Leah K. Morabito

Personal Details

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Employment History

Oct 2016 - Present Postdoctoral Research Assistant in Galaxy Evolution, *University of Oxford*

Apr 2005 - Aug 2011 Air Battle Manager (highest rank: Captain), *United States Air Force*

Education

Sep 2012 - Sep 2016 **Leiden University**, Astronomy PhD Researcher *Supervisor: Huub Röttgering*
Thesis: 'Radio Galaxies at Low Frequencies'

Sep 2009 - Apr 2012 **University of Oklahoma**, M.Sc. Astronomy *Supervisor: Xinyu Dai*
Thesis: 'AGN: From Supermassive Black Holes to Rare FeLoBALs'

Sep 2001 - Apr 2005 **University of Michigan**, B.Sc. Physics & B.Sc. Astrophysics

Science Highlights

- First spatially resolved maps of high redshift radio galaxies, $1''$ resolution at 55 MHz
- First extragalactic detection of low frequency carbon radio recombination lines, in M82
- Widest, deepest survey field map to date with low band Low Frequency Array (LOFAR) data
- Determined intrinsic X-ray properties of broad absorption line quasars with new method

Research Goals

My main research goal is to use low frequency radio observations coupled with multi-wavelength data to answer fundamental questions on how super-massive black holes co-evolve with the galaxies in which they reside. I aim to provide new insight using high-resolution radio imaging to clearly distinguish two main components in galaxy evolution: star formation, and high-energy processes associated with super-massive black holes that are actively accumulating material.

Professional Experience

Aug 2015, Jan 2017 **LOFAR Long Baseline Workshops**. Helped with commissioning/developing the LOFAR long baseline (LB) data reduction pipeline, and training of new users.

Mar 2016 **LOFAR Low Band Antenna Busy Week**: Organised and led first busy week exclusively devoted to working on challenges for the LOFAR Low Band Antenna.

Jul 2012 - present **LOFAR Commissioning Busy Weeks**. Participated in 10 busy weeks to commission software for low-frequency, wide-field imaging.

Apr 2015 **Resident Shared Risk Observing, JVLA**. Assessed P-band spectroscopy feasibility on-site with staff at National Radio Astronomy Observatory in New Mexico.

Jan 2013 **Chair of Local Organising Committee, LOFAR Busy Week 21**. Workshop with 40+ global participants, including specialized talks and training for new users.

May 2012 - Aug 2012 **Research Experience for Graduate Students**. 3-month program working with radio data to detect ammonia transitions in nearby starburst galaxies.

May 2012 **12th Synthesis Imaging Workshop**. 2 weeks of radio interferometry classes at New Mexico Tech, with hands-on data reduction sessions.

Aug 2011 **X-ray Astronomy and CIAO Workshops, CXC**. Week-long workshops on specialized X-ray data reduction techniques, focussed on hands-on data reduction.

Aug 2008 - Aug 2011	**Evaluator/Instructor Electronic Combat Officer (ECO), USAF, Capt**. Operated Passive Detection System on E-3 Airborne Warning And Control System (AWACS). Culminated experience as Chief Evaluator and subject matter expert.
Jun 2005 – Aug 2008	**Air Weapons Officer, USAF, 1Lt**. Controlled tactical aircraft from AWACS. Deployed in support of combat missions in Afghanistan and Iraq.

Funding Awards

Jun 2014	Leids Kerkhoven-Bosscha Fonds grant for travel to international conference, 1 000 Euro
Nov 2013	Award for contribution to successful NWO-TOP1 grant, total grant 4 million Euro
Sep 2001	Reserve Officer Training Corps Scholarship, value approximately 120 000 USD
May 2001	University of Michigan Regents Merit Scholarship, 3000 USD

Honours

Feb 2010	Distinguished Graduate, Instructor Electronic Combat Officer Training
Sep 2009	Air Force Achievement Medal, for leadership of Deployed Electronic Support Team
May 2008	Air Medal, for flying combat hours
May 2007	Distinguished Graduate, Initial Air Weapons Officer Qualification Training
Jul 2006	Top Scope Award, Undergraduate Air Battle Management Training
Apr 2005	College of Literature, Science & the Arts 'Angell Scholar'

Professional Society Memberships

Feb 2017 – present	Member of Royal Astronomical Society, by election
Oct 2016 – present	Oxford Society of Women in Physics, Outreach Officer
Sep 2011 – Dec 2015	Member of American Astronomical Society
Apr 2005 – present	Member of Sigma Pi Sigma, National Physics Honors Society, by election
2004 - 2005	Co-President, co-founder of Society for Women in Physics, University of Michigan

