Cavity quantum electrodynamics with quantum dots in microcavities

Bakker, M.P.

Curriculum Vitæ

Morten Bakker was born on the 1st of February 1987 in Groningen. He lived in Muscat (Oman) from 1987-1993, in Copenhagen (Denmark) from 1993-1996, and moved to Zuidlaren in the Netherlands in 1996. He graduated in 2005 from the Maartenscollege high school in Haren with a Science and Technology (NT) profile and the additional subjects Latin and Geography. He finished on the 5th place in the National Geography Olympiad in 2005. He went on to study Applied Physics at the University of Groningen in 2005 and obtained his BSc cum laude in 2008. His BSc final project was on 'Heat transport measurements in spin-ladder compounds', with Marian Otter and prof. Paul van Loosdrecht. During his bachelor studies, he spent 10 months in 2007-2008 studying various subjects at the National University of Singapore. In 2008 he started on the top master programme in Nanoscience at the Zernike Institute for Advanced Materials at the University of Groningen. During this time, he performed a summer research internship project in the 'Superconducting circuits and quantum computation' group with dr. Will Oliver and prof. Terry Orlando at MIT in Boston (USA) in 2009. He then performed his MSc thesis project 'Electromagnetically induced transparency with electron spins bound to neutral Si donors in GaAs' with Maksym Sladkov and prof. Caspar van der Wal and graduated cum laude in 2010. He joined the Quantum Optics at the University of Leiden on the 1st of October 2010 to work on quantum dots in microcavities with dr. Martin van Exter and prof. Dirk Bouwmeester.

List of publications

1. M. Sladkov, A. U. Chaubal, M. P. Bakker, A. R. Onur, D. Reuter, A. D. Wieck, and C. H. van der Wal, "Electromagnetically induced transparency with an ensemble of donor-bound electron spins in a semiconductor," *Phys. Rev. B* **82**, 121308(R) (2010)

2. M. Sladkov, M. P. Bakker, A. U. Chaubal, D. Reuter, A. D. Wieck, and C. H. van der Wal, "Polarization-preserving confocal microscope for optical experiments in a dilution refrigerator with high magnetic field," *Rev. Sci. Instrum.* **82**, 043105 (2011)

3. J. Hagemeier, C. Bonato, T.-A. Truong, H. Kim, G. J. Beirne, M. P. Bakker, M. P. van Exter, Y. Luo, P. M. Petroff, and D. Bouwmeester, "H1 photonic crystal cavities for hybrid quantum information protocols," *Opt. Exp.* **20**, no. 22, pp. 24714-24726 (2012)

4. M. P. Bakker, D. J. Suntrup III, H. Snijders, T.-A. Truong, P. M. Petroff, M. P. van Exter and D. Bouwmeester, "Monitoring the formation of oxide apertures in micropillar cavities," *Appl. Phys. Lett.* **102**, 101109 (2013)

5. M. P. Bakker, D. J. Suntrup III, H. Snijders, T.-A. Truong, P. M. Petroff, D. Bouwmeester and M. P. van Exter, "Fine tuning of micropillar cavity modes through repetitive oxidations," *Opt. Lett.* **38**, pp. 3308-3311 (2013)

6. M. P. Bakker, A. V. Barve, A. Zhan, L. A. Coldren, M. P. van Exter and D. Bouwmeester, "Polarization degenerate micropillars fabricated by designing elliptical oxide apertures," *Appl. Phys. Lett.* **104**, 151109 (2014)

7. M. P. Bakker, A. V. Barve, T. Ruytenberg, W. Löffler, L. A. Coldren, D. Bouwmeester, and M. P. van Exter, "Polarization degenerate solid-state cavity quantum electrodynamics," *Phys. Rev. B* **91**, 115319 (2015)

8. M. P. Bakker, T. Ruytenberg, W. Löffler, A. V. Barve, L. A. Coldren, M. P. van Exter, and D. Bouwmeester, "Quantum dot nonlinearity through cavity-enhanced feedback with a charge memory," *submitted to Phys. Rev. B*

9. M. P. Bakker, H. Snijders, W. Löffler, A. V. Barve, L. A. Coldren, D. Bouwmeester, and M. P. van Exter, "Homodyne detection of coherence and phase shift of a quantum dot in a cavity," *submitted to Opt. Lett.*

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The samples used in Chapters 5-9 were realized with great care and professionalism by Ajit Barve in the group of Larry Coldren in UCSB, whom I owe a very big thanks.

During my PhD I have had the enjoyment, and also great benefit, of supervising three students. Henk Snijders performed his bachelor research project on realizing the new oxidation furnace and oxidation monitoring technique in 2012, which directly lead to Chapters 3 and 4. Later in 2014, he rejoined the group as a PhD student, and made large contributions to among others Chapter 8. Ajan Ramachandran visited us from India in 2013 and worked on the first low temperature sample characterizations with the new cryostat system. From these we learned a lot in order to improve future samples and getting the setup to work nicely without vibrations. Thomas Ruytenberg performed his master research project on 'The One QD' in 2014. During an uppermost productive time we were able to set up many new measurements, increased the setups complexity by an order of magnitude, and obtained many results that directly lead to Chapters 6 and 7, and preliminary work that lead to results in Chapters 8 and 9. And a nice poster prize in Arnemuiden.

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I studied at the Zernike Institute at the University of Groningen which provided me with both much knowledge, but also inspiration to continue with PhD research. I have especially good memories on my time working in the Physics of Nanodevices group with Maksym Sladkov and Caspar van der Wal, and I would like to thank

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