Curriculum Vitae

Personal details:

Name:	Ian McKellar Stewart.
Nationality:	Australian.
Languages:	English, German.

Tertiary Education:

- BSc (2A Hons), Physics major, University of Western Australia, 1987
- PhD in Physics, University of New England, Australia, 1995

Employment History (in reverse time order):

2014-2018 **Sterrewacht Leiden** **Software Engineer**

At Leiden I was working as part of the ALMA Local Expertise Group (Allegro). I was responsible for maintaining and improving a software package called LIME which is designed to simulate ALMA observations of molecular clouds by solving the equations of radiative transfer for the given environment. LIME is available on github at

https://github.com/lime-rt/lime

I contributed over 30k lines to LIME, which includes two new algorithms *raythrucells* and *tree_random* which are available in code form at

https://github.com/imckstewart

I adapted LIME to be usable from within a python environment, which required extensive coding with the python-C API.

I also managed user access to the Allegro computing resources. In connection with this I overhauled the software for managing the project database, in the process rewriting the central engine to OO form. I also modified and added to the PyQt-powered GUI.

2012-2014 **Universität Bonn** **Wissenschaftlicher Mitarbeiter**

My task at Bonn was to write software to help calibrate LOFAR observations, specifically those made with long (i.e. international) baselines. My main interest was the application of Bayesian methods to fringe-fitting.

2009-2012 **University of Cape Town** **Honorary Research Associate**

At UTC I pursued my own research in the analysis of various types of astronomy data. The most recent interest was the detection of H I and pulsar signals in interferometer data and the use of Bayesian methods in spectral stacking.

I taught a Masters-level course in Computational Astronomy for NASSP. I supervised a Masters student at UCT and was joint supervisor for two more.

Jan-May 2011 **JIVE** **Software Scientist**

I was invited to contribute to the Global Fringe Fitting work package of the ALBiUS project (the sucessor to ALBUS). The original plan was that I would do this work while employed by the Hartebeesthoek Radio Observatory in South Africa, but due to severe difficulties in obtaining an SA work permit, eventually it was decided it would be easier to employ me for four months in the Netherlands to do this work.

2006 - 2008 **University of Manchester** **Research Associate**

In this period I was employed at the Jodrell Bank Centre for Astrophysics (JBCA), a part of the University of Manchester. My position was funded as part of the Radionet ALBUS project, which was intended to create software to process data from the upcoming generation of cm-wavelength radio telescope arrays. My particular brief was to attack those problems caused by the greatly increased bandwidth of such new instruments as e-merlin. In the course of the work I added python and C++ to my language skills, and learnt about radio interferometry to supplement my previous single-dish experience.

1999 - 2005 **University of Leicester** **Research Associate**

During this period of 6 years I worked for the XMM-Newton Survey Science Centre (SSC) at the University of Leicester. I learnt fortran 95 at Leicester. I was responsible for the creation and maintenance of many tasks in the Science Analysis System (SAS) for ESA's XMM-Newton x-ray telescope. My software responsibilities included the treatment of images, exposure correction, and coordinate transformations. This was 'production' software and necessitated working to high standards and to deadlines in coordination with the other members of the team.

1996 - 1999 **Australia Telescope National Facility** **Operations Scientist**

During this time I was employed at the Parkes Radio Observatory division of the Australia Telescope National Facility (ATNF). I had manifold responsibilities at ATNF, not restricted to software development, including the coordination and administration of some observing programs at the telescope. Among the computer languages I learnt at Parkes were C, fortran 77, perl and glish. My software responsibilities included the construction of database and data archive interfaces, as well as the analysis of research data. For example I wrote a mixed-language (C and F77) application which obtained the telescope position in real time and used this to display the patch of sky, with sources from several catalogs overlaid, to which the telescope was currently pointing.

I became interested in 21-cm radio survey research at ATNF and contributed to the development of methods of survey data reduction.

