

# DR. TOBY BROWN

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Herzberg Astronomy & Astrophysics Research Centre, Victoria, British Columbia, Canada

## RESEARCH INTERESTS

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Galaxy evolution, interstellar medium, star formation, multi-wavelength astronomy

## PROFESSIONAL EXPERIENCE

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### Research Officer

July 2020 - present

*Herzberg Astronomy & Astrophysics Research Centre*

*Victoria, BC*

*National Research Council of Canada*

*Canada*

- PI of VERTICO, an ongoing ALMA Large Program that is studying environmental effects on galaxy evolution by mapping molecular gas at high resolution in 51 Virgo Cluster galaxies
- PI of ARCADE, an ALMA Development Study that is building a fully interactive online platform for cloud-based ALMA data reduction, analysis, and visualisation
- Completing and facilitating astronomy research through the leadership and project management of large international (VERTICO) and cross-discipline (ARCADE) collaborations

### Postdoctoral Fellow

October 2017 - June 2020

*McMaster University*

*Hamilton, Canada*

- PI of VERTICO ALMA Large Program
- Completed self-directed original research and supervised undergraduate and graduate students

## EDUCATION

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### Doctor of Philosophy (Ph.D.), Astrophysics

October 2013 - May 2017

*Swinburne University of Technology*

*Melbourne, Australia*

- *The Life Cycle of Nearby Galaxies: internal and external processes regulating atomic gas content*
- Supervisors: Dr. Barbara Catinella, Prof. Luca Cortese, Prof. Virginia Kilborn
- Conferred: September 2017

### Astrophysics MPhys, Hons

September 2009 - June 2013

*University of Liverpool & Liverpool John Moores University*

*Liverpool, UK*

## COMPETITIVE FUNDING AND HONOURS

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NRAO Student Observing Support (co-I, \$48,000)	2020
ARCADE: ALMA Reduction in the CANFAR Data Environment (PI, \$250,000 + equivalent in-kind)	2019
NAASC ALMA Ambassador (\$20,000)	2018 & 2019
Mitacs Globalink Research Award (\$6,000)	2019
TMT Early-Career Workshop Grant (\$1,800)	2018
ASTRO-3D Science Visitor Program (\$1,500)	2018
ACURA Travel Award (\$1,000)	2018
MacDATA Fellow Supervisor (\$7,500)	2017
Famelab Australia Finalist	2016
ASA Travel Award (\$1,000)	2015
SUPRA Graduate Scholarship (\$98,000 + Tuition-fee Waiver)	2013

## LEADERSHIP AND SERVICE ROLES IN ASTRONOMY

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### **Principle Investigator, ARCADE**

July 2020 - present

*ALMA Cycle 7 Development Study*

- ARCADE is a web-accessible cloud-based computing environment tailored to ALMA users. We will ultimately provide a fully-developed version of ARCADE to the wider astronomical community
- As PI, I lead a cross-disciplinary team of astronomers, software developers, project managers, and beta users to successfully develop and deliver ARCADE
- Total funding is \$250,000 CAD (\$186,000 USD) from the National Radio Astronomy Observatory with an equivalent contribution of in-kind costs by the National Research Council of Canada. I took over as PI in July 2020 having been co-I on the original proposal

### **Principle Investigator, VERTICO**

July 2019 - present

*Virgo Environment Traced in CO, ALMA Cycle 7 Large Program*

- I have been awarded the VERTICO ALMA Large Program (186 hrs), an ongoing survey that is investigating the effects of environment on galaxy evolution
- VERTICO is the first Canadian-led Large Program and the only such program awarded to a postdoc
- As PI, I built and lead the VERTICO collaboration of 35 leading international researchers
- Survey and team information at [bit.ly/verticoALMA](http://bit.ly/verticoALMA)

### **Survey Coordinator, DOWSING**

September 2019 - present

*James Clerk Maxwell Telescope Large Program*

- One of five coordinators of a JCMT Large Program surveying nearby galaxies

### **2019 and 2020 ALMA Ambassador**

December 2018 - present

*North American ALMA Science Center*

- Acting as an ALMA resource for the Canadian community
- Hosting ALMA preparation workshops and sharing ALMA/interferometry expertise

