Section A: Overview of the Research Project

1. **Title of the research project:**
A deep investigation of HI and galaxy evolution in and around the galaxy cluster A2626

2. Broad area of research:
Science (gas and galaxy evolution across cosmic environments)

3. Academic level of research project:
Doctoral

4. Abstract of research:
The aim of this research will be to investigate the effects of different cosmic environments on the evolution of galaxies in and around the galaxy cluster Abell 2626 (z=0.055) using existing, science-ready HI data from MeerKAT. This project will build on initial investigations of the central region of the cluster by Healy et al.,(2021) and Deb et al., (2023) using more recent follow-up MeerKAT observations at higher spectral resolution of a much wider area, going out to ~3 times the virial radius of the cluster. This will enable detailed studies of the processes influencing galaxy evolution from infall to cluster membership. HI data, optical imaging and optical spectroscopy is already in hand and further spectroscopic measurements are currently in progress to map the cluster region out to larger radii. The study will focus on how the HI and other properties of galaxies change as a function of their smaller-scale vs. larger scale environments as a means to probe the various physical processes taking place to drive galaxy evolution in the cluster.

5. Primary supervisor's details:

a. **Full name of primary supervisor:** Assoc. Prof. Sarah Blyth
b. **Email address:** sarah.blyth@uct.ac.za
c. **University:** University of Cape Town

First Co-supervisor's details:
d. **Full name of co-supervisor:** Dr Julia Healy
e. **Email address:** julia.healy@manchester.ac.uk
f. **University:** University of Manchester/University of Cape Town

Second Co-supervisor's details:
g. **Full name of co-supervisor:** Prof. Marc A.W. Verheijen
h. **Email address:** verheyen@astro.rug.nl
i. **University:** University of Groningen

Section B: Details of Research Project

1. Scientific merit:

Galaxy evolution is a key research area in extragalactic astrophysics. A key driver of galaxy evolution is the environment in which a galaxy is located. Dense environments like galaxy groups or galaxy clusters have been found to influence galaxy properties (e.g. Dressler, 1980) due to the various physical interactions and processes that can take place between galaxies due to their gravitational influences on each other, as well as interactions between galaxies and the intra-group or intra-cluster medium. These various different processes can impact a galaxy's morphology, star formation properties, gas content, etc. Since the neutral hydrogen gas content of galaxies typically makes up a significant fraction of the overall baryonic mass of galaxies, as well as the fact that it usually extends further out spatially than the stellar component, it is a very useful tracer of different types of interaction. Therefore studying the HI content, spatial, and kinematic distributions of galaxies in galaxy clusters can provide important insights on environmentally-driven galaxy evolution processes.

Abell 2626 (A2626) is a relatively nearby (z=0.055), moderately massive (M_{halo} ~ $5x10^{14}$ $M_{\odot}$) galaxy cluster embedded in a large scale structure wall with a cosmic web filament behind the wall. A study by Healy et al. (2021) using optical spectroscopy of the cluster has also revealed several sub-structures within the larger cluster environment. Together its large scale structure location and sub-structure make it an ideal target for studying galaxy evolution processes. Furthermore, pilot 4k HI observations of the cluster with MeerKAT (Healy et al., 2021) indicated high numbers of HI detections in the cluster and initial HI stacking results indicated a radial dependence of HI deficiency, i.e. galaxies closer to the centre of the cluster are more gas-deficient than galaxies closer to the outskirts. More recently, further MeerKAT HI data have been gathered which cover the cluster area out to ~3 times the virial radius. This complements other cluster studies, which are usually limited to the core of the cluster or are biased toward particular selected regions in the outskirts.

The aims of this project will be to investigate environmentally-driven galaxy evolution processes in A2626 using the in-hand wider area MeerKAT data combined with other existing ancillary data including optical imaging and optical spectroscopy. The extensive spatial coverage of the cluster out to ~3 times the virial radius will enable detailed studies of galaxies in the different regions of the cluster from the outskirts/infall regions right to the centre, providing insight into the different processes and the timescales that influence galaxy evolution. The large number of spatially resolved HI detections will also enable a study of kinematic asymmetries compared to morphological asymmetries as well as enabling a study of the resolved kinematics of galaxies in different regions of the cluster and larger scale environment. Comparisons of HI content and radio continuum properties will allow the investigation of gas content compared to star formation properties of the cluster galaxies.

Relevance to SARAO research priority areas for 2027:

This project falls under the **highest priority area: existing data from MeerKAT** for science as listed in the application guide. The project will utilise science-ready data which is already in hand from the observed MeerKAT Open Time projects SCI-20210212-TD-01 and SCI-20230907-TD.

2. Feasibility:

Data availability and analysis techniques:

The project will use our in-hand MeerKAT HI observations of A2626. The HI data have already been processed by co-supervisor J. Healy into a mosaic which covers the cluster out to more than 3 times its virial radius, enabling the study of galaxies which are still falling into the cluster, galaxies which have already passed through the cluster environment (so-called back-splash galaxies), as well as cluster members. Publicly available optical imaging and photometry of the cluster galaxies also exists as well as a very complete optical spectroscopic catalog of the central cluster region. A2626 is a pilot target for the WEAVE Wide-field Cluster Survey, a spectroscopic survey with the William Herschel Telescope, and observations of the cluster's outer regions are 100% complete, to match the radio data coverage, and will be available to be used for the project.

Various data analysis techniques will be required, from cross-matching multi-wavelength catalogues, to detailed analysis of HI galaxy data and measurement of galaxy properties including both radio continuum and HI. Depending on achieved progress, kinematic modelling of extended sources may also be performed.

Skills development:

During the project, the student will learn various detailed aspects of HI and multi-wavelength data analysis. The student will be involved in direct data handling and will also learn about radio continuum data analysis. The student is expected to follow courses and workshops on career advancement, professional development, scientific integrity and project management.