1988 - 1996 **University of New England** **Associate Lecturer**

I was employed as an Associate Lecturer in the Department of Physics during my PhD candidature at the University of New England. The teaching load scaled up with the years until in my final teaching semester at UNE I was allocated 44 lectures in 5 first and second year units, and was the unit coordinator for two of these units. I also supervised laboratory classes including one at 3rd-year level in Electronics & Microprocessors.

The title of my PhD thesis was 'Experimental and Theoretical Studies of the Argon Prebreakdown Discharge.' As part of my research I wrote software (in QB45) both to analyse my research data and to supplement these findings by means of Monte Carlo and also semi-analytical simulations. I designed and built much of the optical and electronic equipment for my experiment, in which I measured the time-variable concentration of metastably-excited states of Argon via absorption of light from a frequency-locked diode laser - the fractional absorption being in the 10^{-9} range.

1985 - 1987 **University of Western Australia** **Student**
1984 **Flinders University of South Australia** **Student**

During this period I studied for my Bachelor of Science degree. I was awarded the Chancellor's Letter of Commendation at the end of the year at Flinders University.

1974 - 1983 **Various** **Various**

Between the end of my secondary schooling and the commencement of University study in 1984 I worked at a variety of non-professional occupations.

Software Experience Tables:

Language	First used	Years active (net)
basic, QB45	1982	14
fortran 77	1989	4
c	1996	6
perl	1996	14
perl/tk	1996	3
perl cgi	1996	3
sql	1997	1
glish	1997	2
fortran 95	1999	11
python (including OO)	2006	12
c++ (including OO)	2006	0.5

Platform/OS	First used	Present experience level
other PC	1982	User
mac	1985	User
ms windows	1988	User
ms-dos	1988	Programmer
vms	1996	Programmer
unix (solaris)	1996	Programmer
linux	2003	Administrator

Software application	First experience
Numeric computation	1982
Curve fitting, modelling, monte carlo, finite difference	1988
Radio astronomy	1996
FITS	1996
GUIs	1996
X-ray astronomy	1999
Interferometry	2006
Bayesian statistics	2010
Radiative transfer equations	2015
Computational geometry	2017

Publicly available software repositories:

https://github.com/imckstewart
https://github.com/allegroLeiden

Referees:

Prof Michiel Hogerheijde,
Sterrewacht Leiden,
Niels Bohrweg 2,
NL-2333 CA Leiden,
The Netherlands.
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Prof Simon Garrington,
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University of Leicester,
Leicester LE1 7RH,
United Kingdom.

phone: +44 116 252 3598
fax: +44 116 252 2770
e-mail: julo@star.le.ac.uk

Research:

Membership of Research Teams:

- H I Parkes All-Sky Survey (PI: R Webster, U Melbourne)
- Zone Of Avoidance survey (PI: L Staveley-Smith, ATNF)
- The Cardiff DEEP H I survey team (PI: M Disney, U Cardiff)
- Legacy eMERLIN Multi-band Imaging of a Complete Nearby Galaxy Sample (LeMMINGS) (PI: R Beswick, JBCA)
- "Thunderkats" - a search for radio transients with MeerKAT (PIs Woudt P A & Fender R P)
- "LADUMA" - a MeerKAT ultradeep H I survey (PIs Blyth S-L, Holwerda B & Baker A)
- "Mightee" - a deep continuum survey with MeerKAT (PIs van der Heyden K & Jarvis M)
- "Shykats" - a survey of hydrogen with KAT-7 (PIs Kločkner H-R, Kerp J & Zwaan M)

Other affiliations:

1998 - 2000: Member of the Australia Telescope Users' Committee.

Past and Present Research Interests:

- Bayesian analysis in both the Gaussian and Poissonian statistical regimes.
- Algorithms for calibration and imaging of radio interferometer data.
- Source detection in astronomical images.
- Blind H I radio surveys.
- Ellipsometry, and interferometric techniques which employ polarised light.
- Numerical solution of the Boltzmann equation close to boundaries.
- Sympatric speciation and lattice-diffusion models of genetic drift.

