

Alexander Plavin

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Personal Information

Born in 1993, 28 years old
 Citizenship: Russian Federation

Languages English: fluent, Russian: native

Education

- 2017 – 2022 **Ph.D. in Physics and Astronomy**, *Lebedev Physical Institute*, Moscow.
 Astro Space Center, advisor Yuri Kovalev
 Thesis: “High-energy processes in active galaxies studied through radio, optical, and neutrino observations”
- 2015 – 2017 **M.Sc. in Applied Maths and Physics**, *Moscow Institute of Physics and Technology*,
GPA 9.1/10.
 Department of Control and Applied Mathematics, advisor Yuri Kovalev
 Thesis: “Variability of the core shift effect in jets of active galaxies”
- 2011 – 2015 **B.Sc. in Applied Maths and Physics**, *Moscow Institute of Physics and Technology*,
GPA 9.2/10.
 Department of Control and Applied Mathematics, advisor Konstantin Vorontsov
 Thesis: “Topic selection in topic model problems”

Professional Employment

- 2022 – present **Research Fellow**, *Lebedev Physical Institute*, Moscow.
 Astro Space Center
- 2016 – 2022 **Junior Research Fellow**, *Lebedev Physical Institute*, Moscow.
 Astro Space Center
- 2015 – 2021 **Teaching Assistant**, *Moscow Institute of Physics and Technology*.
 Discrete Calculus, Graph Theory, Algorithms

Awards

- 2022 Young Scientists Award, Moscow government
- 2019-2021 Research grant for PhD students, Russian Foundation for Basic Research
- 2019 D. V. Skobeltsyn Award for Best Projects of Young Scientists, Lebedev Physical Institute

Research Experience and Interests

The main research area since my M.Sc. involves central parsecs of active galactic nuclei (AGN), where jets are formed and accelerated. I've been studying these regions with methods of multimessenger astronomy: radio single-dish and interferometric observations, optical, high-energy, and neutrino observations.

Central scientific achievements:

Demonstrated that bright AGNs are dominant high-energy neutrino sources. Jets should host numerous relativistic protons in order to produce such neutrinos. Associated new AGNs with neutrinos using a statistical approach: they appear to be typical bright and flaring blazars. Questions remain on where and how exactly neutrinos are born, and understanding this would greatly improve our picture of blazars as cosmic supercolliders.

Found how particle influx drives both the observed AGN flares and the apparent variability of the jet origin position. The latter happens through significant synchrotron opacity variations over time. VLBI measurements let us quantify the changes in particle density and magnetic field strength. These opacity variations also affect precise astrometry and geodesy that rely on stable AGN positions.

Revealed that bright extended optical emission is common in AGN jets. This high-energy emission fades before lower-energy radio does, and its measurements are crucial to constrain particle energy spectra and properties. Numerous optical jets were first indirectly found through VLBI-Gaia astrometry comparison, and are now being confirmed with dedicated Hubble Space Telescope observations.

Processed and analyzed VLBI and single-dish observations, neutrino telescope detections. Utilized images from millisecond to arcsecond scales in radio and optical bands. Participated in designing and planning observations on radio telescopes and interferometers, and on the Hubble Space Telescope.

Mentoring and Teaching Experience

- 2020 – present Advising Ivan Kostrichkin, an undergrad student at the Moscow Institute of Physics and Technology.
B.Sc. thesis defense expected in 2023. The research project is focused on geometry variations of AGN jets with small viewing angles.
- 2015 – 2021 Teaching Assistant for Discrete Calculus, Graph Theory, and Algorithms courses at the Moscow Institute of Physics and Technology.
Responsible for a group of twenty students each semester. Developed seminar programs given the list of topics to be covered. Designed tests and graded students for the course.

Selected Conferences

- 2022 Active Galactic Nuclei session
SOC *Town Hall KM3NeT Meeting* *Catania, Italy*
- 2022 Direct confirmation of the VLBI-Gaia offsets nature
EVN Symposium *Cork, Ireland*
- 2021 Radio blazars: sources of neutrinos from TeV to PeV
invited *EAS Annual meeting* *Leiden, Netherlands*
- 2021 VLBI as a key to neutrino production in blazars
award *Scientific Symposium of the International Union of Radio Science* *Rome, Italy*
- 2021 TeV to PeV neutrinos from radio-bright blazars
43rd COSPAR Scientific Assembly *Sydney, Australia*
- 2019 Evolution of AGN jets from multiepoch core-shift studies
30th Texas Symposium on Relativistic Astrophysics *Portsmouth, UK*
- 2018 AGN physics from multiepoch core-shift measurements in a large sample of radio sources
Half a Century of Blazars and Beyond *Torino, Italy*
- 2018 Core-shift measurements in a large sample of extragalactic radio sources and their effect on high-accuracy astrometry
10th IVS General meeting *Longyearbuen, Norway*
- 2017 Application of VLBI and Gaia results to physics of active galactic nuclei
Texas Symposium on Relativistic Astrophysics *Cape Town, South Africa*
- 2016 Variability of the core shift effect in AGN jets
13th European VLBI Network Symposium *S. Petersburg, Russia*

