

Andrej Dvornik

Curriculum Vitæ

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Research interests

◦ Weak gravitational lensing ◦ Large scale structure ◦ Cosmology ◦ Dark matter ◦ Dark energy ◦ Galaxy–dark matter connection ◦ Halo model ◦

Research

10. 2019 – **Post Doctoral Researcher & GCCL fellow**, *German Centre for Cosmological Lensing, Astronomisches Institut, Ruhr-Universität Bochum*, Bochum, Germany.

9. 2015 – **PhD Researcher**, *Leiden Observatory, Leiden University*, Leiden,

9. 2019 The Netherlands.

Education

2015 – 2019 **PhD**, *Leiden University*, Leiden, The Netherlands.

PhD in Astronomy/Astrophysics

Thesis: *The Galaxy–Dark Matter Connection: A KiDS Study*

Supervisors: Prof. dr. Koenraad Kuijken, Prof. dr. Henk Hoekstra

2013 – 2015 **MSc**, *Leiden University*, Leiden, The Netherlands.

Master of Science in Astronomy

Thesis: *Galaxy-galaxy lensing as a probe of the mass distribution on galactic scales*

Supervisors: Prof. dr. Henk Hoekstra, Dr. Marcello Cacciato

2009 – 2013 **BSc**, *University of Ljubljana*, Ljubljana, Slovenia.

Bachelor of Science in Physics

Honours and Awards

2013 – 2015 Ad Futura Scholarship (scholarship of Slovenian government for studying abroad)

2005 – 2013 Žiga Zois Scholarship for exceptional students

Research Achievements

Lead KiDS-1000 halo model 2x2pt analysis, KiDS-GAMA galaxy-halo connection analyses, and intrinsic alignments studies.

Developed the halo model for consistent 2x2 point and 3x2 point cosmological analyses, including baryon feedback, non-linear halo bias, and non-Poisson behaviour of satellite galaxies using a wealth of information on highly non-linear (small) scales. Me and my collaborators have demonstrated how the halo model can provide similar cosmological constraints to traditional 3x2pt analysis, by using galaxy-galaxy lensing, galaxy clustering and stellar mass function on such scales (*Dvornik et al. in prep.*, *Dvornik et al. 2023*, *Mahony et al. 2022*).

Co-developed a Python and Bash pipeline to process and calibrate large cosmological datasets, automating the data flow and statistical calculations for consistent, repeatable scientific outcomes (*Dvornik et al. in prep.*).

Co-developed a unified analytical covariance estimation code (*Reishcke et al. 2024*, *Dvornik et al. 2023*, *Dvornik et al. 2018*).

Developed a complete halo model for the galaxy-galaxy lensing pipeline used by the KiDS collaboration (*Bilicki et al. 2021*, *Dvornik et al. 2018*, *Dvornik et al. 2017*, *Brouwer et al. 2016*).

Co-developed a maximum-likelihood galaxy-galaxy lensing software (*Dvornik et al. 2020*, *Dvornik et al. 2019*).

Reduced photometric data for the KiDS survey DR4 and DR5 using Astro-WISE pipeline (*Wright et al. 2024*, *Kuijken et al. 2019*).

Since the start of my PhD in Sept 2015, I have authored a total of 47 papers in international peer-reviewed journals with a total of 3953 citations (*h-index* of 27).

Leadership Positions

Co-coordinator of the KiDS galaxy-galaxy lensing and cosmology working groups
Co-lead the KiDS DR4 and DR5 data reductions (Astro-WISE) and data release activities

Profesional Service

Referee/reviewer for A&A and MNRAS
Chair of the meetings and journal clubs for the gravitational lensing and cosmology research group (October 2015 – August 2017)
Member of the KiDS, Euclid, LSST, and WAVES collaborations

