Curriculum Vitae: Geraint Harker

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Education:

- **University of Durham**

  Sept. 2003 – Nov. 2006: Doctor of Philosophy in Astrophysics, supervised by Prof. Shaun Cole. Thesis title: "Connecting galaxy formation and galaxy clustering".

- **Fitzwilliam College, Cambridge**

  Sept. 2002 – June 2003: Certificate of Advanced Study in Mathematics (Part III of the Mathematical Tripos) Passed.

  Sept. 1999 – June 2002: Bachelor of Arts Honours Degree in Mathematics

  - Part II: Upper second class.
  - Part Ib: First class.
  - Part Ia: First class.

  2000 – 2002: College scholarship

  2001: Stumbles Prize in Mathematics.

  2000: College Prize for examination results.

- **Queen Elizabeth Grammar School, Wakefield**

  Sept. 1997 – June 1999: A-levels: Mathematics, Further Mathematics, Physics, Chemistry, General Studies (all grade A)

  Sept. 1995 – June 1997: Nine GCSEs (8 A*, 1 A)

Employment:

- Marie Curie Fellow, University College London (Mar. 2014 – Feb. 2016)
- Center for Astrophysics and Space Astronomy, University of Colorado at Boulder (Oct. 2009 – Feb. 2014): postdoctoral research associate in the Lunar University Network for Astrophysics Research (LUNAR), part of the NASA Lunar Science Institute (NLSI).

- Kapteyn Astronomical Institute, University of Groningen, the Netherlands (Nov. 2006 – Oct. 2009): postdoctoral research associate as part of the LOFAR Epoch of Reionization key science project.

Publications (first-author in bold):

- 'Simulating the 21cm forest detectable with LOFAR and SKA in the spectra of high-z GRBs'; Ciardi B. et al., 2015, MNRAS, 453, 101
- 'Polarization leakage in Epoch of Reionization windows: I. LOFAR observations of the 3C196 field'; Asad K. M. B. et al., 2015, MNRAS, 451, 3709
- **'Selection between foreground models for global 21-cm experiments'; Harker G., 2015, MNRAS Letters, 449, L21–L25**
- 'Lunar occultation of the diffuse radio sky: LOFAR measurements between 35 and 80 MHz'; Vedantham H. K. et al., 2015, MNRAS, 450, 2291
- 'Cosmic Dawn and Epoch of Reionization Foreground Removal with the SKA'; Chapman E., Bonaldi A., Harker G., Jelić V., Abdalla F. B., Bernardi G., Bobin J., Dulwich F., Mort, B., Santos M. & Starck, J.-L., SKA Science Book, 2015 (arXiv:1501.04429)
- 'Effects of the ionosphere on ground-based detection of the global 21-cm signal from the Cosmic Dawn and the Dark Ages'; Datta A., Bradley R., Burns J. O., Harker G. J. A., Komjathy A. & Lazio T. J. W., ApJ, submitted (arXiv:1409.0513)
- 'Initial LOFAR observations of Epoch of Reionization windows: II. Diffuse polarized emission in the ELAIS-N1 field'; Jelić V. et al., 2014, A&A, 568, id.A101
- 'Constraining the epoch of reionization with the variance statistic: simulations of the LOFAR case'; Patil A. et al., 2014, MNRAS, 443, 1113
- 'Interpreting the Global 21-cm Signal from High Redshifts. I. Model Independent Constraints'; Mirocha J., Harker G. J. A. & Burns J. O., 2013, ApJ, 777, 118
- 'The brightness and spatial distribution of terrestrial radio sources'; Offringa A. R. et al., 2013, MNRAS, 435, 584
- 'Probing reionization with LOFAR using 21-cm redshift space distortions'; Jensen H. et al., 2013, MNRAS, 435, 460
- 'LOFAR insights into the epoch of reionization from the cross-power spectrum of 21 cm emission and galaxies'; Wiersma R. P. C. et al., 2013, MNRAS, 432, 2615
- 'The Scale of the Problem: Recovering Images of Reionization with GMCA'; Chapman E., Abdalla F. B., Bobin J., Starck J.-L., Harker G., Jelić V., Labropoulos P., Zaroubi S., Brentjens M. A., de Bruyn A. G. & Koopmans L. V. E., 2013, MNRAS, 429, 165
- 'Initial deep LOFAR observations of Epoch of Reionization windows: I. The North Celestial Pole'; Yatawatta S. et al., 2013, A&A, 550, id.A136
- 'Prospects for detecting the 21 cm forest from the diffuse intergalactic medium with LOFAR'; Ciardi B. et al., 2013, MNRAS, 428, 1755
- 'The LOFAR radio environment'; Offringa A. R. et al., 2013, A&A, 549, id.A11