Successful observing proposals: PI/selected Co-I

- 'Long Baseline Studies of High Redshift Radio Galaxies' – PI, LOFAR Cycle 4/5/6, 92 hrs
- 'Radio Recombination Lines in M82 with P-band' – PI, JVLA Semester 2015B, 17 hrs
- 'Commissioning LBA Long Baselines using the HBA' – PI, Commissioning, 9.75 hrs
- 'Long Baseline Studies of High Redshift Radio Galaxies' – Co-I, LOFAR Cycles 2/3, 51 hrs
- 'The LOFAR LBA Exploratory Survey' – Co-I LOFAR Cycle 7, 64 hrs
- 'A large, perfectly matched, Lya-Ha dual narrow-band survey at z=2.23' – Co-I, INT 2013A

Observing Experience

- GMRT radio telescope, Pune, India, 5 nights
- INT 2.5 m optical telescope, Roque de los Muchachos, La Palma, 18 nights
- MDM 2.4 m Hiltner optical telescope, Tucson, AZ, USA, 7+ nights

Computing Skills

- **Operating systems:** Linux, Mac, Windows, and standard packages therein
- **Programming Languages:** R, Python, IDL, Bash, FORTRAN
- **High Performance Computing:** Torque and slurm queuing systems with MPICH, OpenMP
- **Telescope commissioning:** Experience using expert software tools to interface with data at lower level than end user
- **Data pipelining:** Written end-to-end pipelines for LOFAR data, both low band antenna data and for high-resolution imaging
- **Astronomical Software:** LOFAR software, AIPS, CASA, ParselTongue, HEASOFT, PIMMS, XSELECT, IRAF, CIAO, SHERPA, XSPEC, FTOOLS, STILTS

Teaching and Outreach

Oct 2016 – present	**Outreach Coordinator, Oxford Women in Physics**. New position in the organisation, planning two major upcoming events within the next eight months.
Sep 2013 – Aug 2016	**Supervision of MSc students**. Supervised two students to successful completion of research projects involving low frequency radio astronomy.
Jan 2015 – Jul 2015	**Teaching Assistant, Radio Astronomy MSc class**. Developed tutorials and practical project for 14 students, supervised hands-on sessions, organized and conducted field trip to Dutch radio observatories.
Oct 2012, 2014	**Public Outreach, Leiden Old Observatory**. Helped with open day for public to view the observatory, visitor's center, and participate in outreach activities.
Feb 2010 – Aug 2011	**Instructor Electronic Combat Officer**. Instructed students one-on-one and in larger classroom settings on all technical and tactical aspects of using the Passive Detection System on the E-3 AWACS.
Apr 2005	**Physics Girls' Inreach**. Developed content for and organized all logistics for public inreach targeted to 10/11 year old girls with the intent to interest them in science and show them strong female role models.
Sep 2004 - Apr 2005	**Co-Founder and Co-President, Society of Women in Physics (SWiP)**. Program focused on mentorship of younger women undergraduate students, and promoting women in STEM fields.
Jan 2003 - Apr 2005	**Angell Hall Public Viewing Nights**. Operated 0.6 meter telescope, Celestron 8 telescopes, and planetarium at Angell Hall Observatory for public viewing nights with the Student Astronomical Society.
Aug 2004 - Apr 2005	**Physics Public Outreach**. Taught multiple hour-long workshops on various physical principles with the Society of Physics Students.

Publication Record

Six first-author, three second-author, and thirteen co-author peer-reviewed publications; also eight conference proceedings. One article submitted (not listed). Total of 132 citations, h-index 7.

First Author

- **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.* Monthly Notices of the Royal Astronomical Society, 461:2676, **Sept. 2016**
- **Morabito, L.K.**, van Harten, G., Salgado, F., et al. *Exact bound-bound Gaunt factor values for quantum levels up to n = 2000.* Monthly Notices of the Royal Astronomical Society, 441:2855, **July 2014**

- **Morabito, L.K.**, Oonk, J.B.R., Salgado, F., et al. *Discovery of Carbon Radio Recombination Lines in M82.* The Astrophysical Journal Letters, 795:L33, **Nov. 2014**
- **Morabito, L.K.**, Dai, X., Leighly, K.M., Sivakoff, G.R., and Shankar, F. *Unveiling the Intrinsic X-Ray Properties of Broad Absorption Line Quasars with a Relatively Unbiased Sample.* The Astrophysical Journal, 786:58, **May 2014**, 1309.5978.
- **Morabito, L.K.** and Dai, X. *A Bayesian Monte Carlo Analysis of the M-σ Relation.* The Astrophysical Journal, 757:172, **Oct. 2012**
- **Morabito, L.K.**, Dai, X., Leighly, K.M., Sivakoff, G.R., and Shankar, F. *Suzaku Observations of Three FeLoBAL Quasi-stellar Objects: SDSS J0943+5417, J1352+4239, and J1723+5553.* The Astrophysical Journal, 737:46, **Aug. 2011**