### **Postdoc Representative**

July 2018 - June 2020

*Department of Physics & Astronomy, McMaster University*

### **Women in Astronomy Working Group Member**

November 2018 - present

*International Astronomical Union*

### **SKA HI Galaxy Science Working Group Member**

November 2018 - present

*Square Kilometer Array Organisation*

### **Steering Committee Member**

May 2016 - May 2017

*Early Career Researcher Chapter, Astronomical Society of Australia*

### **Student Mentor**

January - October 2015

*Swinburne University of Technology*

### **Scientific Organizing Committee Member**

June - September 2016

*ICRARcon, Mandura, Australia*

### **Local Organizing Committee Member**

June - September 2016

*ICRARcon, Mandura, Australia*

### **Local Organizing Committee Member**

June - September 2015

*The Role of Neutral Hydrogen in Galaxy Evolution, Borneo, Malaysia*

## SUPERVISING AND TEACHING EXPERIENCE

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<b>Co-op Student Supervisor</b> <i>Dept. Physics &amp; Astronomy, McMaster University</i>	Sept 2020 - present <i>Hamilton, Canada</i>
· Primary supervisor of a four month co-op student working on a combined VERTICO-ARCADE project using cloud computing to test and develop VERTICO's radio continuum imaging pipeline	
<b>MacDATA Fellow Supervisor</b> <i>Dept. Physics &amp; Astronomy, &amp; MacDATA Institute, McMaster University</i>	March 2018 - December 2018 <i>Hamilton, Canada</i>
· Supervisor of McMaster's MacDATA Graduate (PhD level) Fellow	
<b>Integrated Science Course Supervisor</b> <i>McMaster University</i>	November 2017 - November 2019 <i>Hamilton, Canada</i>
<b>Teaching Assistant</b> <i>University of Western Australia</i>	February - November 2016 <i>Perth, Australia</i>
<b>Teaching Assistant</b> <i>Swinburne University of Technology</i>	February - October 2015 <i>Melbourne, Australia</i>
<b>Undergraduate Project Supervisor</b> <i>Swinburne University of Technology</i>	September 2014 - July 2015 <i>Melbourne, Australia</i>

## CONTRIBUTED CONFERENCE TALKS

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*Total number: 8*

Metals in Galaxies Near and Far, The Lorentz Centre, Leiden, Netherlands	2019
The Life and Death of Star-Forming Galaxies, Perth, Australia	2019
KIAA Forum on Gas in Galaxies, Peking University, Beijing, China	2018
European Week of Astronomy, Liverpool, UK	2018
MockPerth, Perth, Australia	2017
Pathfinders HI Science Coordination Committee Meeting, Cape Town, South Africa	2016
Drifting through the Cosmic Web, Aix-en-Provence, France	2015
The Many Pathways to Galaxy Growth, Prato, Italy	2015

## COLLOQUIA AND SEMINARS

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*Total number: 24*

Princeton, Princeton, NJ, USA	2019
Rutgers University, New Brunswick, NJ, USA	2019
Yale University, New Haven, CT, USA	2019
University of Maryland, College Park, MD, USA	2019
Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA	2019
National Radio Astronomy Observatory, Charlottesville, VA, USA	2019
Swinburne University of Technology, Melbourne, Australia	2019
Carnegie Observatories, Pasadena, CA, USA	2018
York University, York, Canada	2018

Royal Military College of Canada, Kingston, Canada	2018
Queens University, Kingston, Canada	2018
University of Victoria, Victoria, Canada	2018
National Research Council Hertzberg Astronomy and Astrophysics, Victoria, Canada	2018
University of British Columbia, Vancouver, Canada	2018
McMaster University, Hamilton, Canada	2017
Liverpool John Moores University, Liverpool, UK	2016
Max Planck Institute for Extraterrestrial Physics, Garching, Germany	2016
European Southern Observatory, Garching, Germany	2016
University College London, London, UK	2016
University of Hertfordshire, Hatfield, UK	2016
LERMA, l'Observatoire de Paris, Paris, France	2016
Institut d'astrophysique de Paris, Paris, France	2016
ICRAR, University of Western Australia, Perth, Australia	2015
Centre de Recherche Astrophysique de Lyon, Lyon, France	2015