- 'Imaging neutral hydrogen on large scales during the Epoch of Reionization with LOFAR'; Zaroubi S., de Bruyn A. G., Harker G. et al., 2012, MNRAS, 425, 1964

- 'Foreground Removal using FastICA: A Showcase of LOFAR-EoR'; Chapman E., Abdalla F. B., Harker G., Jelić V., Labropoulos P., Zaroubi S., Brentjens M. A., de Bruyn A. G. & Koopmans L. V. E., 2012, MNRAS, 423, 2518

- 'Probing the First Stars and Black Holes in the Early Universe with the Dark Ages Radio Explorer (DARE)'; Burns J. O., Lazio T. J. W., Bale S. D., Bowman J. D., Bradley R. F., Carilli C. L., Furlanetto S. R., Harker G. J. A., Loeb A. & Pritchard J. R., 2012, Adv. Space Res., 49, 433

- **'An MCMC approach to extracting the global 21-cm signal during the cosmic dawn from sky-averaged radio observations'; Harker G. J. A., Pritchard J. R., Burns J. O. & Bowman J. D., 2012, MNRAS, 419, 1070**

- 'Foregrounds of observations of the cosmological 21 cm line. II. Westerbork observations of the fields around 3C196 and the North Celestial Pole'; Bernardi G., Harker G., de Bruyn A. G., Brentjens M. A., Ciardi B., Jelić V., Koopmans L. V. E., Labropoulos P., Offringa A., Pandey V. N., Schaye J., Thomas R. M., Yatawatta S. & Zaroubi S., 2010, A&A, 522, id.A67

- **'Power spectrum extraction for redshifted 21-cm epoch of reionization experiments: the LOFAR case'; Harker G., Zaroubi S., Bernardi G., Brentjens M. A., de Bruyn A. G., Ciardi B., Jelić V., Koopmans L. V. E., Labropoulos P., Mellema G., Offringa A., Pandey V. N., Pawlik A. H., Schaye J., Thomas R. M. & Yatawatta S., 2010, MNRAS, 405, 2492**

- **'Non-parametric foreground subtraction for 21cm epoch of reionization experiments'; Harker G., Zaroubi S., Bernardi G., Brentjens M. A., de Bruyn A. G., Ciardi B., Jelić V., Koopmans L. V. E., Labropoulos P., Mellema G., Offringa A., Pandey V. N., Schaye J., Thomas R. M. & Yatawatta S., 2009, MNRAS, 397, 1138**

- 'Foregrounds of observations of the cosmological 21 cm line. I. First Westerbork measurements of Galactic emission at 150 MHz at a low latitude field'; Bernardi G., de Bruyn A. G., Brentjens M. A., Ciardi B., Harker G., Jelić V., Koopmans L. V. E., Labropoulos P., Offringa A., Pandey V. N., Schaye J., Thomas R. M., Yatawatta S. & Zaroubi S., 2009, A&A, 500, 965

- **'Detection and extraction of signals from the epoch of reionization using higher order one-point statistics'; Harker G., Zaroubi S., Thomas R. M., Jelić V., Labropoulos P., Mellema G., Iliev I., 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., 2008, MNRAS, 393, 1449**

- 'The LOFAR EoR Data Model: (I) Effects of Noise and Instrumental Corruptions on the 21-cm Reionization Signal-Extraction Strategy'; Labropoulos P., Koopmans L. V. E., Jelić V., Yatawatta S., Thomas R. M., Bernardi G., Brentjens M. A., de Bruyn A. G., Ciardi B., Harker G., Offringa A., Pandey V. N., Schaye J. & Zaroubi S., 2009, arXiv:0901.3359