Invited and contributed talks and colloquia

October 2024 *Mock Barcelona conference*, Barcelona, Spain (*invited talk*)
April 2024 *UCL astrophysics seminar*, London, UK (*invited talk*)
March 2023 *hol-IA: a holistic approach to galaxy intrinsic alignments workshop*, Leiden, The Netherlands (*invited participation*)
March 2023 *Astrophysics seminar*, Oslo, Norway (*invited talk*)
November 2022 *Cambridge cosmology seminar*, Cambridge, UK (*invited talk*)
July 2022 *Intriguing discrepancies in the growth of structure over cosmic time*, Sesto/Sexten, Italy (*invited talk*)
June 2022 *Cosmology talks*, <https://www.youtube.com/watch?v=Lhfsk24GYyU> (*invited talk*)
January 2019 *Astrodebata seminar*, Ljubljana, Slovenia (*invited talk*)
November 2018 *KIPAC Tea Talk*, Stanford, CA, USA (*invited talk*)
November 2018 *CosmoClub*, UC Santa Cruz, CA, USA (*invited talk*)
November 2018 *INPA seminar*, UC Berkeley, CA, USA (*contributed talk*)
November 2018 *Cosmology seminar*, UC Davis, CA, USA (*contributed talk*)
July 2018 *Astronomy seminar*, Waterloo, ON, Canada (*invited talk*)
July 2018 *CITA lunch talk*, Toronto, ON, Canada (*invited talk*)
July 2018 *The Physics of Galaxy Scaling Relations, and the Nature of Dark Matter*, Kingston, ON, Canada (*poster*)
May 2017 *Quantifying and Understanding the Galaxy-Halo Conneciton*, Santa Barbara, CA, USA (*contributed talk*)
December 2016 *Astrodebata seminar*, Ljubljana, Slovenia (*invited talk*)
July 2016 *Diving into the Dark: Bridging Cosmological Theory and Observation*, Cairns, Australia (*contributed talk*)
July 2016 *From theory to applications: celebrating a century of gravitational lensing*, Leiden, The Netherlands (*contributed talk*)

Teaching and Mentoring

Teaching *Leiden Observatory, Leiden University*, Leiden,
Assistant The Netherlands

- Origin and Evolution of the Universe (Master level) - two semesters (2016–2018)
- Databases and Datamining in Astronomy (Master level) - one semester (2015–2016)

Supervision of students Co-supervision of master student Bas Zoutendijk (together with Henk Hoekstra) for his Master project (October 2016 – July 2017, Leiden)
Co-supervision of master student Steven de Rond (together with Koenraad Kuijken) for his Master project (October 2016 – July 2017, Leiden)
Supervision of master student Sam Taziaux for his Master project (March 2021 – April 2022, Bochum)
Supervision of bacheror student Juan Manuel Blase Daza for his Bachelor project (February 2024 – July 2024, Bochum)
Supervision of master student Elias Buunk for his Master project (September 2023 – October 2024, Bochum)

Outreach

Member of Labod astronomical society (2010–2017)
○ Organised astronomical camps for youth (2011–2013)
○ Gave public talks and workshops for elementary and high school students on various topics of popular astronomy (2011–2013)
○ Ogranised workshops for high school teachers (2011–2013)

Key Skills

Programming languages	python, C, Objective-C, julia, Swift, HTML, CSS, bash, zsh
Tools	git, matplotlib, numpy, scipy, scikit-learn, astropy, tensorflow, SQL, Astro-WISE
Big data	Kilo-Degree Survey data, Galaxy And Mass Assembly data, EAGLE simulation data

Languages

Slovenian	Native	
English	Full professional proficiency	C2, IELTS: 8.0 (2013)
German	Intermediate proficiency	B2
French	Elementary proficiency	A2

References

- Prof. Dr. Hendrik Hildebrandt, German Centre for Cosmological Lensing, Ruhr-Universität Bochum
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- Prof. Dr. Koenraad Kuijken, Leiden Observatory, Leiden University
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- Prof. Dr. Benjamin Joachimi, Department of Physics & Astronomy, University College London
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Publications

