Radio galaxies at low frequencies: high spatial and spectral resolution studies with LOFAR

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Publications

Refereed first author publications

- **Morabito, L. K.**, Deller, A. T., Röttgering, H., et al., *LOFAR VLBI studies at 55 MHz of 4C 43.15, a z= 2.4 radio galaxy*, 2016, MNRAS, 461, 2676
- **Morabito, L. K.**, Oonk, J. B. R., Salgado, F., et al., *Discovery of Carbon Radio Recombination Lines in M82*, 2014, ApJL, 795, L33
- **Morabito, L. K.**, van Harten, G., Salgado, F., et al., *Exact bound-bound Gaunt factor values for quantum levels up to n = 2000*, 2014, MNRAS, 441, 2855
- **Morabito, L. K.**, Dai, X., Leighly, K. M., Sivakoff, G. R., & Shankar, F., *Unveiling the Intrinsic X-Ray Properties of Broad Absorption Line Quasars with a Relatively Unbiased Sample*, 2014, ApJ, 786, 58
- **Morabito, L. K.**, & Dai, X., *A Bayesian Monte Carlo Analysis of the M-σ Relation*, 2012, ApJ, 757, 172
- **Morabito, L. K.**, Dai, X., Leighly, K. M., Sivakoff, G. R., & Shankar, F., *Suzaku Observations of Three FeLoBAL Quasi-stellar Objects: SDSS J0943+5417, J1352+4239, and J1723+5553*, 2011, ApJ, 737, 46

Refereed co-author publications

- Williams, W. L., van Weeren, R. J., Röttgering, H. J. A., et al., *LOFAR 150-MHz observations of the Boötes field: catalogue and source counts*, 2016, MNRAS, 460, 2385
- Varenius, E., Conway, J. E., Martí-Vidal, I., et al., *Subarcsecond international LOFAR radio images of Arp 220 at 150 MHz: A kpc-scale star forming disk surrounding nuclei with shocked outflows*, 2016, arXiv:1607.02761
- Shimwell, T. W., Luckin, J., Brüggen, M., et al., *A plethora of diffuse steep spectrum radio sources in Abell 2034 revealed by LOFAR*, 2016, MNRAS, 459, 277
- Williams, W. L., van Weeren, R. J., Röttgering, H. J. A., et al., *LOFAR 150-MHz observations of the Boötes field: Catalogue and Source Counts*, 2016, arXiv:1605.01531
- Heald, G. H., Pizzo, R. F., Orrú, E., et al., *The LOFAR Multifrequency Snapshot Sky Survey (MSSS). I. Survey description and first results*, 2015, A&A, 582, A123

- Oonk, R., **Morabito, L.**, Salgado, F., et al., *The Physics of the Cold Neutral Medium: Low-frequency Radio Recombination Lines with the Square Kilometre Array*, 2015, Advancing Astrophysics with the Square Kilometre Array (AASKA14), 139
- Varenius, E., Conway, J. E., Martí-Vidal, I., et al., *Subarcsecond international LOFAR radio images of the M82 nucleus at 118 MHz and 154 MHz*, 2015, A&A, 574, A114
- Moldón, J., Deller, A. T., Wucknitz, O., et al., *The LOFAR long baseline snapshot calibrator survey*, 2015, A&A, 574, A73
- Oonk, J. B. R., van Weeren, R. J., Salgado, F., et al., *Discovery of carbon radio recombination lines in absorption towards Cygnus A*, 2014, MNRAS, 437, 3506

Conference proceedings

- **Morabito, L.**, Deller, A., Moldón, J., et al., *A LOFAR survey of spatially resolved Ultra Steep Spectrum sources*, 2015, The Many Facets of Extragalactic Radio Surveys: Towards New Scientific Challenges, 71
- **Morabito, L. K.**, Deller, A., Oonk, J. B. R., Röttgering, H., & Miley, G., *Spatially resolved studies of extragalactic jets in high redshift radio galaxies*, 2015, Extragalactic Jets from Every Angle, 313, 231
- Toribio, M. C., **Morabito, L. K.**, Oonk, J. B. R., et al., *Radio Recombination Line studies on M82 from LOFAR HBA observations*, 2015, Galaxies in 3D across the Universe, 309, 350
- **Morabito, L. K.**, Oonk, J. B. R., Salgado, F., et al., *Discovery of Carbon Radio Recombination Lines in M82*, 2015, Galaxies in 3D across the Universe, 309, 141
- Moldon, J., Deller, A., Wucknitz, O., et al., *The LOFAR long baseline snapshot calibrator survey*, 2014, Proceedings of the 12th European VLBI Network Symposium and Users Meeting (EVN 2014). 7-10 October 2014. Cagliari, Italy. Online at `http://pos.sissa.it/cgi-bin/reader/conf.cgi?confid=230`, id.97, 97
- Dai, X., **Morabito, L. K.**, Shankar, F., Sivakoff, G. R., & Leighly, K. M., *Large BALQSO Fractions Inferred from NIR and Radio Surveys: Implication to AGN and Feedback Models*, 2012, AGN Winds in Charleston, 460, 120
- **Morabito, L. K.**, Dai, X., Leighly, K. M., Sivakoff, G. R., & Shankar, F., *X-ray Observations of Broad Absorption Line Quasars*, 2012, American Astronomical Society Meeting Abstracts #219, 219, 154.06