Refereed Publications:

"Periodic Pressure Instabilities in an Oil Diffusion Pumped System", Flexman J, Hayes P, Bennett M A, Stewart I M, Williams J F and Mikosza A G, Vacuum **40**, 381-5 (1990).

"The Reflection of Metastable Particles at a Surface", Stewart I M, J. Phys. D: Appl. Phys. **27**, 1487-91 (1994).

"The Distribution of Electrons in a Uniform Electric Field", Stewart I M, Aust. J. Phys. **48**, 89-102 (1995).

"Tidal Disruption of the Magellanic Clouds by the Milky Way", Putman M E and 25 coauthors, including Stewart I M, Nature **394**, 752 (1998).

"New Galaxies Discovered in the First Blind H I Survey of the Centaurus A Group", Banks G and 28 coauthors including Stewart I M, Ap. J. **524**, 612-22 (1999).

"An Extragalactic H I Cloud with No Optical Counterpart?", Kilborn V A and 27 coauthors including Stewart I M, AJ **120**, 1342-1350 (2000)

"The H I Parkes All Sky Survey: Observations, Calibration and Robust Imaging.", Barnes D G, Staveley-Smith L, deBlok W J G, Oosterloo T, Stewart I M and 34 more coauthors, Mon Not R Astron Soc, **322**, 486-498 (2001)

"The XMM-Newton Serendipitous Survey. I. The role of XMM-Newton Survey Science Centre.", Watson M G and 48 coauthors including Stewart I M, Astron. Astrophys., **365**, L51-L59 (2001)

"HIPASS Detection of an Intergalactic Gas Cloud in the NGC 2442 Group." Ryder S D and 28 coauthors including Stewart I M, Ap. J., **555** 232-239 (2001)

"HIPASS High-Velocity Clouds: Properties of the Compact and Extended Populations.", Putman M E and 31 coauthors including Stewart I M, AJ., **123** 873-891 (2002)

"A Catalogue of H I Selected Galaxies from the South Celestial Cap Region of Sky." Kilborn V A and 31 coauthors including Stewart I M, AJ., **124** 690-725 (2002)

"The 1000 Brightest HIPASS Galaxies: Newly Catalogued Galaxies." Ryan-Weber E and 38 coauthors including Stewart I M, AJ., **124** 1954-1974 (2002)

"The XMM-Newton Serendipitous Source Catalogue.", Watson M G and 19 coauthors including Stewart I M, AN., **324**, 89 (2003)

"The 1000 Brightest HIPASS Galaxies: The H I Mass Function and $\Omega_{\rm H\,I}$." Zwaan M A and 39 coauthors including Stewart I M, AJ., **125** 2842-2858 (2003)

"HIDEEP - An Extragalactic Blind Survey for Very Low Column-Density Neutral Hydrogen." Minchin R F and 16 coauthors including Stewart I M, Mon Not R Astron Soc, **346**, 787-802 (2003)

"In-Orbit Vignetting Calibrations of XMM-Newton Telescopes", Lumb D H, Finoguenov A, Saxton R, Aschenbach B, Gondoin P, Kirsch M and Stewart I M, Experimental Astronomy, **15**, 89 (2003)

"The cosmological significance of low surface brightness galaxies found in a deep blind neutral hydrogen survey." Minchin R F and 18 coauthors including Stewart I M, Mon Not R Astron Soc, **355**, 1303 (2004)

"The HIPASS Catalogue: I - Data Presentation." Meyer M and 35 coauthors including Stewart I M, Mon Not R Astron Soc, **350**, 1195 (2004)

"The HIPASS Catalogue: II - Completeness, Reliability and Parameter Accuracy." Zwaan M A and 35 coauthors including Stewart I M, Mon Not R Astron Soc, **350**, 1210 (2004)

"The 1000 Brightest HIPASS Galaxies: H I Properties." Koribalski B S and 40 coauthors including Stewart I M, AJ., **128** 16-46 (2004)