Resources and equipment:

As a UCT student, the student will have access to the IDIA/ilifu cloud computing facilities where the A2626 HI data are stored and will be processed and analysed. Being at UCT will enable the student to interact with IDIA researchers and technical experts who will be able to help support the computing aspects. As a student in the Department of Astronomy, the student will also have access to the usual desk and office space, internet access and library access afforded to all postgraduate students. The collaborating co-supervisors will also play important roles in co-supervision and training and it would be expected that the student spend some time in Europe to work directly with the co-supervisors as well.

High level breakdown of activities:

- Perform literature review on related HI studies and methods (2027)
- Characterize the HI properties of all HI detected galaxies out to 3Rvir such as atomic gas masses, HI morphologies, HI deficiencies, asymmetries and kinematics. This will involve refining existing methodologies and calibrations of scaling relations. (2027)

- Analyse the HI properties as a function of location within the smaller scale and larger scale environments of A2626 to investigate the importance of pre-processing in cosmic filaments and galaxy groups prior to cluster infall. This will take advantage of the environmental analysis provided by the WEAVE team in which the supervisors are participating as external collaborators.(2027-2028)
- The student will use the radio continuum map to estimate star formation rates and AGN activities to investigate the efficiency of star formation quenching in different cosmic environments. This will be compared to other tracers of star formation activity inferred from spectroscopy and H-alpha imaging. (2028-2029)
- These analyses are expected to form the basis of 3 publications. (late 2027- early 2029)
- Write up thesis (2029)

3. Skills/experience useful to the student on this project:

Good python programming skills will be needed and experience in analyzing and working with HI data cubes will be an advantage. Excellent writing skills, project management, communication skills and time management are essential. However, the student will learn these skills on the project if they have not yet had this experience.

Curriculum Vitae : SARAH-LOUISE BLYTH

Contact Information

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Department of Astronomy
University of Cape Town
Rondebosch, Cape Town, 7701, South Africa

Tel: +27 21 650 5372
Cell: +27 78 541 2969
E-mail: sarah.blyth@uct.ac.za

Research Interests

Galaxy evolution, radio astronomy (H I), large scale structure, Physics/Astronomy education

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Education

Ph.D. in High Energy Nuclear Physics, University of Cape Town, South Africa (2007)

(Hosted at Lawrence Berkeley National Laboratory, California, USA)
Thesis title: "Using the ϕ-meson to probe the medium created in Au+Au collisions at RHIC"

M.Sc. (*with distinction*) in High Energy Nuclear Physics, University of Cape Town, South Africa (2004)
(Hosted at Lawrence Berkeley National Laboratory, California, USA)
Thesis title: "Jet Study in Ultra-Relativistic Heavy-Ion Collisions with the ALICE Detector at the LHC"

BSc. (Hons) in Theoretical Physics, University of Cape Town, South Africa (1999)

BSc. in Physics and Astrophysics (*with distinction in Physics & the degree*), University of Cape Town, South Africa (1998)

Awards & Leadership Positions

– Head of Department of Astronomy, University of Cape Town
– Co-Director National Astrophysics and Space Science Programme (NASSP), UCT-node (2018 - 2021) and (mid-2023 - 2025)
– Co-Chair of SKA HI Science Working Group (2018 - 2021, international invited position)
– Co-PI of LADUMA survey on MeerKAT (2009 - present)
– Chair of SARAO Users' Committee (2021 - 2023, member since 2018, national invited position)
– Member of the Pathfinder HI Coordination Committee (PHISCC) (2010 - present)
– Member of the Inter-University Institute for Data Intensive Astronomy (IDIA) Management Committee (2018 - 2021, and 2023 - present, invited University position)
– NRF C2 rating
– RHIC & AGS Thesis award for an outstanding thesis related to research conducted at the RHIC or AGS complex (2008)
– NRF Innovation Postdoctoral Fellowship (2008)
– Junior Representative on STAR Experiment Council (2006-2007)

Academic Experience

University of Cape Town, Cape Town, South Africa
(2024 -) Head of Department of Astronomy, University of Cape Town
(Jul 2023 - Dec 2023) Acting Head of Department of Astronomy, University of Cape Town
(2020 -) Associate Professor, Department of Astronomy, University of Cape Town
(2017 - July 2023) Deputy Head of Department
(2018 - 2021) & (mid-2023 - 2025) Co-Director National Astrophysics and Space Science Programme -

UCT node
(2016 - 2020) Senior Lecturer
(2009 - 2015) Lecturer
(2008) NRF Innovation Postdoctoral Fellow in Astronomy
(mid-end 2007) Postdoctoral Fellow in Astronomy (departmentally funded)

Lawrence Berkeley National Laboratory, Berkeley, California, USA
(2005 - 2006) Visiting Scholar (during PhD work)

Other Work Experience

(Aug 2001 - Dec 2002) *Management Consultant*, Pyxis Capital Management
(Mar 2000 - Jun 2001) *Business Analyst*, MarchFIRST

Absences

Maternity leave (October 2009 - January 2010)
Maternity leave (June 2012 - October 2012)

Supervision

Doctoral

Munira Hoosain, *co-supervised* (2021 -) (SARAO-funded)
Nadine Hank, *co-supervised* (2021 -) (University of Groningen)
Nazir Makda, *co-supervised* (2019 -) (SAAO Prize funding)
Gerald Balekaki, *co-supervised*, (Computer science) graduated 2024
Tshiamiso Makwela, *co-supervised*, graduated 2022
Narges Hatamkhani, *co-supervised*, graduated 2022
Julia Healy, *co-supervised*, graduated 2021 (SARAO-funded, Joint UCT/University of Groningen)
Jamie Bok, *co-supervised*, (Upgraded from MSc.) graduated 2021
Tom Mutabazi, *supervised*, (upgraded from MSc.), graduated June 2015, (SKA-funded)