Publications 27

h-index

ORCID 0000-0001-7415-1977

- First author **Dvornik, A.**, Heymans, C., Asgari, M., Mahony, C., Joachimi, B., *KiDS-1000: Combined halo-model cosmology constraints from galaxy abundance, galaxy clustering and galaxy-galaxy lensing*, 2023, A&A, 675, A189
- Dvornik, A.**, Hoekstra H., Kuijken K., et al., *KiDS+GAMA: The weak lensing calibrated stellar-to-halo mass relation of central and satellite galaxies*, 2020, A&A, 642, A83
- Dvornik, A.**, Zoutendijk B., Hoekstra H., Kuijken K., *The case for two-dimensional galaxy-galaxy lensing*, 2019, A&A, 627, A74
- Dvornik, A.**, Hoekstra H., Kuijken K., Schneider P., et al., *Unveiling Galaxy Bias via the Halo Model, KiDS and GAMA*, 2018, MNRAS, 479, 1240
- Dvornik, A.**, Cacciato M., Kuijken K., Viola M., et al., *A KiDS weak lensing analysis of assembly bias in GAMA galaxy groups*, 2017, MNRAS, 468, 3251
- Second author Fortuna, M. C., **Dvornik, A.**, Hoekstra, H., Chisari, N. E., et al., *KiDS-1000: weak lensing and intrinsic alignment around luminous red galaxies*, 2024, arXiv:2409.15416
- Mahony, C., **Dvornik, A.**, Mead, A., Heymans, C., et al., *The halo model with beyond-linear halo bias: unbiasing cosmological constraints from galaxy-galaxy lensing and clustering*, 2022, MNRAS, 515, 2612
- Smit, M., **Dvornik, A.**, Radovich, M., Kuijken, K., Maturi, M., Moscardini, L., Sereno, M., *AMICO galaxy clusters in KiDS-DR3: the impact of estimator statistics on the luminosity-mass scaling relation*, 2022, A&A, 659, A195
- Bilicki, M., **Dvornik, A.**, Hoekstra, H., Wright, A. H., Chisari, N. E., et al., *Bright galaxy sample in the Kilo-Degree Survey Data Release 4. Selection, photometric redshifts, and physical properties* 2021, A&A, 653, A82
- Grootes, M. W., **Dvornik, A.**, et al, *Galaxy And Mass Assembly (GAMA): Gas Fuelling of Spiral Galaxies in the Local Universe II. – Direct Measurement of the Dependencies on Redshift and Host Halo Mass of Stellar Mass Growth in Central Disk Galaxies*, 2018, MNRAS, 477, 1015
- Contributing author Reischke, R., Unruh, S., Asgari, M., **Dvornik, A.**, Hildebrandt, H., et al., *KiDS-Legacy: Covariance validation and the unified OneCovariance framework for projected large-scale structure observables*, 2024, arXiv:2410.06962
- He, Z., Li, R., Shu, Y., Tortora, C., **et al.**, *Using Convolutional Neural Networks to Search for Strongly Lensed Quasars in KiDS DR5*, 2024, arXiv:2409.17471
- Johnston, H., Chisari, N. E., Joudaki, S., **et al.**, *6x2pt: Forecasting gains from joint weak lensing and galaxy clustering analyses with spectroscopic-photometric galaxy cross-correlations*, arXiv:2409.17377
- Jalan, P., Bilicki, M., Hellwing, W. A., **et al.**, *Enhancing Photometric Redshift Catalogs Through Color-Space Analysis: Application to KiDS-Bright Galaxies*, 2024, arXiv:2409.14799
- Linke, L., Unruh, S., Wittje, A., Schrabback, T., Grandis, S., **et al.**, *Euclid and KiDS-1000: Quantifying the impact of source-lens clustering on cosmic shear analyses*, 2024, arXiv:2407.09810
- Wright, A. H., Kuijken, K., Hildebrandt, H., Radovich, M., Bilicki, M., **Dvornik, A.**, Getman, F., Heymans, C., et al., *The fifth data release of the Kilo Degree Survey: Multi-epoch optical/NIR imaging covering wide and legacy-calibration fields*, A&A, 2024, 686, A170
- Dark Energy Survey and **Kilo-Degree Survey Collaboration**, *DES Y3 + KiDS-1000: Consistent cosmology combining cosmic shear surveys*, 2023, OJAp, 6, 36
- Lim, S., Hill, R., Scott, D., **et al.**, *Constraints on galaxy formation from the cosmic-infrared-background – optical-imaging cross-correlation using Herschel and UNIONS*, 2023, MNRAS, 525, 1443
- Contigiani, O., Hoekstra, H., **et al.**, *Dynamical cluster masses from photometric surveys*, 2023, MNRAS, 518, 2640
- Amon, A., Robertson, N. C., Miyatake, H., Heymans, C., **et al.**, *Consistent lensing and clustering in a low-S8 Universe with BOSS, DES Year 3, HSC Year 1, and KiDS-1000*, 2023, MNRAS, 518, 477
- Loureiro, A., Whittaker, L., Spurio Mancini, A., Joachimi, B., **et al.**, *KiDS & Euclid: Cosmological implications of a pseudo angular power spectrum analysis of KiDS-1000 cosmic shear tomography*, 2022, A&A, 665, A56
- Schneider, P., Asgari, M., Najafi Jozani, Y., **et al.**, *Pure-mode correlation functions for cosmic shear and application to KiDS-1000*, 2022, A&A, 664, A77
- Tröster, T., Mead, A. J., Heymans, C., Yan, Z., **et al.**, *Joint constraints on cosmology and the impact of baryon feedback: combining KiDS-1000 lensing with the thermal Sunyaev-Zeldovich effect from Planck and ACT*, 2022, A&A, 660, A27

Driver, S., Bellstedt, S., Robotham, A., **et al.**, *Galaxy And Mass Assembly (GAMA): Data Release 4 and the $z < 0.1$ total and $z < 0.08$ morphological galaxy stellar mass functions*, 2022, MNRAS, 513, 439

Li, R., Napolitano, N. R., Spiniello, C., Tortora, C., **et al.**, *High-quality Strong Lens Candidates in the Final Kilo-Degree Survey Footprint*, 2021, ApJ, 923, 1, 16