"The HIPASS catalogue: III - Optical Counterparts and Isolated Dark Galaxies." Doyle M T and 40 coauthors including Stewart I M, Mon Not R Astron Soc, **361**, 34 (2005)

"The H I Parkes Zone of Avoidance survey: The Northern Extension." Donley J L and 8 coauthos including Stewart I M, Ap J **129**, 220 (2005)

"The Northern HIPASS Catalogue - Data Presentation, Completeness and Reliability Measures." Wong O L and 34 coauthors including Stewart I M, Mon Not R Astron Soc, **371**, 1855 (2006)

"Matched filters for source detection in the Poissonian noise regime." Stewart I M, A & A **454**, 997 (2006)

"The Subaru - XMM-Newton Deep Survey (SXDS) III: X-Ray Data." Ueda Y, Watson M G, Stewart I M, Akiyama M, Schwope A D, Lamer G, Ebrero J, Carrera F J, Sekiguchi K, Yamada T, Simpson C, Hasinger G and Mateos S, Ap J Suppl. Ser. **179**, 124 (2008)

"The XMM-Newton serendipitous survey. VI. The Second XMM-Newton Serendipitous Source Catalogue." Watson M G and 47 coauthors including Stewart I M, A & A **493**, 339 (2009)

"Maximum-likelihood detection of sources among Poissonian noise." Stewart I M, A & A **495**, 989 (2009)

"A multiple-beam CLEAN for imaging intra-day variable radio sources." Stewart I M, Fenech D M & Muxlow T W B, A & A **535**, A81 (2011)

"A Simple Model for Global H I Profiles of Galaxies." Stewart I M, Blyth S-L & W J G de Blok.
A & A **567**, A61 (2014)

"The Parkes HI Zone of Avoidance Survey." Staveley-Smith L, Kraan-Korteweg R C, Schröder A C, Henning P A, Koribalski B S, Stewart I M & Heald G
AJ **151**, 52 (2016)

In preparation:

"Considerations for H I stacking experiments in future deep surveys." Blyth S-L & Stewart I M.

Invited talks:

"Wide-band interferometry." Stewart I M, The European Radio Interferometry School (ERIS), Bonn, Sep 2007.

"Applications of multi-beam CLEAN." Stewart I M, Workshop on Imaging and Calibration Algorithms for EVLA, e-MERLIN and ALMA, Oxford e-Science Centre, Dec 2008.

"Radio interferometry: new challenges in aperture synthesis imaging." Stewart I M, Symposium at the Department of Astronomy, Nagoya University, Japan, Oct 2009.

"A high-fibre diet: sucking the last juice from large sets of noisy spectra." Stewart I M, Workshop on Parameterisation of Galaxies in HI, University of Cape Town, Jan 2012.

Posters and Conference Proceedings:

"Optical Absorption Studies of the Argon Prebreakdown Discharge", Stewart I M, Gaseous Electronics meeting, Adelaide (1994).

"The H I Parkes All-Sky Survey", Staveley-Smith L, Koribalski B S, Stewart I M, Putman M E, Kilborn V A and Webster R L, ASP conference series **217**, 50-57 (2000).

"A Second-Generation Southern Continuum Survey at 21 cm", Stewart I M and Wright A E, New Era in Wide-Field Astronomy, ASP conference series **232**, 59-61 (2001).

"Survey Science Centre Pipeline Processing System", Ballet J and 34 coauthors including Stewart I M, New Visions of the X-Ray Universe, ESA WPP Conference Series (2002).

"XMM-Newton Science Analysis System (SAS)", Ballet J and 26 coauthors including Stewart I M, New Visions of the X-Ray Universe, ESA WPP Conference Series (2002).