Second Author

- Salgado, F., **Morabito, L.K.**, Oonk, J.B.R., et al. *Low Frequency Carbon Radio Recombination Lines II: The Diffuse Interstellar Medium.* The Astrophysical Journal, accepted, **Dec. 2016**
- Salgado, F., **Morabito, L.K.**, Oonk, J.B.R., et al. *Low Frequency Carbon Radio Recombination Lines I: Calculations of Departure Coefficients.* The Astrophysical Journal, accepted, **Dec. 2016**
- 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.* Advancing Astrophysics with the Square Kilometre Array (AASKA14), page 139, **Apr. 2015**

Co-author

- Sobral, D., Matthee, J., Best, P., et al. *The CALYMHA survey: Lyα luminosity function and global escape fraction of Lyα photons at $z = 2.23$.* Monthly Notices of the Royal Astronomical Society, 466:1242, **Apr. 2017**
- Shimwell, T.W., Röttgering, H.J.A., Best, P.N., et al. *The LOFAR Two-metre Sky Survey. I. Survey description and preliminary data release.* Astronomy & Astrophysics, 598:A104, **Feb. 2017**
- Salas, P., Oonk, J.B.R., van Weeren, R.J., et al. *LOFAR observations of decameter carbon radio recombination lines towards Cassiopeia A.* Monthly Notices of the Royal Astronomical Society, **Jan. 2017**
- Oonk, J.B.R., van Weeren, R.J., Salas, P., et al. *Carbon and hydrogen radio recombination lines from the cold clouds towards Cassiopeia A.* Monthly Notices of the Royal Astronomical Society, 465:1066, **Feb. 2017**
- Clarke, A.O., Heald, G., Jarrett, T., et al. *LOFAR MSSS: Discovery of a 2.56 Mpc giant radio galaxy associated with a disturbed galaxy group.* Astronomy & Astrophysics, accepted, **Feb. 2017**
- 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.* Monthly Notices of the Royal Astronomical Society, 460:2385, **Aug. 2016**
- 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.* Astronomy & Astrophysics, 593:A86, **Sept. 2016**
- Shimwell, T.W., Luckin, J., Brüggen, M., et al. *A plethora of diffuse steep spectrum radio sources in Abell 2034 revealed by LOFAR.* Monthly Notices of the Royal Astronomical Society, 459:277, **June 2016**
- Jackson, N., Tagore, A., Deller, A., et al. *LBCS: The LOFAR Long-Baseline Calibrator Survey.* Astronomy & Astrophysics, 595:A86, **Nov. 2016**
- 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.* Astronomy & Astrophysics, 574:A114, **Feb. 2015**
- Moldón, J., Deller, A.T., Wucknitz, O., et al. *The LOFAR long baseline snapshot calibrator survey.* Astronomy & Astrophysics, 574:A73, **Feb. 2015**
- Heald, G.H., Pizzo, R.F., Orrú, E., et al. *The LOFAR Multifrequency Snapshot Sky Survey (MSSS). I. Survey description and first results.* Astronomy & Astrophysics, 582:A123, **Oct. 2015**

- Oonk, J.B.R., van Weeren, R.J., Salgado, F., et al. *Discovery of carbon radio recombination lines in absorption towards Cygnus A.* Monthly Notices of the Royal Astronomical Society, 437:3506, **Feb. 2014**