Ruiz-Zapatero, J., Stölzner, B., Joachimi, B., **et al.**, *Geometry versus growth. Internal consistency of the flat Λ CDM model with KiDS-1000*, 2021, A&A, 655, A11

Brouwer, M. M., Oman, K. A., Valentijn, E. A., **et al.**, *The weak lensing radial acceleration relation: Constraining modified gravity and cold dark matter theories with KiDS-1000*, 2021, A&A, 650, A113

Robertson, N. C., Alonso, D., Harnois-Déraps, J., **et al.**, *Strong detection of the CMB lensing and galaxy weak lensing cross-correlation from ACT-DR4, Planck Legacy, and KiDS-1000*, 2021, A&A, 649, A146

Tröster, T., Asgari, M., Blake, C., **et al.**, *KiDS-1000 Cosmology: Constraints beyond flat Λ CDM*, 2021, A&A, 649, A88

Nakoneczny, S. J., Bilicki, M., Pollo, A., **et al.**, *Photometric selection and redshifts for quasars in the Kilo-Degree Survey Data Release 4*, 2021, A&A, 649, A81

Johnston, H., Wright, A. H., Joachimi, B., **et al.**, *Organised randomness: Learning and correcting for systematic galaxy clustering patterns in KiDS using self-organising maps*, 2021, A&A, 648, A98

Georgiou, C., Hoekstra, H., Kuijken, K., **et al.**, *Halo shapes constrained from a pure sample of central galaxies in KiDS-1000*, 2021, A&A, 647, A185

Hildebrandt, H., van den Busch, J. L., Wright, A. H., **et al.**, *KiDS-1000 catalogue: Redshift distributions and their calibration*, 2021, A&A, 647, A124

Asgari, M., Friswell, I., Yoon, M., **et al.**, *Minimizing the impact of scale-dependent galaxy bias on the joint cosmological analysis of large-scale structures*, 2021, MNRAS, 501, 3003

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Giblin, B., Heymans, C., Asgari, M., Hildebrandt, H., **et al.**, *KiDS-1000 catalogue: Weak gravitational lensing shear measurements*, 2021, A&A, 645, A105

Asgari, M., Lin, C., Joachimi, B., Giblin, B., Heymans, C., **et al.**, *KiDS-1000 cosmology: Cosmic shear constraints and comparison between two point statistics*, 2021, A&A, 645, A104

Taylor, E. N., Cluver, M. E., Duffy, A., Gurri, P., **et al.**, *GAMA+KiDS: empirical correlations between halo mass and other galaxy properties near the knee of the stellar-to-halo mass relation*, 2020, MNRAS, 499, 2896

Blake, C., Amon, A., Asgari, M., Bilicki, M., **Dvornik, A.**, *Testing gravity using galaxy-galaxy lensing and clustering amplitudes in KiDS-1000, BOSS, and 2dFLenS*, 2020, A&A, 642, A158

Georgiou, C., Chisari, N. E., Fortuna, M. C., **et al.**, *GAMA+KiDS: Alignment of galaxies in galaxy groups and its dependence on galaxy scale*, 2019, submitted to A&A

Kuijken, K., Heymans, C., **Dvornik, A.**, Hildebrandt, H., de Jong, J.T.A., Wright A.H., et al., *The fourth data release of the Kilo-Degree Survey: ugri imaging and nine-band optical-IR photometry over 1000 square degrees*, 2019, A&A, 625, A2

Petrillo, C. E., Tortora, C., Vernardos, G., Koopmans, L. V. E., Verdoes Kleijn, G., **et al.**, *LinkS: Discovering galaxy-scale strong lenses in the Kilo-Degree Survey using Convolutional Neural Networks*, 2019, MNRAS, 484, 3879

Brouwer, M. M., Demchenko V., Harnois-Déraps J., **et al.**, *Studying galaxy troughs and ridges using Weak Gravitational Lensing with the Kilo-Degree Survey*, 2018, MNRAS, 481, 5189

Brouwer, M. M., Visser, M. R., **Dvornik, A.**, et al., *First test of Verlinde's theory of emergent gravity using weak gravitational lensing measurements*, 2017, MNRAS, 466, 2547

Hildebrandt, H., Viola, M., Heymans, C., **et al.**, *KiDS-450: cosmological parameter constraints from tomographic weak gravitational lensing*, 2017, MNRAS, 465, 1454

Brouwer, M. M., Cacciato, M., **Dvornik, A.**, et al., *Dependence of GAMA galaxy halo masses on the cosmic web environment from 100 deg² of KiDS weak lensing data*, 2016, MNRAS, 462, 4451