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Cosmic tomography with weak gravitational lensing

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Publications during PhD study

Refereed publications

2. *KiDS-Legacy calibration: Unifying shear and redshift calibration with the SKILLS multi-band image simulations*
Li, S.-S.; Kuijken, K.; Hoekstra, H.; Miller, L.; Heymans, C.; Hildebrandt, H.; van den Busch, J.L.; Wright, A.H.; Yoon, M.; Bilicki, M.; Bravo, M.; Lagos, C.P.; 2023, A&A, 670, A100 (**Chapter 3**)
1. *KiDS+VIKING-450: An internal-consistency test for cosmic shear tomography with a colour-based split of source galaxies*
Li, S.-S.; Kuijken, K.; Hoekstra, H.; Hildebrandt, H.; Joachimi, B.; Kannawadi, A.; 2021, A&A, 646, A175 (**Chapter 2**)

Submitted publications

3. *KiDS-1000: Cosmology with improved cosmic shear measurements*
Li, S.-S.; Hoekstra, H.; Kuijken, K.; Asgari, M.; Bilicki, M.; Giblin, B.; Heymans, C.; Hildebrandt, H.; Joachimi, B.; Miller, L.; van den Busch, J.L.; Wright, A.H.; Kannawadi, A.; Reischke, R.; Shan, H.; submitted to A&A, arXiv:2306.11124 (**Chapter 4**)
2. *DES Y3 + KiDS-1000: Consistent cosmology combining cosmic shear surveys*
Dark Energy Survey and Kilo-Degree Survey Collaborations; submitted to the Open Journal of Astrophysics, arXiv:2305.17173
1. *Strong lensing selection effects*
Sonnenfeld, A.; **Li, S.-S.**; Despali, G.; Shajib, A.J.; Taylor, E.N.; submitted to A&A, arXiv:2301.13230

Curriculum vitae

Born on a snowy day in 1994, I took my first steps in a small town named Dongyang in Zhejiang, China. My parents often recall how I was a quiet nerd, keen on calculations but with a poor memory. The disparity between my language and math scores on my school report cards echoed their observations. My ever-growing curiosity about nature ultimately drove me to pursue a career in scientific research.

In pursuit of higher education, I left my hometown after 18 years and joined Nanjing University, renowned for having the oldest Astronomy department in China. The rigorous courses in mathematics, physics, and astronomy clarified many of the theories that piqued my curiosity during high school. It was a reaffirmation that I was on the right path. Additionally, I participated in some early research training programs offered by various institutes. A particularly formative experience was the two-month ‘UWA Research Training Program’ at the University of Western Australia in Perth. This was my first immersion into a different culture, which enriched both my research and language skills and broadened my worldview. It was this journey that solidified my aspiration to study in a diverse international environment.

My deep dive into research kicked off in Beijing during the final year of my Bachelor’s program. Guided by Prof. Shude Mao, I started to explore the world of gravitational lensing, especially in relation to gravitational waves. Our first paper on the topic has since collected over a hundred citations. Yet, beyond the recognition, the sheer joy and fulfilment I derived from the process truly fueled my passion. I completed my Bachelor’s degree in Astronomy and proceeded with a Master’s in Astrophysics, deepening my expertise in gravitational lensing, spanning strong to microlensing, and expanding from gravitational waves to planetary exploration.

Fulfilling my aspiration to study abroad, I relocated to the picturesque town of Leiden in the Netherlands for my PhD studies. Under the guidance of Profs. Koen Kuijken and Henk Hoekstra, I delved into the fascinating realm of gravitational lensing within cosmology. My involvement in international collaborations, notably the Kilo-Degree Survey (KiDS) and the *Euclid* space mission, greatly enriched my academic journey. With steadfast support from my supervisors and the KiDS team, we developed the third-generation image simulations for KiDS, dubbed ‘SKiLLS’. This naming convention follows its predecessors - ‘SCHOOl’ and COLlege’, symbolising both the development of KiDS and our shared personal growth. Beyond my primary research, I contributed to Master’s courses on ‘Gravitational lensing’ and ‘Large scale structure and galaxy formation’, and helped mentor two Master’s students through their research projects.

The global pandemic did throw a wrench into my PhD journey, especially affecting collaborations and connections with colleagues. Virtual interactions became our norm for over two years. However, I was fortunate to have some trips both before and after the pandemic, forging lasting memories. These include visits to institutions in the UK and Germany and delivering oral presentations at international conferences.

Come November 2023, I will embark on a new adventure as a KIPAC Rubin postdoctoral fellow at Stanford. I eagerly await the challenges and discoveries that lie ahead, especially with the Legacy Survey of Space and Time by the Vera C. Rubin Observatory.

Acknowledgements

Words always fall short when it comes to acknowledgements, especially given the immense support I have received from countless remarkable individuals throughout my PhD journey. I am deeply grateful to have crossed paths with such talented and generous souls, each imparting invaluable lessons and insights. Foremost among them are my two supervisors. Many students would consider themselves fortunate to be mentored by just one of you, yet I had the rare privilege of learning from both. Our engaging discussions have been instrumental in shaping my academic and personal trajectory. Without your unwavering patience, guidance, and support—even in the face of my sometimes naive questions and broken English—I wouldn't be where I am today. I hope our paths keep crossing, permitting me to draw upon your wisdom and advice throughout my career.

The colleagues from the Leiden weak lensing and cosmological simulations groups have been another indispensable source of knowledge and guidance. I cherish our conversations during group meetings, lunches, and conferences. Engaging with each of you, discussing science, and learning about our diverse cultures have been truly enriching experiences.

A significant portion of my knowledge can be attributed to the exceptional KiDS team. The fusion of science and camaraderie we experienced during the KiDS busy weeks will forever resonate with me. Collaborations of this nature are priceless, and I am convinced that every international research group should embrace a similar approach! A special mention goes to the KiDS-Legacy Calibration team. Our collective effort birthed 'SKILLS', which stands as one of my most valuable experiences.

I would like to thank the administrative and support staff at the Leiden Observatory. Every interaction with you was imbued with warmth and efficiency, significantly simplifying my life and work at the institute. The dedicated IT team, in particular, stands out; you are the finest technical support group I have ever encountered. I am thankful for all the tasks handled upon my request and, more so, for your proactive behind-the-scenes contributions.

I am also indebted to my fellow PhD mates, particularly the 'Class of 2019'. We journeyed through the same challenging phases, supporting one another. The memories we created during off-campus hangouts, game nights, and dinners, both pre- and post-pandemic, will always hold a special place in my heart. I hope for our paths to intertwine once more in the future.

Beyond academia, I owe a debt of gratitude to my girlfriend and her remarkable circle of friends who became a major part of my social life. Your company at countless

memorable events has been one of the highlights of my PhD journey. You have added so much joy and warmth to my time here.

In conclusion, my heartfelt gratitude goes to my family and friends back home. They made countless sacrifices, especially given my prolonged absences. Their enduring faith and encouragement have been my pillars of strength, dispelling my moments of doubt and lighting the way to clarity. I will forever treasure the warmth of home.