

Andrija Kostić — Curriculum Vitae

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🔄 Cosmicstring

Education

Max Planck Institute for Astrophysics

Postdoc

Garching, Germany

Aug. 2023 - Nov. 2023

Max Planck Institute for Astrophysics

PhD, International Max Planck Research School, Bayesian forward modelling of LSS

Garching, Germany

Oct. 2020 – Jul. 2023

Ludwig Maximilians University

Master in Theoretical Physics

Munich, Germany

Sep. 2018 – Oct. 2020

GPA: 1.19/1.0

University of Belgrade, Faculty of Mathematics, Department of Astronomy

Bachelor in Astronomy and Astrophysics

Belgrade, Serbia

Sep. 2014 – Jul. 2018

GPA: 9.78/10.00

Gymnasium "Svetozar Marković"

Grammar school class for students gifted in physics

Niš, Serbia

Sep. 2010 – Jun. 2014

Music high school "Vojislav Vučković"

Guitar, Piano, Music Theory, Choir, Composing

Niš, Serbia

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 IEEEESTEC 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

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

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](#)
 - Backend 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
 - Results: Here is a [link 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 [link 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)
- Code: [github repo link](#)
- Results: [link 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

Programming skills

Proficient: python

Intermediate: C/C++, bash, JAX

Basic: PyTorch

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 IEEEESTEC 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