- 'Fast, large-scale reionization simulations'; Thomas R. M., Zaroubi S., Ciardi B., Pawlik A. H., Labropoulos P., Jelić V., Bernardi G., Brentjens M. A., de Bruyn A. G.,

Harker G., Koopmans L. V. E., Mellema G., Pandey V. N., Schaye J. & Yatawatta S., 2009, MNRAS, 393, 32

- 'Foreground simulations for the LOFAR-epoch of reionization experiment'; Jelić V., Zaroubi S., Labropoulos P., Thomas R. M., Bernardi G., Brentjens M. A., de Bruyn A. G., Ciardi B., Harker G., Koopmans L. V. E., Pandey V. N., Schaye J. & Yatawatta S., 2008, MNRAS, 389, 1319
- **'Constraints on σ_8 from galaxy clustering in N-body simulations and semi-analytic models'; Harker G., Cole S. & Jenkins A., 2007, MNRAS, 382, 1503**
- **'A marked correlation function analysis of halo formation times in the Millennium Simulation'; Harker G., Cole S., Helly J., Frenk C. S. & Jenkins A., 2006, MNRAS, 367, 1039**

Major proposals:

- Co-Investigator on the Dark Ages Radio Explorer:
  - Proposed to NASA 'Explorer 2011' AO; US FY 2011 $143.907m
  - Proposed to NASA 'Small Explorer 2014' AO; US FY 2015 $184.1m

Invited talks:

- 'Data analysis and foreground removal algorithms for *DARE* and its prototypes', Jan. 2014, USNC-URSI National Radio Science Meeting, Boulder, Colorado.
- 'Foreground removal for 21-cm experiments', May 2011, conference on 'Understanding Galactic and extragalactic foregrounds: A road to success for cosmological experiments', Zadar, Croatia.

Contributed talks:

- 'What can we really learn from global 21-cm observations of the Cosmic Dawn?', July 2015, RAS National Astronomy Meeting, Llandudno, Wales.
- 'Signal and foreground inference for global 21-cm observations', May 2015, Olympian Symposium on Cosmology and the Epoch of Reionization, Greece.
- 'Telerobotic exploration and radio astrophysics from the far side of the Moon', May 2014, European Lunar Symposium, London.
- 'Watching the Cosmic Dawn from the Moon: How and Why', 2013 Lunar Science Virtual Forum.
- 'Signal extraction for sky-averaged 21-cm experiments', Jan. 2012, 219th AAS meeting, Austin, Texas.
- 'Signal extraction for sky-averaged 21-cm experiments', Jan. 2012, USNC-URSI National Radio Science Meeting, Boulder, Colorado.

- ‘Modelling the foregrounds and the system response for DARE’, Oct. 2010, workshop on ‘Robotic Science from the Moon’, Boulder, Colorado.
- ‘Extracting information about high-redshift cosmology from a lunar-orbiting dipole’, July 2010, NLSI Lunar Science Forum, NASA Ames Research Center, California.
- ‘Foreground removal’, June 2010, Aspen Center for Physics summer workshop on ‘Astrophysics and Cosmology with the 21cm background’, Aspen, Colorado.
- ‘Update on power spectra’, Apr. 2010, LOFAR EoR plenary meeting, Groningen, the Netherlands.
- ‘Extracting a signal from the epoch of reionization with LOFAR’, June 2009, colloquium in Boulder, Colorado.
- ‘Progress on power spectrum extraction’, May 2009, LOFAR EoR plenary meeting, Groningen, the Netherlands.
- ‘Extracting the 21cm power spectrum from the epoch of reionization’, Mar. 2009, conference on ‘Cosmic Evolution of Hydrogen and Helium’, Ringberg Castle, Germany.
- ‘Non-parametric foreground fitting’, Nov. 2008, LOFAR EoR plenary meeting, Dwingeloo, the Netherlands.
- ‘EoR signal extraction using skewness’, Sep. 2008, ‘Astrophysics with E-LOFAR’ workshop, Hamburg, Germany.
- ‘Signal extraction through higher-order statistics’, Apr. 2008, LOFAR EoR plenary meeting, Groningen, the Netherlands.
- ‘Redshift space distortions during the epoch of reionization’, Oct. 2007, LOFAR EoR plenary meeting, Groningen, the Netherlands.
- ‘Marked cross-correlation functions and merger trees’. Nov. 2005, Virgo Consortium meeting, Durham University, UK.
- ‘Environmental dependence of halo formation times’. Apr. 2005, Virgo Consortium meeting, MPA, Garching, Germany.