Masters

Damien Matthew (SARAO-funded), (Jan 2025 -)
Lara Featherstone (SARAO-funded), (Jan 2024 -)
Tilman Oelgeschläger, *co-supervised*, (graduated 2025)
Munira Hoosain, *co-supervised*, (graduated 2022)
Nadine Hank (SARAO-funded), *supervised*, (graduated 2021)
Nazir Makda, *co-supervised*, (graduated 2020)
Julia Healy (SKA-funded), *supervised*, (graduated June 2017)
Scott Badenhorst, *co-supervised*, (graduated June 2015)
Christopher Schollar, *supervised*, (graduated June 2015)
Riona Ramraj, *co-supervised*, (graduated 2014)
Zara-Nomena Randriamanakoto, *co-supervised*, (graduated 2010)

Honours

1 Astronomy Hons student (Nadine Hank, 2017)
7 (previous) jointly supervised Computer Science Hons students

Postdoctoral

Abhisek Mohapatra, Postdoctoral Fellow on SARAO-UCT group grant (Jan 2024 -)
Jacinta Delhaize, SKA Postdoctoral Fellow (Aug 2018 - Jan 2022)
Natasha Maddox, SKA Postdoctoral Fellow (Aug 2011 - Jul 2014)

Successful Funding Proposals

Research funding

- NRF Competitive Support for Rated Researchers, R 792 800 (2021)
- UCT URC Travel Grant, R 14k (2018)
- NWO / NRF Cooperation Programme for HI Surveys (*SA PI*), R450k (*+ €15k p.a. NL*) (2017-2019)
- NRF Incentive funding, R40k p.a. (2016 - 2018)
- NWO / NRF Cooperation Programme for HI Surveys (*SA PI*), R450k (*+ €15k p.a. NL*) (2013-2016)
- NRF Multi-Wavelength Astronomy Research Programme, R127k (2015)
- URC Visiting Scholars Fund, R23k (2015)
- NRF Competitive Support for Unrated Researchers, R341k (2015-2017)
- UCT URC Travel Grant, R26k (2014)
- SKA-SA Mobility Grant, R10k (2014)

Teaching funding

- SARAO Block Grant, R720k (2024), *(undergraduate student bursaries)*
- SARAO Block Grant, R692k (2023), *(undergraduate student bursaries)*
- SARAO Block Grant, R774k (2020), *(undergraduate student bursaries)*
- SARAO Block Grant, R725k (2019), *(undergraduate student bursaries)*

Meeting Organisation

SOC, "IAU Symposium 392: Neutral Hydrogen in and around Galaxies in the SKA Era", Cape Town, South Africa, August 2024
SOC, "2023 PHISCC Workshop, HI Surveys in full swing", Cape Town, South Africa, March 2023
SOC, "A Precursor View of the SKA Sky", SKA Observatory Virtual Conference, March 2021
SOC, "2020 PHISCC Workshop", to be held in Cagliari, Italy May 2020, postponed due to Covid-19
SOC, "SKA General Science Meeting and Key Science Workshop 2019", Manchester, UK, April 2019
SOC, "SKA/SARAO Bursary Conference", Cape Town, South Africa, 2016, '17, '18, '19, '20, '21, '22, '23
LOC + SOC, "2016 PHISCC Workshop: Upgrading our HI Toolkit", Cape Town, South Africa, February 2016
LOC (Lead), Fourth LADUMA Team Meeting, Cape Town, South Africa, February 2016
SOC, "2015 PHISCC Workshop: HI Surveys Get Real, Rutgers", NJ, USA, March 2015
SOC, "Life-cycle of gas in galaxies: A local perspective" meeting, ASTRON, NL, August 2015
LOC + SOC, "5th Pathfinder HI Science Coordination Committee (PHISCC) Workshop", Cape Town, South Africa, January 2012
LOC (Lead), First LADUMA Team Meeting, Cape Town, South Africa, January 2012

Recent Conference Talks

A Scientific and Technical Update on the LADUMA Deep HI Survey, joint talk at 15th workshop of the Pathfinder HI Survey Coordination Committee (PHISCC), Cagliari, Italy, September 2025

HI in Galaxies from MeerKAT to SKA, contributed talk at 2025 SKAO General Science Meeting, A new era in astrophysics: Preparing for early science with the SKAO, Gorlitz, Germany, June 2025

Recent results from LADUMA, contributed talk at MeerKAT@5 Conference, Stellenbosch, February, 2024

LADUMA: Looking At the Distant Universe with the MeerKAT Array, talk presented at PHISCC: HI Surveys in Full Swing, Cape Town, March 2023

Probing Galaxy Merger Activity Via HI Asymmetries, short talk at MIAPP 2-week residential invited

meeting on *Galaxy Evolution in a New Era of HI Surveys*, Garching, Germany, August 2019

Future high redshift observations of HI kinematics, invited talk at the Focus Meeting on Galactic Angular Momentum, IAU General Assembly, Vienna, August 2018

Recent Public Talks

The Science of Galaxies with MeerKAT, UCT Summer School lecture (2023)

Looking at Galaxies with Radio Eyes, talk to Grades 3-6 learners at International School of Cape Town, Cape Town (2023)

From the Dark Side of the Moon to Black Holes, UCT Summer School lecture (2020)

Looking at Galaxies with Radio Eyes, lecture to Astronomical Society of Southern Africa (2019)

The Solar System, talk to Grades 4-7 learners at Forres Preparatory School, Cape Town (2019)

LADUMA: Looking at the Distant Universe with the MeerKAT Array, lecture at ASSA Symposium (2018)

From MeerKAT to the SKA, lecture to Friends of the Hout Bay Museum (2018)

Publications

Astronomy & Astronomy Education:
First author means highest contribution and primary author. For student papers, the student is typically listed first and the supervisors directly afterwards.

