simulated dataset of galaxy images from classifications done by K-means clustering, SOMs,MDS algorithm
  - Code: github repo link
  - Results: Here is a link to a report I made

Max Planck Institute For Astronomy   **Heidelberg, Germany**

Research Internship   *22nd June - 31st August, 2016*

- ○ Research subject: **Hunting for Intermediate Mass Black Holes in Milky Way Globular Clusters** mentored by Glenn van de Ven, Paolo Bianchini, Alessandra Mastrobuono
  - – Modelling globular cluster internal dynamics and exploring the parameter space with the use of emcee code
  - – Incorporating energy equipartition with a goal to improve the existing models
  - – <u>Results:</u> Here is a <u>link</u> to a modest report I made

Max Planck Institute For Solar System Research **Göttingen, Germany**
Research Internship *1st - 31st August, 2015*

- ○ Research subject: **Kuiper belt structure** mentored by Pedro Lacerda
  - – N-body simulations of the Kuiper belt region with and without Nice model event
  - – MERCURY and REBOUND integration packages used, along with Fortran, C/C++ and python codes written for data analysis and visualization
  - – Results: Here is a <u>link</u> to a small report

Petnica Science Center **Valjevo, Serbia**
High school student research *2011 - 2014*

- ○ Research project name:
  Dynamical evolution of dust particles ejected from the surface of comets C/2012 S1 (ISON) and C/2011 W3(Lovejoy)
- ○ <u>Code:</u> github repo <u>link</u>
- ○ <u>Results:</u> <u>link</u> to a summary of research I wrote (abstract and figure captions are in English)
  - – Modeling the comet's nucleus and the thermodynamical processes which lead to ejection of the dust particles
  - – Writing an N-body integration code and ejection physics in C/C++ with addition of Matlab for image processing

Tech stack

Proficient: python, PyTorch

Intermediate: C/C++, bash, CI/CD

Basic: JAX

Scientific Software: R, Wolfram Mathematica, jupyter

HPC libraries:
- – Basic knowledge of OpenMP, SLURM

Awards

2018: "Best student research paper" award, awarded by the University of Belgrade

2018: "Zaharije Brkić" prize, awarded to the best astrophysics student of the generation 2017/2018

2014: 1st place at IEEESTEC 7th Student projects conference for the best graded paper (practical and theoretical realisation), held in Niš, Serbia

Grants and Scholarships

DAAD scholarship (2019 - 2020): Merit based scholarship awarded to foreign students studying in Germany

Dositeja fund (2018-2023): Merit based award of Serbian Ministry of education granted to students studying outside Serbia

Languages

●**Serbian**: Native speaker ●**English**: Fluent ●**German**: Intermediate

Interests

●Guitar, Violin and Piano ●Composing music ●Poetry ●Tennis