Conference Proceedings

- Smith, D.J.B., Best, P.N., Duncan, K.J., et al. *The WEAVE-LOFAR Survey.* In Reylé, C., Richard, J., Cambrésy, L., et al., editors, *SF2A-2016: Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics*, pages 271–280, **Dec. 2016**
- Toribio, M.C., **Morabito, L.K.**, Oonk, J.B.R., et al. *Radio Recombination Line studies on M82 from LOFAR HBA observations.* In Ziegler, B.L., Combes, F., Dannerbauer, H., and Verdugo, M., editors, *Galaxies in 3D across the Universe*, volume 309 of IAU Symposium, pages 350–350, **Feb. 2015**
- **Morabito, L.K.**, Oonk, J.B.R., Salgado, F., et al. *Discovery of Carbon Radio Recombination Lines in M82.* In Ziegler, B.L., Combes, F., Dannerbauer, H., and Verdugo, M., editors, *Galaxies in 3D across the Universe*, volume 309 of IAU Symposium, pages 141–144, **Feb. 2015**
- **Morabito, L.K.**, Deller, A., Oonk, J.B.R., Röttgering, H., and Miley, G. *Spatially resolved studies of extragalactic jets in high redshift radio galaxies.* In Massaro, F., Cheung, C.C., Lopez, E., and Siemiginowska, A., editors, *Extragalactic Jets from Every Angle*, volume 313 of IAU Symposium, pages 231–235, **Mar. 2015**
- **Morabito**, L., Deller, A., Moldón, J., et al. *A LOFAR survey of spatially resolved Ultra Steep Spectrum sources.* In *The Many Facets of Extragalactic Radio Surveys: Towards New Scientific Challenges*, page 71, **Oct. 2015**
- Moldon, J., Deller, A., Wucknitz, O., et al. *The LOFAR long baseline snapshot calibrator survey.* In *Proceedings of the 12th European VLBI Network Symposium and Users Meeting (EVN 2014).* 7-10 October 2014. Cagliari, Italy, page 97, **Oct. 2014**
- **Morabito, L.K.**, Dai, X., Leighly, K.M., Sivakoff, G.R., and Shankar, F. *X-ray Observations of Broad Absorption Line Quasars.* In *American Astronomical Society Meeting Abstracts #219*, volume 219 of *American Astronomical Society Meeting Abstracts*, page 154.06, **Jan. 2012**
- Dai, X., **Morabito, L.K.**, Shankar, F., Sivakoff, G.R., and Leighly, K.M. *Large BALQSO Fractions Inferred from NIR and Radio Surveys: Implication to AGN and Feedback Models.* In Chartas, G., Hamann, F., and Leighly, K.M., editors, *AGN Winds in Charleston*, volume 460 of *Astronomical Society of the Pacific Conference Series*, page 120, **Aug. 2012**

Selected Scientific Presentations

Presentations on scientific results at a rate of 4 times per year, mostly in the setting of scientific conferences or seminars at internationally recognised institutions. Yearly highlights are given.

2016

- **Long Baseline Imaging (aka VLBI with LOFAR)**, LOFAR Surveys Key Science Project Meeting, *Bologna, IT*
- **Radio Galaxies at Low Frequencies: high spatial and spectral resolution studies with LOFAR**, General Astronomy Colloquim, *University of Leiden, NL*
- **High Resolution Studies of 4C 43.15 with International LOFAR**, LOFAR Community Science Workshop, *Zandvoort aan Zee, NL*

2015

- **Low-frequency Views on the Cold Neutral Medium and High Redshift Radio Galaxies**, Galaxy Evolution Seminar, *University of Oxford, UK*
- **LOFAR Survey of Spatially Resolved Ultra-Steep Spectrum Sources**, The Many Facets of Extragalactic Radio Surveys, *Bologna, IT*

- **Carbon Radio Recombination Lines in M82 with P-Band**, Lunch Talk, *National Radio Astronomy Observatory, New Mexico, USA*
- **Spatially Resolved Studies of High-z Radio Galaxies at 60 MHz**, NL/SA Radio Continuum Science Meeting, *University of Cape Town, SA*

2014

- **Spatially Resolved Studies of (Extragalactic Jets in) High-z Radio Galaxies at Low Frequencies**, IAU 313: Extragalactic Jets from Every Angle, *Galapagos, EC*
- **Discovery of Carbon Radio Recombination Lines in M82**
  - IAU 309: Galaxies in 3D, *University of Vienna, AT*
  - LOFAR Community Science Workshop, *Amsterdam, NL*

2013

- **LOFAR: Radio Recombination Lines and High Redshift Radio Galaxies**, Invited Seminar, *University of Oklahoma, USA*
- **Recombination Line Studies with LOFAR**, The Radio Universe at Ger's (wave)-length, *University of Groningen, NL*
- **High Redshift Radio Galaxies and the Advent of LOFAR**, Google Tech Talk, *Google office, Munich, DE*
- **Radio Recombination Lines and Long Baselines on 4C 41.17**, Astronomy, Radio Sources and Society, *Leiden, NL*
- **HBA Tied-Array Observations of Radio Recombination Lines**, LOFAR Status Meeting, *ASTRON, NL*
- **Radio Spectroscopy with LOFAR**, LOFAR Science Community Workshop, *Dalfsen, NL*

2012

- **Ammonia in NGC 6946**, Lunch Talk, *National Radio Astronomy Observatory, New Mexico, USA*
- **Active Galactic Nuclei: from Supermassive Black Holes to Rare FeLoBALs**, Invited Lunch Talk, *National Radio Astronomy Observatory, New Mexico, USA*
- **X-ray Observations of Broad Absorption Line Quasars**
  - Cosmology Seminar, *University of Oxford*
  - Cosmology Seminar, *Max Planck Institut für Astronomie*