Ultra-diffuse galaxy analogues in the Subaru Hyper-Suprime Cam Wide-Field Clusters, N.A. Makda, S.L. Blyth, R.E. Skelton, MNRAS, Volume 544, Issue 4, pp. 3824-3845 (2025)

HI asymmetries in spatially resolved SIMBA galaxies, Nadine. A.N. Hank, Marc A.W. Verheijen, Sarah-L. Blyth, et al., MNRAS, Volume 540, Issue 4, pp. 3047-3068 (2025)

Looking at the Distant Universe with the MeerKAT Array: The H I Mass Function in the Local Universe, A. Kazemi-Moridani, et al., ApJ, Volume 981, Issue 2 (2025)

WALLABY Pilot Survey and ASymba: Comparing HI Detection Asymmetries to the SIMBA Simulation, Mathieu Perron-Cormier, et al., AJ, Volume 169, Issue 2 (2025)

The K_s-band luminosity function of the rich cluster VC04 in the Vela supercluster, N. Hatamkhani, R.C. Kraan-Korteweg, S.-L. Blyth, R.E. Skelton, ApJ, Volume 972 (2024)

MHONGOOSE: A MeerKAT nearby galaxy H I survey, W.J.G. de Blok, et al., A&A Volume 688, A109 (2024)

The effect of cosmic web filaments on galaxy properties in the RESOLVE and ECO surveys, M. Hoosain, S-L. Blyth, R.E. Skelton, S.J. Kannappan, D.V. Stark, K.D. Eckert, Z.L. Hutchens, D.S. Carr, K. Kraljic, MNRAS, Volume 528, Issue 3, pp.4139-4159 (2024)

Measuring galaxy asymmetries in 3D, N. Deg, M. Perron-Cormier, K. Spekkens, M. Glowacki, S.-L. Blyth, N. Hank, MNRAS, Volume 523, Issue 3, pp.4340-4352 (2023)

Galaxy clusters in the Vela Supercluster - I: Deep NIR Catalogues, N. Hatamkhani, R.C. Kraan-Korteweg, S.L. Blyth, K. Said, A. Elagali, MNRAS, Volume 522, Issue 2, pp.2223-2240 (2023)

ASymba: H I global profile asymmetries in the SIMBA simulation, M. Glowacki, N. Deg, S.-L. Blyth, N. Hank, R. Davé, E. Elson, K. Spekkens, MNRAS, Volume 517, Issue 1, pp.1282-1298 (2022)

Looking at the Distant Universe with the MeerKAT Array: Discovery of a Luminous OH Megamaser at $z > 0.5$, M. Glowacki, J. Collier, A. Kazemi-Moridani, et al., ApJ, Volume 931, Issue 1, id.L7 (2022)

MeerKAT 21-cm HI imaging of Abell 2626 and beyond, J. Healy, T. Deb, M.A.W. Verheijen, S.-L. Blyth, P. Serra, M. Ramatsoku, B. Vulcani, A&A, Volume 654, id.A173 (2021)

Abell 2626 and friends: large and small scale structure, J. Healy, S.P. Willner, M.A.W. Verheijen, S.-L. Blyth, AJ, Volume 162, Issue 5, id.193 (2021)

HI content in Coma cluster substructure, J. Healy, S.-L. Blyth, M.A.W. Verheijen, K.M. Hess, P. Serra, J.M. van der Hulst, T.H. Jarrett, K. Yim, G.I.G. Jozsa, A&A, Volume 650, id.A76 (2021)

MIGHTEE: are giant radio galaxies more common than we thought?, J. Delhaize, I. Heywood, M. Prescott, M.J. Jarvis, I. Delvecchio, I.H. Whittam, S.V. White, M.J. Hardcastle, C.L. Hale, J. Alfonso, Y. Ao, M. Brienza, M. Bruggen, J.D. Collier, E. Daddi, M. Glowacki, N. Maddox, L.K. Morabito, I. Prandoni, Z. Randriamanakoto, S. Sekhar, F. An, N.J. Adams, S. Blyth, R.A.A. Bowler, L. Leeuw, L. Marchetti, S.M. Randriamampandry, K. Thorat, N. Seymour, O. Smirnov, A.R. Taylor, C. Tasse, M. Vaccari, MNRAS, Volume 501, Issue 3, p3833-3845 (2021)

MIGHTEE-HI: The H I emission project of the MeerKAT MIGHTEE survey, N. Maddox, N., B.S. Frank, A.A. Ponomareva, M.J. Jarvis, E.A.K. Adams, R. Davé, T.A. Oosterloo, M.G. Santos, S.L. Blyth, M. Glowacki, R.C. Kraan-Korteweg, W. Mulaudzi, B. Namumba, I. Prandoni, S.H.A Rajohnson, K. Spekkens, N.J. Adams, R.A.A. Bowler, J.D. Collier, I. Heywood, S. Sekhar, A.R. Taylor, A&A, Volume 646, idA35 (2021)

Systematically Asymmetric: A comparison of HI profile asymmetries in real and simulated galaxies, N. Deg, S.-L. Blyth, N. Hank, S. Kruger, C. Carignan, MNRAS, Volume 495, Issue 2, p.1984-2001 (2020)

HISS, a new tool for H I stacking: application to NIBLES spectra, J. Healy, S.-L. Blyth, E. Elson, W. van Driel, Z. Butcher, S. Schneider, M.D. Lehnert, R. Minchin, MNRAS, Volume 487, Issue 4, p.4901-4938 (2019)

On the uncertainties of results derived from HI spectral line stacking experiments, E.C. Elson, A.J. Baker, S.-L. Blyth, MNRAS, Volume 486, Issue 4, p4894-4903 (2019)

Enhanced HI profile asymmetries in close galaxy pairs, J. Bok, S.-L. Blyth, D.G. Gilbank, E.C. Elson, MNRAS, Volume 484, Issue 1, p582-594 (2019)

HST H_α grism spectroscopy of ROLES: a flatter low-mass slope for the $z\sim1$ SSFR-mass relation, Riona Ramraj, David G. Gilbank, Sarah-Louise Blyth, Rosalind E. Skelton, Karl Glazebrook, Richard G. Bower, Michael L. Balogh, MNRAS, Volume 466, Issue 3, p.3143-3160 (2017)

Synthetic data products for future HI galaxy surveys: a tool for characterising source confusion in spectral line stacking experiments, E.C. Elson, S.L. Blyth, A.J. Baker, MNRAS, Volume 460, Issue 4, p.4366-4381 (2016)

NIBLES – an HI census of stellar mass selected SDSS galaxies: I. The Nançay HI survey, W. van Driel, Z. Butcher, S. Schneider, M.D. Lehnert, R. Minchin, S-L. Blyth, L. Chemin, N. Hallet, T. Joseph, P.

