Alexander Kaurov

Also known as Sasha, Alexander Aleksandrovich Kaurov.

Princeton, NJ
(773) 787-9856
a@kaurov.org
kaurov@ias.edu

https://www.kaurov.org/

EXPERIENCE

The Institute for Advanced Study — *postdoc (member)*
Princeton, NJ, 2016 — PRESENT

- **AMIAS fellowship**   2016 — 2017
- **Eric and Wendy Schmidt fellowship**   2017 — 2018
- **William D. Loughlin fellowship**   2018 — 2019
- **IBM Einstein fellowship**   2019 — 2020
- *Paternity leave*   01 — 06/2017

The University of Chicago — *Research Assistant*
Chicago IL, 2012 — 2016

The University of Chicago — *Teaching Assistant*
Chicago IL, 2011 — 2012

- PHSC 12000 The Origin of Universe & How We Know
- PHSC 11900 Introductory astronomy course
- PHSC 13500 Chemistry — The Atmosphere

EDUCATION

The University of Chicago — *Ph.D.*
Chicago IL, 2011 — 2016

Astronomy & Astrophysics. Thesis: "Analytical and numerical modeling of the epoch of cosmic reionization."

- **McCormick Fellowship**   2011 — 2012
  The University of Chicago, Chicago, IL

- **Fermilab Fellowship in Theoretical Physics**   2012 — 2013
  Fermilab, Batavia, IL

St. Petersburg State Polytechnic University — *B.Sc.*
St. Petersburg, Russia, 2007 — 2011

Nuclear astrophysics. Thesis: "Multidimensional numerical simulations of heat transfer in the crusts of neutron stars."

- **Russian Academy of Science fellowship**   2009 — 2011
  Central Astronomical Observatory of the Russian Academy of Sciences at Pulkovo, Russia

- **Ioffe Institute Fellowship**   2009 — 2010
  St. Petersburg State Polytechnic University, Russia

PUBLIC SERVICE

- The National Aeronautics and Space Administration (NASA) grant review panelist.
- Referee for Monthly Notices of the Royal Astronomical Society.

INTERESTS

Astrophysics, Cosmology, Astronomy.

Science communication.

Science outreach.

SKILLS

Research, data analysis, programming, numerical simulations.

Course and curriculum development, teaching at school and college level.

Academic mentoring.

Application of Virtual and Augmented Reality in science communication and education.

REFERENCES

Academic:

Nickolay Gnedin
gnedin@fnal.gov

Matias Zaldarriaga
matiasz@ias.edu

Hsiao-Wen Chen
hchen@astro.uchicago.edu

Jordi Miralda-Escudé
jmiralda@fqa.ub.edu

Education and outreach:

Piet Hut
piet@ias.edu

LANGUAGES

English, Russian

OUTREACH AND SCIENCE COMMUNICATION PROJECTS

Science communication in the virtual worlds

I design and supervise the development of various virtual world experiences. In collaboration with the **Earth Life Science Institute** (ELSI, Tokyo Institute of Technology) and the **Japan Aerospace Exploration Agency** (JAXA) we designed a virtual outreach lecture about the Hayabusa2 mission. We also created the first virtual world for **Nautilus** science magazine. More information: https://www.omniscope.org/virtual-worlds

Planetarium accessibility in the United States

Together with Mark Subbarao (President, International Planetarium Society) and Vyacheslav Bazhenov (undergraduate student, Ekaterinburg State University) we study the accessibility of the planetariums in the United States. Our finding help to understand who might benefit from the at-home immersive experiences: https://doi.org/10.22541/au.159724581.14747461

XR educational apps

We experiment with using Virtual and Augmented reality for science communication. In one of the projects we explore how the sense of scale of the cosmic objects can be conveyed, and in another project we explore how molecular mechanics can be explained with spatial puzzles. More information: https://www.omniscope.org/xr

Cosmology curriculum

The highlight of my outreach activities is the development of the dark matter high-school course that will be adopted for more than 50,000 students per year in Moscow (Russia).

