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Simulating Cosmic Reionisation

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Curriculum vitae

I WAS born on June 6, 1978, in Finsterwalde, a small town not far south of Berlin. In 1998, after thirteen years of school education, I received my diploma (Abitur) at the Sangerstadt-Gymnasium in Finsterwalde and joined the German Air Force to take up a career as an officer. I quickly realised, however, that my childhood dream of exploring the sky was more likely to become true by studying astrophysics rather than survival guides and quit the army in 1999.

I subsequently enrolled at the University of Potsdam to study physics. In 2003, after four years of study, I abandoned my original plans of specialising in astrophysics and became a member of the research group Statistical Physics/Theory of Chaos. My decision was mostly triggered by my interest in the lectures on statistical physics held by Prof. Arkardy Pikovsky. Under his supervision I investigated the dynamics of self-sustained oscillators as forced by a delayed feedback and an external noise. I received my diploma in 2005, after finishing my thesis with title Effects of Noise and Delay on Nonlinear Oscillators, and was awarded the Wilhelm und Else Heraeus excellence prize.

By then I had accepted a PhD position at the astronomy department of the University of Leiden, The Netherlands. For the next four years, i.e. from 2005 to 2009, I thus had the opportunity to follow upon my interests in astrophysics and study the origin and evolution of the Universe. The times were exciting. LOFAR, a novel-technique radio telescope being built in the Netherlands, was soon to open a new observational window on a previously largely unexplored epoch in the history of the Universe: the epoch of reionisation. I followed the invitation of my supervisors Dr. Joop Schaye and Prof. Huub Rottgering to focus on the investigation of this interesting epoch using numerical simulations. The development of a novel radiative transfer method for application in epoch-of-reionisation simulations may be considered my main scientific achievement during my PhD.

PhD time is travel time. I participated in several schools on topics such as radio interferometry (Manchester, UK, 2005) and cosmology/astroparticle physics (Trieste, Italy, 2006). I visited the research group of Dr. Volker Springel at MPA (Garching, Germany, Jan-April 2008) as part of an EARA traineeship. I presented my work during conferences, workshops and seminars at institutes across the world, including IAP (Paris, France, 2005), Nordita (Stockholm, Sweden, 2007), ICC (Durham, UK, 2007), MPA (Garching, Germany, 2008, 2009), ETH conference center (Ascona, Switzerland, 2008), CITA (Toronto, Canada, 2008), CfA (Cambridge, USA, 2008), Caltech (Pasadena, USA, 2008) and others.

I will continue research in astrophysics at the University of Texas in Austin, USA. Being employed as a postdoctoral researcher from 2009-2012, I will use numerical simulations to investigate the physics of the first generation of stars and black holes in the first galaxies that formed in our Universe and assess their observability with future telescopes.

Publication list

Photoheating and supernova feedback amplify each other's effect on the cosmic star formation rate

Pawlik, A. H., Schaye, J.

2009, Monthly Notices of the Royal Astronomical Society, 396, L64

Keeping the Universe ionized: photoheating and the clumping factor of the high-redshift intergalactic medium

Pawlik, A. H., Schaye, J., van Scherpenzeel, E.

2009, Monthly Notices of the Royal Astronomical Society, 394, 1812

Detection and extraction of signals from the epoch of reionization using higher-order one-point statistics

Harker, G. J. A., Zaroubi, S., Thomas, R. M., Jelic, M., Labropoulos, P., Mellema, G., Iliev, I. T., Bernardi, G., Brentjens, M. A., de Bruyn, A. G., Ciardi, B., Koopmans, L. V. E., Pandey, V. N., **Pawlik, A. H.**, Schaye, J., Yatawatta, S.

2009, Monthly Notices of the Royal Astronomical Society, 393, 1449

Fast large-scale reionization simulations

Thomas, R. M., Zaroubi, S., Ciardi, B., **Pawlik, A. H.**, Labropoulos, P., Jelic, V., Bernardi, G., Brentjens, M. A., de Bruyn, A. G., Harker, G. J. A.; Koopmans, L. V. E., Mellema, G., Pandey, V. N., Schaye, J., Yatawatta, S.