Kotze, R.C. Kraan-Korteweg, A.O.H. Olofsson, M. Ramatsoku, Astronomy & Astrophysics, Volume 595, id.A118, 43 (2016)

Exploring Neutral Hydrogen and Galaxy Evolution with the SKA, S.-L.Blyth, J.M. van der Hulst, M.A.W. Verheijen, HI SWG Members, B. Catinella, F. Fraternali, M.P. Haynes, K.M. Hess, B.S. Koribalski, C. Lagos, M. Meyer, D. Obreschkow, A. Popping, C. Power, L. Verdes-Montenegro, M. Zwaan (2015) PoS(AASKA14)128 (Chapter in revised SKA Science Book)

Variation of galactic cold gas reservoirs with stellar mass, N. Maddox, K.M. Hess, D. Obreschkow, M.J. Jarvis, S.-L. Blyth, MNRAS, Volume 447, Issue 2, p1610-1617 (2015)

The introductory astronomy course at the University of Cape Town: probing student perspectives, V. Rajpaul, S. Allie, S.-L. Blyth, Physical Review Special Topics - Physics Education Research (2014), Volume 10, Issue 2, id.020126

A Simple Model for Global HI Profiles of Galaxies, I.M. Stewart, S.-L. Blyth, W.J.G. de Blok, Astronomy & Astrophysics, Volume 567, A61, p27 (2014)

The Norma cluster (ACO 3627) - III. The distance and peculiar velocity via the near-infrared Ks-band Fundamental Plane, T. Mutabazi, S.-L. Blyth, P.A. Woudt, J.R. Lucey, T. H. Jarrett, M. Bilicki, A. Schroeder, S.A.W. Moore, MNRAS, Volume 439, Issue 4, p3666-3682 (2014)

Scalable desktop visualization of very large radio astronomy data cubes, S. Perkins, J. Questiaux, S. Finniss, R. Tyler, S. Blyth, M.M. Kuttel, New Astronomy, 30, 17 (2014)

Comparison of HI and optical redshifts of galaxies - the impact of redshift uncertainties on spectral line stacking, Natasha Maddox, Kelley M. Hess, S.-L. Blyth, M.J. Jarvis, MNRAS, Volume 433, Issue 3, p.2613-2625 (2013)

Quantified H I morphology - VII. Star formation and tidal influence on local dwarf H I morphology, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, S.-L. Blyth, MNRAS, Volume 435, Issue 2, pp 1020-1036 (2013)

Quantified HI Morphology – I: Multi-wavelength analysis of the THINGS galaxies, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, E.C. Elson, MNRAS, Volume 416, Issue 4, pp 2401-2414 (2011)

Quantified HI Morphology - II: Lopsidedness and interaction in WHISP column density maps, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, E.C. Elson, MNRAS, Volume 416, Issue 4, pp 2415-2425 (2011)

Quantified HI Morphology – III: Merger visibility times from HI in galaxy simulations, B. W. Holwerda, N. Pirzkal, T.J. Cox, W.J.G. de Blok, J. Weniger, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, MNRAS, Volume 416, Issue 4, pp 2426-2436 (2011)

Quantified HI Morphology – IV: The merger fraction and rate in WHISP, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, MNRAS, Volume 416, Issue 4, pp 2437-2446 (2011)

Luminous Red Galaxies in Simulations: Cosmic Chronometers?, S. Crawford, A. Ratsimbazafy, C. Cress, E. Olivier, S.-L. Blyth, K.J. van der Heyden, MNRAS, Volume 406, Issue 4, pp.2569-2577 (2010)

Physics:
STAR Collaboration papers authorship strictly alphabetical in all cases, no matter primary author. Other papers, primary author is listed first.

Partonic flow and ϕ-meson production in Au+Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV, B.I. Abelev et al., Physical Review Letters 99, 112301, (2007)
(This is my thesis paper for which I was primary author, but listed strictly alphabetically.)

A Cone Jet-Finding Algorithm for Heavy-Ion Collisions at LHC Energies, S-L Blyth. M.J. Horner, T. Awes, T. Cormier, J.L. Klay, S.R. Klein, M. van Leeuwen, A. Morsch, G. Odyniec, A. Pavlinov, Journal of Physics G: Nucl. Part. Phys. 34 (2007)

Longitudinal Double-Spin Asymmetry for Inclusive Jet Production in p+p Collisions at s=200GeV, B.I. Abelev et al., Physical Review Letters, vol. 100, Issue 23, id. 232003 (2008)

Enhanced strange baryon production in Au+Au collisions compared to p+p at $\sqrt{s_{NN}}$=200 GeV, B.I. Abelev et al., Physical Review C, vol. 77, Issue 4, id. 044908 (2008)

ρ_0 photoproduction in ultraperipheral relativistic heavy ion collisions at $\sqrt{s_{NN}}$=200 GeV, B.I. Abelev et al., Physical Review C, vol. 77, Issue 3, id. 034910 (2008)

Forward Neutral-Pion Transverse Single-Spin Asymmetries in p+p Collisions at s=200 GeV, STAR, B.I. Abelev et al., Physical Review Letters, vol. 101, Issue 22, id. 222001 (2008)

Forward Lambda production and nuclear stopping power in d + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV (STAR Collaboration) B.I. Abelev et al., Physical Review C 76 (2007) 064904

Energy dependence of pi+-, p and anti-p transverse momentum spectra for Au+Au collisions at $\sqrt{s_{NN}}$ = 62.4 and 200-GeV (STAR Collaboration) B.I. Abelev et al., Physics Letters B 655 (2007) 104

Mass, quark-number, and $\sqrt{s_{NN}}$ dependence of the second and fourth flow harmonics in ultra-relativistic nucleus-nucleus collisions (STAR Collaboration), B.I. Abelev et al., Physical Review C 75 (2007) 054906

