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## Unveiling dark structures with accurate weak lensing

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# Curriculum Vitae

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I saw first light on the 3<sup>rd</sup> of May 1988 in Rotterdam in the Netherlands. I attended the Stedelijk Gymnasium in Breda as my high school, specialising in the natural sciences and following extra classes in classical Greek, which enabled me to pronounce the weird symbols used in physics. The choice to study astronomy came in the last few months of the final year, when I joined a friend for an open day at the University of Leiden. Not sure yet what I wanted do for the rest of my life, I decided to combine the two studies of astronomy and physics.

In those days I was one of the few students of both physics and astronomy and for our bachelor's project we were relegated to choose something with spectroscopy, which was deemed to be sufficient for both fields. I spent several months under the supervision of dr. Peter Gast working with extremely powerful magnets to investigate hydrogen bonds of nitroxide spin-labeled protein sites in organic molecules. I obtained a bachelor's degree in both physics and astronomy in 2009, after which I spent one year as treasurer in the board of directors for student society Catena.

I pursued a master's programme in astronomy and for my first project I investigated the performance of shape measurement methods under the supervision of prof. Konrad Kuijken. This project was continued in the next year by (now dr.) Axel Buddendiek and together our projects have laid the ground work for the first chapter of this thesis. In my second year as a master student I joined the group of prof. Huub Röttgering and studied protoclusters: galaxy clusters before they can be called galaxy clusters. In a simulation of galaxies, the Millennium Simulation, I looked at the detectability of protoclusters at redshifts 2-3 with submillimeter wavelengths, specifically those of the SPIRE instrument on the Herschel space satellite. I found that some, but not all protoclusters could be identified with the submillimeter measurements. Although I did not pursue this project, collaborators published their work on protoclusters after I had finished the master's project. And, eventually I did return to galaxy clusters for the second half of this thesis.

In 2012 I started as a PhD student under the supervision of, then dr. and now, prof. Henk Hoekstra and prof. Konrad Kuijken. The emphasis of the PhD would be the improvement of shape measurement methods, so that weak gravitational lensing experiments are able to produce reliable results. Having some experience with calibration simulations I was drafted as an active member of the Kilo Degree Survey (KiDS) collaboration, whose goal it is to set constraints on cosmological parameters using cosmic shear. In a dedicated team we derived the calibration for the KiDS shape measurement algorithm using the simulated telescope images I created. Unsatisfied with just fake data, I used the observations of galaxy clusters to measure the dark matter structures with weak gravitational lensing. For this I also spent several nights observing galaxy clusters at the Isaac Newton Telescope on La Palma. This was my second time at that telescope, with which I had already observed in the second year of my bachelor's programme. I have participated in a summer school in Cargese and I have attended conferences at several (inter)national venues: Leiden, Madrid, Rome, Marseille, Philadelphia. I have been invited to Bonn twice, but for different projects, as well as to Malta. At some of these occasions I have also presented my own work, and also at the regular KiDS collaboration meetings in Leiden, Edinburgh and Oxford.

This autumn I will continue to study galaxy clusters with weak gravitational lensing

in the group of dr. Anja Von der Linden at the Stony Brook University in the United States of America.

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# Acknowledgements

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After 11 years at the Leiden Observatory, a page or two cannot suffice to acknowledge all who have in some way contributed to the completion of this thesis. First of all my thanks goes out to the entire institute, which, as an independent reviewer has said, has a very comfortable atmosphere and displays easy interaction between members of different groups, who work on vastly different subjects. I wholeheartedly agree with this statement and I have enjoyed meeting lots of people in the long 11 years I have spent here.

Specific thanks to those who have enjoyed (or endured) my company most. Koen, although we collaborated mostly just for the first half of my thesis, besides our two-weekly telecons, working with you has always been fun and enlightening. In contrast, the frequency of my interactions with professor Hoekstra grew over time and correlated with the decreasing distance between my office and yours, to an almost daily get-together. Given our Dutch inclination to get to the point, these meetings were always productive, but enjoyable too when the conversation diverted to astropolitics. I have grown much as a researcher under your tutelage and thank you for the importance you attach to your role as supervisor.