2009, Monthly Notices of the Royal Astronomical Society, 393, 32

TRAPHIC - radiative transfer for smoothed particle hydrodynamics simulations

Pawlik, A. H., Schaye, J.

2008, Monthly Notices of the Royal Astronomical Society, 389, 651

Control of oscillators coherence by multiple delayed feedback

Pawlik, A. H., Pikovsky, A.

2006, Physics Letters A, 358 (3), 181

Nawoord

THIS is my thesis. Without Joop, I would not have started it. Without Claudio, I would not have finished it. It was a pleasure to work under your supervision. Joop, I am grateful that you gave me both the opportunity to succeed and the freedom to fail. Claudio, I admire the selflessness with which you provided help and the patience with which you listened to my problems. Much must remain unsaid. Huub, I thank you for your valuable, often comfortably practical, advice. Rob, we went through it together. Olivera, I could not imagine the time without you. Marcel, I appreciate your refreshingly normal appearance; days without you are definitely less fun. Duffy, I will miss your comments in the group calendar. Freeke, I enjoyed your cheerful company; thank you for your help with the Dutch summary. Eveline, it was a great experience to work with you. Akila, Craig and David, I benefited from your interesting contributions to the group meetings and other scientific discussions.

I experienced the astronomy department at Leiden University, the *Sterrewacht*, as an exceptional environment for pursuing my research interests. Exciting colloquia and lunch seminars, the possibility to attend presentations at the nearby Lorentz conference center and the scientific exchange with the theoretical physics department all contributed to an atmosphere that enabled me to look beyond my own nose and to place my research into the larger context. The financial support was excellent, and I particularly thank Jan, Christine and Peter that I never had to worry about where all the money that I needed came from. I thank the secretaries Anita, Elise, Jeanne, Kirsten and Liesbeth and the computer administrators David, Tycho, Erik and Aart for their competent support. I appreciate that David and Erik were also reachable outside office hours, which was helpful at weekends before many a conference.

Simon, I will remember your readiness to help. Remco, I enjoyed being your office mate. Chocolate Easter eggs, t-shirt contests, the transformation of our office into a spaceship: I am looking forward to meeting you in Austin. Tracey, our after-work squash sessions were great fun. Niruj and Dharam, your disputes on radio astronomy were as passionate as your cookery. Cyril, thank you for helping me to produce my first (and last!) radio image. Maria, thank you for surprising me with the original version of War and Peace. Nina, Rik, Ann-Marie, Esther, Richard, Brent, Sarah, Cat, Kalle, Maaïke, Rafael, Raymond, Ryan, Sergio, Christian, Mariska, Dominic, Edith, Jeanette and all who remain unmentioned, it was fun to meet you at vrijdag borrels, dinners, parties and for beers in the sun. Carolina, thank you for infecting me with your enthusiasm. Nadine, I enjoyed your company at theatres. David, your strong opinions turned every discussion into an event. Hendrik, I thank you for providing me with the German drug Tatort. Ernst and Karoliina, I am happy to see you reviving the vrijdag borrel.

I spent a wonderful time at MPA and I thank Volker for his hospitality and Maria and Kate for organising my stay. I enjoyed discussions, dinners and parties with Margarita, Margherita, Jens, Tom, Miro, Simone, Matthias, Mona, Umberto, Silvia, Ewald, Cecilia, Andre, Antonella, Benedetta and many more. Jens, thank you for your warm reception at CITA.

Whenever I came back to Potsdam/Berlin I felt very comfortable. I thank Prof. Arkady Pikovsky for his cordiality during my stays at the University of Potsdam. I enjoyed discussions with Arthur, Markus and Herr Hachenberger. Arthur, your advice was crucial for my decision to stay. Eric, Christian and Christoph, I am happy to have friends whom I can blindly trust.

Thomas, thank you for designing a great cover. Mathias, Franziska und René, bis hier und noch viel weiter. Ich danke meiner Familie. Ich danke meiner Mutter für ihre unbedingte und aufopferungsvolle Unterstützung.

In Erinnerung an meinen Vater.