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Strange particle production in p+p collisions at $\sqrt{s_{NN}}$ = 200 GeV (STAR Collaboration), B.I. Abelev et al., Physical Review C 75 (2007) 064901

Transverse momentum and centrality dependence of high-p(T) non-photonic electron suppression in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. (STAR Collaboration), B.I. Abelev et al., Physical Review Letters 98 (2007) 192301

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Longitudinal Double-Spin Asymmetry and Cross Section for Inclusive Jet Production in Polarized Proton Collisions at $\sqrt{s_{NN}}$ = 200 GeV, B.I. Abelev et al., Physical Review Letters 97 (2006) 252001

Neutral Kaon interferometry in Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV, B.I. Abelev et al., Physical Review C 74 (2006) 054902

Identified baryon and meson distributions at large transverse momenta from Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV, (STAR Collaboration) B.I. Abelev et al., Physical Review Letters 97 (2006) 152301

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Strange baryon resonance production in $\sqrt{s_{NN}}$ = 200 GeV p+p and Au+Au collisions,(STAR Collaboration) J. Adams et al., Physical Review Letters 97 (2006) 132301

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Conference Proceedings

A scalable database model of RFI data for MeerKAT radio telescope, Gerald Nathan Balekaki, Michelle Kuttel, Sarah Blyth, Anja Schroeder, Proceedings of South African Institute for Computer Scientists and Information Technologists Conference (SAICSIT 2019), 16-18 September 2019, Skukuza, South Africa, DOI: 10.1145/3351108.3351127

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A.J. Baker, The Spectral Energy Distribution of Galaxies, Proceedings of the International Astronomical Union, IAU Symposium, Volume 284, p. 496-499 (2012)

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Neutral Hydrogen in Galaxies from Low to High Redshift, S-L Blyth, A. Bouchard, K.J. van der Heyden, W.J.G. de Blok, R.C. Kraan-Korteweg, M.Ramatsoku, W. van Driel in "Panoramic Radio Astronomy: Wide-field 1-2 Ghz research on galaxy evolution", Proceedings of Science, (2009)

The Environmental Impact on Galaxy Evolution: Highlighting the Structure of the Local Cosmic Web, A. Bouchard, S. Blyth, E. de Blok, B. Holwerda, K van der Heyden in "Panoramic Radio Astronomy: Wide-field 1-2 Ghz research on galaxy evolution", Proceedings of Science, (2009)

Evolution of Neutral Gas in Galaxies over Cosmic Time with SKA pathfinder instruments, K. van der Heyden, A. Bouchard, B. Holwerda, S. Blyth, W.J.G. de Blok in "Panoramic Radio Astronomy: Wide-field 1-2 Ghz research on galaxy evolution", Proceedings of Science, (2009)

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NIBLES: an HI census of SDSS galaxies in the Local Volume, W. van Driel, S. Schneider, M. Lehnert, S. Blyth, A. Bouchard, K.J. van der Heyden, W.J.G. de Blok, R.C. Kraan-Korteweg, M. Ramatsoku in"Panoramic Radio Astronomy: Wide-field 1-2 Ghz research on galaxy evolution", Proceedings of Science, (2009)

Centrality dependence of the N(Omega)/N(phi) ratios and phi v2 - a test of thermalization in Au+Au collisions at RHIC, Sarah-Louise Blyth for the STAR collaboration, J. Phys. G. 34 (2007) S933-S936 (Proceedings of Quark Matter 2006 Conference, 13-20 November 2006, Shanghai.)

ϕ-meson Production in Heavy-Ion Collisions at RHIC, Sarah-Louise Blyth for the STAR Collaboration, J. Phys. G: Nucl. Part. Phys. 32 (2006) S461-S464. (Proceedings of International Conference on Strangeness in Quark Matter (SQM2006), Los Angeles, California, 26-31 Mar 2006.)

Jet study in ultra-relativistic heavy-ion collisions with the ALICE detector at the LHC, Sarah-Louise Blyth for the ALICE-USA Collaboration, Journal of Physics G: Nucl. Part. Phys. 30 (2004) S1155

Dr Julia Healy

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Education

University of Groningen and University of Cape Town (2017 – 2021)

PhD in Astronomy
University of Groningen and the South African Radio Observatory jointly funded research titled: "Insights from spectral stacking on the HI content of cluster galaxies in various environments: a tale of two clusters"
Advisors: Prof. dr M.A.W. Verheijen, Assoc. Prof. S-L Blyth, Prof. dr J.M. van der Hulst & Prof. R. Kraan-Korteweg

University of Cape Town (2011 – 2017)

MSc. in Astronomy (2015 – 2017)
South African Radio Observatory funded research titled: "Using HI stacking to study galaxy properties in the nearby universe"
Advisors: Assoc. Prof. S-L. Blyth and Dr E. Elson

B.Sc.(Honours) in Physics (2014)
South African National Research Foundation Scarce Skills funded research titled: "Multi-wavelength Analysis of the Star Formation in NGC 628"
Advisor: Dr E. Elson

B.Sc. in Astrophysics and Physics (2011 – 2013)

Employment

Research Scientist for the UK SKAO Regional Centre (UKSRC), University of Manchester (2024 – present)
This is a staff position is based within the Jodrell Bank Centre for Astrophysics at the University of Manchester. As a Research Scientist my responsibilities include helping to build the UKSRC through community, support, and engagement. I have also been appointed as a Project Scientist for the international SKA Regional Centre Network (SRCNet) where I am part of the small team that is responsible for preparing the SRCNet for Science Operations and the SKAO Science Verification stage. My responsibilities to the UKSRC and SRCNet account for 70% of my time. With the other 30% of my time, I can pursue my own research which focuses on how the processes affecting the neutral gas in galaxies influences the evolution of galaxies. I also co-supervise a PhD student (Sept 2025-) and mentor the three other PhD students in our research group.