Jeroen, after embarking on the journey of astronomy together 11 years ago, there is too much to mention about you. Although I (and others with me) found you scary at first, you've been a great friend and a great help during my PhD. Thanks for sticking with me through club power and going for walks in the fresh air until you replaced me with someone better.

Ian, you've shared the KiDS image simulations adventure with me. You've given me the best working week of my PhD; it was both fun and productive. And you have taught me that a Mediterranean style of conversation is sometimes preferable to a Dutch style.

The greatest victim of my club power agenda has been Fabian, who made it clear that he was definitely victim. However, you stuck with me through the suffering and, for me at least, our dinners together, where we discussed the horror of club power, PhD life and we made some fun of general Dutch and German stereotypes, made the whole thing an enjoyable experience.

I could not have been more fortunate to share my time as a PhD with Massimo. You were always available for a pleasant talk, for helpful discussions, to dispense general wisdom and sometimes to give me some insights in astrosociology. My PhD could not have been done without you. Although I wish you the best of times in the outside world, you will be sorely missed.

Cristobal, after working closely together, I cannot but have respect for your achievements as a scientist, given your demanding private life. Thanks for all your invaluable help for this thesis.

Axel, your help was indispensable in getting the start of this thesis finished.

Being a PhD student is about soaking up knowledge and expertise to grow as a researcher and I have been fortunate with the cosmology group in Leiden. It has been instructive to work with you and many thanks for your patient explanations. In a wider sense the KiDS team has provided me with a professional environment in which to work and learn, as well as a great group of people to get to know. Although there

was a lot of work for a relatively small group of people, I'm very proud to have been part of what we accomplished. Thanks to all those who made the Sterrewacht the fun place it has been for me: David, Henriette, Emmanuele, Clement, Leah, Eva, Ann-Sofie, Edwin, Niels, Vincent, Kirstin, Heather, Paula, Andrej, Francois, Allison, Mason, Chris, Michael, Nico, Geert-Jan, Mieke and anyone else who I might have forgotten, but has been there with me in these last 11 years.

A Dutch saying states that a good neighbour is better than a distant friend and this sentiment is applicable to office mates as well. Thanja, talking with you always made me feel better, whatever we discussed; Andrew, although I had to wait until 12.25 we had great fun in the office and I hope I will find as good a friend in my next office; Tim, your presence always seemed to fill up the room; Caroline; Umut; Merel; Joe; Christian, for sharing the fresh air; and Emmanuele, because you have been in my office at least as often as I have been and you made sure there was never a dull moment. Jens, being TA with you made grading silly mistakes an enjoyable part of my PhD. Jens, Marijke, and Margot, thanks for sharing all the weird and wonderful questions the public could throw at us. Xander, even though our meetings were not something I looked forward to, you have been a great help in getting this thesis finished and putting me at ease about it. Lastly, it should never be forgotten that a big part of life at the Sterrewacht is thanks to the computer group and the secretaries.

Although the PhD can be an all-consuming project, there is still a life outside it. I want to thank the M(W)BOA crew for a staple source of food and fun on Wednesdays and Huib for the same on Tuesdays. And even though I wasn't around as often as I would have wanted to, and wasn't as fit as you probably would have wanted me to be, I have to thank everyone at Argonauta for making it a fantastic club. Special thanks of course to my team, with which we've accomplished so much in the same time span as my PhD. Robert, together we have had some awesome vacations in exotic locations and discussions with you about life as a PhD and as a post-doc have helped me choose my path. I will see you soon in the USA. Luc, you have always been a great friend for the past 17 years and you got me started with astronomy in the first place. This thesis would definitely not exist without you.

Home is where the heart is, as well as the sarcastic remarks and the barely acceptable humour. Michiel and Elanor, thanks for a home and hours of video entertainment, some of which was actually not too bad. Mother, you're maybe not completely a tiger mother, but thanks for pushing me beyond my normal lazy state of being. Thanks for the unwavering support in every aspect of my life. Now it is time for the next step after my PhD, and I could not have been happier to share it with you, Mette. Thank you for all the support and I look forward to our life together in the USA.