Presented posters:

- ‘Global 21-cm signal modelling and foreground separation’. Aug. 2015, IAU General Assembly, Honolulu, Hawaii.
- ‘Global 21-cm signal modelling and foreground separation’. July 2015, ‘Accurate Astrophysics. Correct Cosmology’, London.
- ‘Inferring the properties of the first stars and galaxies from a radiometer in lunar orbit’. May 2014, European Lunar Symposium, London.
- ‘Seeing the cosmic dawn from lunar orbit with the sky-averaged 21-cm signal’. Sep. 2013, ‘Galaxy Evolution Over Five Decades’, Cambridge, UK.
- ‘A flexible, Monte Carlo approach to modeling data from DARE and its ground-based prototype’. July 2012, NLSI Lunar Science Forum, NASA Ames Research Center, California.

- 'MCMC signal extraction for 21-cm global signal experiments'. June 2012, 220th AAS meeting, Anchorage, Alaska.
- 'Searching for the one in a million: extracting the cosmic signal from Dark Ages Radio Explorer data'. July 2011, NLSI Lunar Science Forum, NASA Ames Research Center, California.
- 'Power spectrum extraction for the LOFAR EoR experiment, with applications to a future lunar array'. Feb. 2010, Aspen Winter Conference on Astrophysics, 'The High Redshift Universe: A Multi-Wavelength View', Aspen, Colorado.
- 'Statistics for signal extraction from the Epoch of Reionization'. July 2008, XXIVth IAP Colloquium, 'Light from the Young Universe', Paris, France.
- 'Cosmological constraints from models of galaxy clustering'. Apr. 2006, National Astronomy Meeting 2006, Leicester University, UK.
- 'The Millennium Simulation'. July 2005, part of 'Cosmic cookery: growing galaxies in a computer' at the Royal Society Summer Science Exhibition 2005, London, UK.
- 'Halo Formation and Environment in the Millennium Simulation'. Apr. 2005, National Astronomy Meeting 2005, Birmingham University, UK.

Service to the community:

- Scientific organising committee member:
  - May 2011, conference on 'Understanding Galactic and extragalactic foregrounds: A road to success for cosmological experiments', Zadar, Croatia.
  - July 2011, NLSI Lunar Science Forum, NASA Ames Research Center, California.
- Refereed five papers for MNRAS, four for ApJ.
- Provided two ad hoc reviews for an NSF review panel on the science of the Epoch of Reionization.

Other Academic Experience:

- 2014 – 2015: Problem-solving tutorials for PHAS2246 and PHAS1246
- Mar. 2012: Guest lecture on Markov Chain Monte Carlo techniques for class ASTR5550 (Observations, Data Analysis & Statistics).
- Jan. – May 2012: Instructor for graduate seminar class 'ASTR-6000: The High Redshift Universe'.
- June 2007: Attended the 'Summer School in Statistics for Astronomers III' at Penn State University, USA.
- 2003 – 2005: Marking first- and second-year undergraduate weekly physics problems.
- July – Sept. 2002: Summer project on computational fluid dynamics at the BP Institute for Multiphase Flow, Cambridge, supervised by Prof. Andy Woods.

Other activities:

- Numerous internal talks and seminars.
- Organizing the LUNAR seminar series for the 2010/11, 2011/12 and 2012/13 academic years; delivered a LUNAR webinar in March 2012.
- Wednesday lunchtime talk organiser at the Kapteyn Institute.
- Keen bridge player and teacher; captained the Great Britain team at the 2006 World University Bridge Championships in Tianjin, China.
- Administered the Durham astronomy social email list and organised some associated activities.

References:

Prof. Saleem Zaroubi	Prof. Shaun Cole	Prof. Jack Burns
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