Postdoctoral researcher, ASTRON – Netherlands Institute for Radio Astronomy (2021 – 2024)
This position has been funded by the European Research Council grant "Meergas" (882793) under the supervision of the grant PI, Prof. W.J.G. (Erwin) de Blok. During this time, I have been a major contributor to the development of the MHONGOOSE pipeline. MHONGOOSE is one of the Large Survey Projects with the SKA precursor telescope, MeerKAT. I have also written the first scientific paper (recently published with A&A) on the full-depth data of one of the galaxies. I developed the system by which the team keeps track of the ongoing observations, as well as helped to automate the reports used to do the data quality assessment. My other responsibilities as part of the MeerGas team have also been to help mentor the two PhD students.

Publications

S. Veronese, W.J.G. de Blok, ..., **J. Healy**, et al. *The inside-out quenching of the MHONGOOSE galaxy NGC 1371* (Astronomy & Astrophysics, November 2025)

M.G. Jones, M.P. Rey, D.J. Sand, …, **J. Healy**, et al. *Pavo: Stellar Feedback in Action in a Low-mass Dwarf Galaxy* (The Astrophysical Journal, September 2025)

B. Namumba, R. Ianjamasimanana, B.S. Koribalski, ..., **J. Healy**, et al. *Investigating the HI Distribution and Kinematics of ESO444-G084 and [KKS2000]23: New Insights from the MHONGOOSE Survey* (Astronomy & Astrophysics, July 2025)

K.C. Santana, F.M. Maccagni, R. Deane, and J. Healy. *MeerKAT discovery of an infalling cold gas tail onto the nearby barred spiral galaxy, NGC 5643.* (Monthly Notices of the Royal Astronomical Society, July 2025)

S. Kurapati, D.J. Pisano, W.J.G. de Blok, P. Kamphuis, N. Zabel, M. de Villiers, **J. Healy** et al. *Uncovering Extraplanar Gas in UGCA250 with the Ultra-deep MHONGOOSE Survey* (Monthly Notices of the Royal Astronomical Society, April 2025)

C. Eibensteiner, J. Sun, F. Bigiel, A.K. Leroy, ..., **J. Healy** et al. *PHANGS-MeerKAT and MHONGOOSE HI observations of nearby spiral galaxies: Physical drivers of the molecular gas fraction,* R_{mol} (Astronomy & Astrophysics, November 2024)

S. Veronese, W.J.G. de Blok, **J. Healy**, et al. *Where is the neutral gas? Searching for the HI around MHONGOOSE galaxies via spectral stacking* (Astronomy & Astrophysics, January 2025)

W.J.G. de Blok, **J. Healy**, F.M. Maccagni et al. *MHONGOOSE — A MeerKAT Nearby Galaxy HI Survey* (Astronomy & Astrophysics, March 2024)

J. Healy, W.J.G. de Blok, F.M. Maccagni et al. *Possible origins of anomalous HI gas around MHONGOOSE galaxy, NGC 5068* (Astronomy & Astrophysics, February 2024)

J. Healy, W.J.G. de Blok, F.M. Maccagni et al. *The curious case of NGC 5068 and its neutral hydrogen fingers* (Proceedings of the International Astronomical Union, Symposium 373, August 2022)

F. M. Maccagni, **J. Healy**, W. J. G. de Blok, P. Serra. *RFI at u=0 in MeerKAT observations* (South African Radio Astronomy Observatory Report, March 2022, https://doi.org/10. 48479/bhpj-nz95)

T. Deb, M.A.W. Verheijen, B.M. Poggianti, Al. Moretti, J.M. van der Hulst, B. Vulcani, M. Ramatsoku, P. Serra, **J. Healy**, et al. *GASP XXXIX: MeerKAT hunts Jellyfish in A2626* (MNRAS, Volume 516, Issue 2, October 2022)

D. Cs. Molnàr, P. Serra, T. van der Hulst, T. H. Jarrett, A. Boselli, L. Cortese, **J. Healy**, et al. *The Westerbork Coma Survey: a blind, deep, high-resolution Hi survey of the Coma cluster* (Astronomy & Astrophysics 659, A94, March 2022)

J. Healy, S. Willner, M.A.W. Verheijen, S-L. Blyth *A2626 and Friends: Large- and Small- scale Structure* (The Astronomical Journal, Volume 162, Issue 5, id.193, 17 pp, November 2021)

J. Healy, T. Deb, M.A.W. Verheijen, S-L. Blyth et al. *MeerKAT 21-cm HI imaging of Abell 2626 and beyond* (Astronomy & Astrophysics, Volume 654, id.A173, 19 pp, October 2021)

A. Ignesti, B. Vulcani, B.M. Poggianti, R. Paladino, T. Shimwell, **J. Healy**, et al. *GASP XXXVIII: The LOFAR-MeerKAT-VLA view on the non-thermal side of a jellyfish galaxy* (The Astrophysical Journal, Volume 924, Issue 2, id.64, 15 pp, January 2022)

J. Healy, S-L. Blyth, M.A.W. Verheijen, K.M. Hess, et al. *HI in the Coma Cluster substructure* (Astronomy & Astrophysics, Volume 650, id.A76, 29 pp., June 2021)

K.A. Oman, Y.M. Bahè, **J. Healy**, et al. *A homogeneous measurement of the delay between the onsets of gas stripping and star formation quenching in satellite galaxies of groups and clusters* (Monthly Notices of the Royal Astronomical Society, Volume 501, Issue 4, pp.5073- 5095, March 2021)

J. Healy, S-L. Blyth, E. Elson, W. van Driel, et al. *HISS, a new tool for HI stacking: application to NIBLES spectra* (Monthly Notices of the Royal Astronomical Society, Volume 487, Issue 4, p.4901-4938, August 2019)

Conferences and presentations

Revealing the HI Environment of a Compact Obscured Nucleus in the Zone of Avoidance [contributed talk], 3rd Sweden SKA days, Stockholm, Sweden (4 – 5 February 2026)

The protective environment of substructures within galaxy clusters: A case study with A2626 [contributed talk], IAU General Assembly Symposium 392, Cape Town, South Africa (13 – 16 August 2024)

Anomalous HI gas around MHONGOOSE galaxy NGC 5068 [invited talk], The Evolution of Gas in and around Galaxies, Stanley, Idaho, USA (31 July – 4 August 2023)