Summer Internships and Schools

- Jun-Aug 2019 NRAO Summer Studentship
“*MeerKAT Polarization Commissioning*”, advisor Bill Cotton *Charlottesville, USA*
- Jun-Aug 2018 ASTRON/JIVE Summer Studentship
“*FRB 121102 and its counterpart as seen by VLBI*”, advisor Zsolt Paragi *Dwingeloo, Netherlands*
- Jul 2017 School of modern astrophysics (*Moscow, Russia*)
- Jun 2016 15th Synthesis Imaging Workshop (*Socorro, USA*)

Computer Programming Experience

Developed libraries and projects for research and hobby, mostly in Julia and Python

- 2013 Google Summer of Code student for the Mercurial project
- 2012 – 2015 ACM ICPC quarterfinals; TopCoder software development prizes
- 2014 – 2016 Hackathons in Shanghai, Philadelphia, Lansing, Moscow
- 2012 – 2013 Software Engineer at ABBYY, working on automated text processing

Publications

First-author

- Nov 2022 1. **A. Plavin**, Y. Y. Kovalev, S. Troitsky, Y. A. Kovalev — Growing evidence for high-energy neutrinos originating in radio blazars // *MNRAS*, *submitted*, [arXiv:2211.09631](#)
- May 2022 2. **A. Plavin**, Y. Y. Kovalev, A. Pushkarev — Direction of Parsec-scale Jets for 9220 Active Galactic Nuclei // *ApJS*, *260*, 4
- Apr 2022 3. **A. Plavin**, Z. Paragi, B. Marcote, A. Keimpema, J. Hessels, K. Nimmo, H. Vedantham, L. Spitler — FRB 121102: Drastic changes in the burst polarization contrasts with the stability of the persistent emission // *MNRAS*, *511*, 6033
- Feb 2021 4. **A. Plavin**, Y. Y. Kovalev, Y. A. Kovalev, S. Troitsky — Directional association of TeV to PeV astrophysical neutrinos with radio blazars // *ApJ*, *908*, 157
- May 2020 5. **A. Plavin**, Y. Y. Kovalev, Y. A. Kovalev, S. Troitsky — Observational Evidence for the Origin of High-energy Neutrinos in Parsec-scale Nuclei of Radio-bright Active Galaxies // *ApJ*, *894*, 101
- May 2019 6. **A. Plavin**, Y.Y. Kovalev, A. Pushkarev, A. Lobanov — Significant core shift variability in parsec-scale jets of active galactic nuclei // *MNRAS*, *485*, 1822
- Feb 2019 7. **A. Plavin**, L. Petrov, Y.Y. Kovalev — Dissecting the AGN disk-jet system with joint VLBI-Gaia analysis // *ApJ*, *871*, 143

Coauthored

- Nov 2022 8. Y. Y. Kovalev, **A. Plavin**, S. Troitsky — Galactic contribution to the high-energy neutrino flux found in track-like IceCube events // *ApJ Letters*, *in press*, [arXiv:2208.08423](#)
- Oct 2022 9. Baikal-GVD Collaboration et al. — High-energy neutrino-induced cascade from the direction of the flaring radio blazar TXS 0506+056 observed by the Baikal Gigaton Volume Detector in 2021 // *Nature Astronomy*, *submitted*, [arXiv:2210.01650](#)
- Sep 2022 10. T. Koryukova, A. Pushkarev, **A. Plavin**, Y. Y. Kovalev — Tracing Milky Way scattering by compact extragalactic radio sources // *MNRAS*, *515*, 1736
- Jul 2022 11. L. Gurvits et al. — The science case and challenges of space-borne sub-millimeter interferometry // *Acta Astronautica*, *196*, 314-333.
- Nov 2021 12. T. Savolainen et al. — RadioAstron discovers a mini-cocoon around the restarted parsec-scale jet in 3C 84 // *A&A*, *submitted*, [arXiv:2111.04481](#)
- Dec 2020 13. I. Pashchenko, **A. Plavin**, A. Kutkin, Y. Y. Kovalev — A bias in VLBI measurements of the core shift effect in AGN jets // *MNRAS*, *499*, 4515
- Apr 2020 14. Y. Y. Kovalev, A. Pushkarev, E. Nokhrina, **A. Plavin** — A transition from parabolic to conical shape as a common effect in nearby AGN jets // *MNRAS*, *495*, 3576
- Mar 2020 15. Y. Y. Kovalev, D. Zobnina, **A. Plavin**, D. Blinov — Optical polarization properties of AGNs with significant VLBI-Gaia offsets // *MNRAS*, *493*, L54
- Apr 2019 16. I. Pashchenko, **A. Plavin** — Inferring AGN jet parameters using Bayesian analysis of VLBI data with a non-uniform jet model // *MNRAS*, *488*, 939
- Jan 2019 17. L. Petrov, Y.Y. Kovalev, **A. Plavin** — A quantitative analysis of systematic differences in positions and proper motions of Gaia DR2 with respect to VLBI // *MNRAS*, *482*, 3023
- Nov 2018 18. P. Voitsik, A. Pushkarev, Y.Y. Kovalev, **A. Plavin**, A. Lobanov, A. Ipatov — Frequency-Dependent Core Shifts in Ultracompact Quasars // *Astronomy Reports*, *62*, 787

Feb 2017 19. Y.Y. Kovalev, L. Petrov, **A. Plavin** — VLBI-Gaia offsets favor parsec-scale jet direction in active galactic nuclei // *A&A*, 598, L1