Curriculum Vitae

I was born on 22 January, 1983 in Englewood, Colorado, USA. When I was five years old my family moved to Federal Way, Washington, where we lived within walking distance of Pugeot Sound. When I was ten years old my family moved to North Carolina, and four years later we moved again to Michigan. As a child I was an avid reader, and also watched all of the science programmes on television that I could. I developed a passion for anything space-related, from the smallest details of the US space program to science fiction. When I was 13 years old I went to Space Camp in Florida, and was the Pilot for the simulated space mission. When I was in high school, this helped prompt my decision to take a four-year scholarship in the Reserve Officer Training Corps for the US Air Force. I took this scholarship to the University of Michigan, where I earned a double major in both Physics and Astrophysics and graduated with an Angell Scholar award and membership in the National Physics Honors Society, Sigma Pi Sigma.

After graduation, I commissioned as an officer in the US Air Force and went to Florida for a year of specialized training to become an Air Battle Manager. Upon finishing training, I moved to Tinker Air Force Base in Oklahoma and qualified as an Air Weapons Officer (Distinguished Graduate) to fly on the E-3 Airborne Warning And Control System (AWACS). After a deployment to south-west Asia where I provided tactical control for aircraft in combat environments, I became qualified as an Electronic Combat Officer (ECO) and operated the Passive Detection System on the AWACS. Upgraded to Instructor ECO well before my peers, I garnered an 'Exceptionally Qualified' ranking and deployed again to south-west Asia. Upon returning to Oklahoma, I became an Evaluator ECO and the subject matter expert for all ECOs in the Air Force. Over the course of my military career, I earned multiple distinctions including two Air Medals (for flying combat hours), and an Air Force Achievement Medal (for leading the deployed Electronic Support Team).

During my last two years in the Air Force, I began working on my master's degree in Astronomy at the University of Oklahoma with X. Dai. I worked on X-ray observations of broad absorption line quasars, and developed a new method to determine their intrinsic X-ray weakness. During this time I also helped out with multiple observing runs on the optical 2.4 m Hiltner Telescope at the MDM Observatory adjacent to Kitt Peak in Arizona. I separated from the Air Force in 2011 and after earning my master's degree in May 2012 I spent three months at the National Radio Astronomy Observatory in Socorro, New Mexico, working with D. Meier, E. Momjian, and J. Ott on radio observations from the Very Large Array. I used these data to search for ammonia lines in nearby star-forming galaxies.

In September 2012 I began my PhD at Leiden Observatory under the guidance of H. Röttgering. My work in the last four years has focused on using low frequency radio astronomy to better understand the physical processes both in distant radio galaxies and in the cold neutral medium. My time has been divided between theoretical work on carbon radio recombination line models, commissioning work for the Low Frequency Array (LOFAR), and developing new methods to calibrate LOFAR data for observational projects. In addition to this, I have performed observing runs on the Isaac Newton Telescope on La Palma, and was the teaching assistant for the Radio Astronomy master's course in 2015. I have presented my work at international conferences and institutes in the United States, the United Kingdom, the Galápagos Islands, Germany, Austria, South Africa, and the Netherlands. I have also organised multiple LOFAR busy weeks for the purpose of commissioning work.

In October 2016 I will begin a post-doctoral researcher position at the University of Oxford in Oxford, the United Kingdom. I will continue to work on the topic of galaxy evolution from a radio perspective, but broaden my experience to include multi-wavelength data for a more complete analysis.

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This thesis relied heavily on computing resources, and would not have been possible without all the help from the Sterrewacht computer group. In particular, I want to say thank you to David for his help with LOFAR software installations (and all the problems that came with that). Also thanks to Erik and David for their help with the new parallel cluster.

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Thanks to Huib and Mike for taking me as their teaching assistant for Radio Astronomy, and giving me the freedom to design my own practical project. Thanks also to the students who were always engaged and had thoughtful questions. The course allowed me to share my deep enthusiasm for radio astronomy, and I am always grateful to be reminded how much I actually love what I do!

There are several key people at Leiden from whom I have learned so much about both science and life. I am deeply thankful to count Emma, Wendy, Tim, David, and Henriette among my friends. I have learned so much both professionally and personally from each of you. Emma, thank you for your scientific guidance, your daily presence in my life, the hugs when I needed them, and for being someone with whom I could share my passion for reading and feminist discourse. Wendy, I am always in awe of your quiet competence and the excel-

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