Anomalous HI gas around MHONGOOSE galaxy NGC 5068 [talk], 14th Pathfinder HI Science Coordination Committee (PHISCC) Workshop, Cape Town, South Africa (27 – 31 March 2023)

Managing the data flow of the MHONGOOSE survey with open-access tools [talk], ADASS XXXI, Cape Town, South Africa. (24 – 28 October 2021)

Talk accepted for 13th Pathfinder HI Science Coordination Committee (PHISCC) Workshop, Cagliari, Sardinia, Italy (Scheduled for 11 – 13 May 2020, suspended due to Covid-19 & talk not given)

HI in the Substructure of the Coma Cluster [poster], Kavli Insitute's Forum on Gas in Galaxies, Peking University, Beijing, China. (18 - 22 June 2018)

HI in the Substructure of the Coma Cluster [talk], 11th Pathfinder HI Science Coordination Committee (PHISCC) Workshop, Astronomy Town, Pingtang, China (11 – 13 June 2018)

The Evolution of HI Gas in Cluster Substructure [poster], Netherlands Astronomy Conference, Groningen, Netherlands. (14 - 16 May 2018)

The Evolution of HI Gas in Cluster Substructure [poster], SARAO Bursary Conference, Cape Town, South Africa. (December 2017)

Looking for needles in the HI-stack [talk], 10th Pathfinder HI Science Coordination Committee (PHISCC) Workshop, National Centre for Radio Astrophysics, Pune, India
(6 – 8 February 2017)

Using HI stacking to study galaxy properties in the nearby universe [talk], SKA Bursary Con- ference, Cape Town, South Africa. (December 2016)

HI Stacking: Software and Applications [talk], 9th Pathfinder HI Science Coordination Com- mittee (PHISCC) Workshop, South African Astronomical Observatory, Observatory, South Africa. (1 – 3 February 2016)

Awards

2019 Dept of Science, Technology & Innovation South African Women in Science Award: TATA Doctoral Scholarship

Selected to participate in 2019 Lindau Nobel Laureates meeting in Lindau, Germany (funded by Academy of Sciences South Africa)

SARAO Doctoral Scholarship (2017 – 2020)

SARAO Masters Scholarship (2015 – 2016)

Joint 1st prize for MSc poster presentation in the Astrophysics Track at 61st South African Institute of Physics Conference (2016).

Professional Associations

SRCNet Project Scientist (2024 – present)

International Astronomy Union Junior Member (2021 – present)

African Astronomical Society Member (2024 – present)

LADUMA [MeerKAT Large Survey Project, team member, co-lead of HI stacking working group since October 2024] (2021 – present)

MHONGOOSE [MeerKAT Large Survey Project, core team] (2021 – present)

WEAVE Consortium [member of the WEAVE Cluster Survey] (2022 – present)

SKA HI Science Working Group (2023 – present)

Research Skills and Experience

Optical spectroscopic and photometric observations: I have had more than seven successful optical proposals, which have included a mix of onsite, remote, and service mode observing. As PI for a number of these proposals, I have also been responsible for the data reduction.

Software development: I have developed an open source HI stacking pipeline (https://github.com/healytwin1/HISS) that is now in regular use as part of both MeerKAT open-time projects, as well as one of the Large Survey Projects, LADUMA. I have also been a contributor to the CARACal pipeline (https://github.com/caracal-pipeline/caracal) which has become the go-to data reduction software for HI observations with MeerKAT, and the SoFiA-image-pipeline (https://github.com/kmhess/SoFiA-image-pipeline). I primarily work with the Python programming language, but I also have experience with C, IDL, HTML, and CSS

Radio observations: I have extensive experience working with not only interferometric radio data, but also single dish observations. I have been both PI and co-I on multiple successful MeerKAT proposals and have been responsible for data reduction and quality assessment of both open-time projects and for MHONGOOSE, one of the Large Survey Projects. This has provided me with a wealth of experience working with the different modes of the MeerKAT correlator (4K wide, 32K wide, and 32K narrow).

Outreach

Looking up with Kechil Kirkham – interviewed while observing remotely with the WIYN Tele- scope on 28 September 2018 (https://www.fmr.co.za/looking-up/)

Women in Research Blog – 10 questions with Julia Healy (https://womeninresearchblog.wordpress.com/2019/11/03/julia-south-africa/)

Cosmic Savannah Podcast – interviewed by podcast host Dr Jacinta Delhaize for episode 15 (http://thecosmicsavannah.com/2019/10/31/episode-15-the-vatican-observatory-and-more/)

Women in Science Africa – article in August 2020 Women's month edition [page 20-21] (https://www.yumpu.com/en/embed/view/GJs7Xt56cpiLAMoH)

Urban Astronomer – interviewed by podcast Allen Versveld (https://www.urban-astronomer.com/podcast/interview-with-dr-julia-healy/)

Teaching Experience

Teaching assistant, University of Cape Town (2014 – 2017)

Lab demonstrator for 1st year Physics for majors (2014 – 2015) [~80 students]
Responsibilities included assisting with the weekly lab sessions, and marking lab assignments and tests.

Lab demonstrator and Teaching assistant for 1st year General Physics for non-majors (2014 – 2016) [~100students]
Responsibilities included running weekly help sessions, assisting with the weekly lab sessions, and marking lab assignments, and tests and exams.

Teaching assistant for Introduction to Astronomy (2017) [~100 students]
I helped run the weekly tutorial sessions, and was part of the assignment, test, and exam marking team.

Teaching assistant for MSc Computation Astrophysics (2017) [~15 students]
I was responsible grading all the assignments, and was the point of contact for the students in Cape Town as the lecturer was not locally-based.

Teaching assistant, University of Groningen (2018)

Teaching assistant for Observational Astronomy (2018) [~40 students]
My responsibilities included running the weekly tutorial session, I also supervised the evening observation sessions with the teaching telescope in the Blaauw Observatory. I also was responsible for helping to grade assignments.