MENTORING

Mentor network for Russian-speaking students

I am a co-founder of a mentoring program that connects Russian speaking students from Russia, Belarus, Ukraine and Kazakhstan with mid-career scientists from all over the world. The objective of the program is to compensate for the isolation of Russian science community. We generate around 60 mentor/mentee pairs each quarter. https://sites.google.com/view/sciencementors

Scientific advisor

Throughout my career I mentored four undergraduate students from St. Petersburg State Polytechnic University that defended their B.Sc. theses under my supervision:

- Evgenii Chaikin (B.Sc., 2017), M.Sc. fellowship at the University of Bonn (Germany), Ph.D. student at Leiden Observatory (Netherlands),
- Nadezhda Tuberozova (B.Sc., 2018), graduate student at the University of Bonn (Germany),
- Ekaterina Leonova (B.Sc., 2019), M.Sc. fellowship at the University of Geneva (Switzerland).
- Vyacheslav Bazhenov (expected B.Sc. 2021)

CONTRIBUTION TO ASTRONOMY, ASTROPHYSICS & COSMOLOGY

My interests span across multiple sub-disciplines. Here I list three of them.
List of my publications is available here: http://bit.ly/ads_kaurov

Dark Matter properties from astronomical observations

By observing the distribution and time variability of the astronomical objects it is possible to extract the details of the dark matter properties. Together with collaborators, I am focused on detecting individual highly magnified

stars with the gravitational lensing. By studying the brightness variability of these objects on the timescale of a few years, we can estimate how granular is dark matter and whether it is consistent with current theories.

Probing Dark Matter Subhalos in Galaxy Clusters Using Highly Magnified Stars

> L Dai, T Venumadhav, **AA Kaurov**, J Miralda-Escudé
>
> The Astrophysical Journal 867 (1), 24, 2018

Highly magnified stars in lensing clusters: new evidence in a galaxy lensed by MACS J0416. 1-2403

> **AA Kaurov**, L Dai, T Venumadhav, J Miralda-Escudé, B Frye
>
> The Astrophysical Journal 880 (1), 58, 2019

Asymmetric Surface Brightness Structure of Lensed Arc in SDSS J1226+ 2152: A Case for Dark Matter Substructure

> L Dai, **AA Kaurov**, K Sharon, MK Florian, J Miralda-Escudé, et al.
>
> arXiv preprint arXiv:2001.00261 2020

Early Universe and cosmology

The early epochs of the universe (0.1–1 Billion years after the Big Bang) are not yet probed by the current generation instruments. However, those epochs can be already studied using theoretical modeling. Together with collaborators I am performing numerical simulations utilizing high–performance computing to predict the observations and to figure out how the upcoming data will help us to understand cosmology better.

Implication of the Shape of the EDGES Signal for the 21 cm Power Spectrum

> **AA Kaurov**, T Venumadhav, L Dai, M Zaldarriaga
>
> The Astrophysical Journal Letters 864 (1), L15,2018

Cosmic reionization on computers. ii. reionization history and its back-reaction on early galaxies

> NY Gnedin, **AA Kaurov**
>
> The Astrophysical Journal 793 (1), 30, 2014

Recombination clumping factor during cosmic reionization

> **AA Kaurov**, NY Gnedin
>
> The Astrophysical Journal 787 (2), 146, 2014

Physics of Neutron Stars

The neutron stars are rapidly spinning compact stars that are the perfect laboratories to test nuclear physics in extreme environments. Almost the only thing we know about them is that their surface temperature is inhomogeneous, and they have stable hot and cold spots. My interest lies in modeling the distribution and evolution of these spots that ultimately can lead to better understanding of the thermal evolution of the neutron stars and allow us to further test nuclear physics.

Thermal emission of neutron stars with internal heaters

> AD Kaminker, **AA Kaurov**, AY Potekhin, DG Yakovlev
>
> Monthly Notices of the Royal Astronomical Society 442 (4), 3484-3494, 2014

Central compact objects in Kes 79 and RCW 103 as 'Hidden' magnetars with crustal activity

> SB Popov, **AA Kaurov**, AD Kaminker
>
> Publications of the Astronomical Society of Australia 32, 2015

Neutron stars with outbursts from superfluid crust

> AD Kaminker, EA Chaikin, **AA Kaurov**, DG Yakovlev
>
> Journal of Physics Conference Series 932 (1), 2017