"In-Orbit Calibrations of XMM-Newton Telescopes", Lumb D H, Finoguenov A, Saxton R, Aschenbach B, Gondoin P, Kirsch M and Stewart I M, 48th annual SPIE conference (2003)

"ASMOOTH: an Adaptive, Weighted, Piecewise Smoother", Stewart I M, 15th annual ADASS conference (2005)

"The 2XMM Catalogue: Cool-Star X-ray Variability Survey", Pye J, Schroeder A, Fyfe D, Webb N and Stewart I M, Cool Stars 14 conference (2006)

"Making the 2XMM x-ray catalogue", Page C G and coauthors including Stewart I M, 17th annual ADASS conference (2007)

"MERLIN Observations of the Starburst Galaxy M82", Fenech D, Pedlar A, Muxlow T W B, Beswick R and Stewart I M, RAS National Astronomy Meeting (2008)

"E-MERLIN algorithm development", Fenech D, Stewart I and Garrington S, The 9th European VLBI Network Symposium on the Role of VLBI in the Golden Age for Radio Astronomy (2008)

"The 2XMM catalogue and variability of X-ray sources", Sakano M and 13 coauthors including Stewart I M, Astrophysics with All-Sky X-Ray Observations, Proceedings of the RIKEN Symposium, held 10-12 June, 2008 (2009)

"Parallel CLEAN: beyond the frequency domain", Stewart I M, 19th annual ADASS conference (2009)

"LIME - the LIne Modelling Engine", Stewart I M, Astronomical Data Analysis Software and Systems XXV, ASP Conference Series, Vol. 512 (2015)

Other Non-refereed:

"Exposure Correction of XMM MOS and PN SAS Products.", Stewart I M, XMM-SSC Technical Note 0053 (2000).

"Some investigations of leakage into MeerKAT images from far-field sources.",
Stewart I M (2010),
http://home.strw.leidenuniv.nl/~ims/aufgaben/meerkat_PB.html

"MeerKAT core vs. core+spur: a comparison of image quality.", Stewart I M (2010),
http://home.strw.leidenuniv.nl/~ims/aufgaben/meerkat_spur.pdf

"MeerKAT: some investigations of the layout.", Stewart I M (2011),
http://home.strw.leidenuniv.nl/~ims/aufgaben/meerkat_layout_1a.pdf

"A suggested layout for the 7 long-baseline MeerKAT antennas.", Stewart I M (2011),
http://home.strw.leidenuniv.nl/~ims/aufgaben/long_baselines_2.pdf

"An adjustable-width window with good dynamic range." Stewart I M (2014) arXiv:1404.6979 [cs.NA]

Teaching Experience:

I was employed as an Associate Lecturer in the Department of Physics during my PhD candidature at the University of New England. The load scaled up with the years until in my final teaching semester at UNE I was allocated 44 lectures in 5 first and second year units, and was the unit coordinator for two of these units. I've described my UNE teaching experience in more detail in the following table:

Unit title:	**Topic:**	**Duties:**
Physics 112	Biophysics.	Laboratory demonstrating; I also designed two of the Biophysics laboratory experiments.
Physics 101	Properties of Materials.	Lecturing; setting and marking weekly assignments and exam questions.
Astronomy 221	The Solar System.	Lecturing; setting and marking essays, exam questions and occasional assignments; laboratory demonstrating. In my last two years at UNE I was the coordinator of the laboratory and observatory program and in this period I wrote an entirely new guide to the laboratory and observatory work. In 1995 I gave lectures in Astronomy equal to one third of the formal part of the course.
Physics 201	Electrostatics.	Lecturing; setting and marking exam questions and weekly assignments. Giving tutorials.
Physics 201	Quantum Mechanics.	Lecturing; setting and marking exam questions and weekly assignments.
Electronics 311	Microprocessors.	Laboratory demonstrating.

I have taught a Masters-level course in Computational Astronomy for NASSP in 2009 and 2010. I have had 1 astronomy Masters student, who successfully graduated in 2011. I was joint supervisor for another Masters student who was working on genetic algorithms for use in fitting microlensing light curves. This student successfully graduated in 2012 and won a Rhodes Scholarship to pursue PhD studies at Oxford University.