## **PUBLIC SPEAKING AND COMMUNICATION**

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### **Award-winning public talks**

- Speaking to audiences of 700+, including the March for Science, the British Council's Famelab Australia Final, British live event series Cosmic Shambles

### **Media coverage**

- Stories on my research have been featured in The Sun (UK), New York Post, Scientific American, Space.com, Gizmodo, IFL Science, among others

### **Media commentary**

- Providing comment on STEM issues for local and national media, including The Conversation, CBC/Radio-Canada, Australian Broadcasting Corporation

## **LEADERSHIP ROLES OUTSIDE ASTRONOMY**

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<b>Chair, Negotiating Committee</b>	October 2018 - December 2020
<i>Canadian Union of Public Employees - Local 3906</i>	<i>Hamilton, Canada</i>
· Elected to represent all postdocs in contract negotiations with McMaster University leadership	
<b>Field Director</b>	July - October 2018
<i>Municipal Council Election Campaign</i>	<i>Hamilton, Canada</i>
<b>Senior Field Organiser</b>	April - June 2018
<i>Ontario New Democratic Party</i>	<i>Hamilton, Canada</i>
<b>Political Action Committee Member</b>	January - September 2018
<i>Canadian Union of Public Employees - Local 3906</i>	<i>Hamilton, Canada</i>

## **SURVEY MEMBERSHIPS**

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VERTICO (Virgo Environment Traced in CO, PI Brown)

CANUCS (Canadian NIRISS Unbiased Cluster Survey, external collaborator, PI Willott)

DOWSING (Dust Observations With Scuba-2 In Nearby Galaxies, PI Smith)

WALLABY (The ASKAP HI All-Sky Survey, PIs Koribalski, Staveley-Smith)

JINGLE (JCMT dust and gas In Nearby Galaxies Legacy Exploration, PI Wilson)

HIX (HI eXcess galaxy survey, PI Lutz)

Since beginning my PhD I have 17 total publications, 15 of which are refereed articles published in leading journals (e.g., *Astronomy & Astrophysics* - impact factor = 6.2, *The Astrophysical Journal* - IF = 5.58, *Monthly Notices of the Royal Astronomical Society* - IF = 5.23).

As of 16 July, 2020, my total citation count is 302, and my first author citation count is 158 at an average of 40 citations per first author paper. For context, I am less than three years from my PhD (Sept. 2017).

## REFEREED JOURNAL ARTICLES

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15. Lutz, K. A.; Kilborn, V.; Catinella, B.; Cortese, L.; **Brown, T.**; Koribalski, B., 2020, *The HIX galaxy survey III: The gas-phase metallicity in HI eXtreme galaxies*, *A&A*, 635, id.A69
14. Gao, Y.; Xiao, T.; Li, C.; Jiang, X.; Tan, Q.; Gao, Y.; Wilson, C.D.; Bureau, M.; Saintonge, A.; Sánchez-Gallego, J.R.; **Brown, T.**; Clark, C.J.R.; Hwang, H.S.; Lamperti, I.; Lin, L.; Liu, L.; Lu, D.; Pan, H.; Sun, J.; Williams, T.G., 2019, *Estimating the molecular gas mass of low-redshift galaxies from a combination of mid-infrared luminosity and optical properties*, *ApJ*, 887, 2
13. Lamperti, I.; Saintonge, A.; De Looze, I.; Accurso, G.; Clark, C.J.R.; Smith, M.W.L.; Wilson, C.D.; Brinks, E.; **Brown, T.**; Bureau, M.; Clements, D.L.; Eales, S.; Glass, D.H.W.; Hwang, H.S.; Lee, J.C.; Lin, L.; Michalowski, M.J.; Sargent, M.; Williams, T.G.; Xiao, T.; Yang, C., 2019, *JINGLE V: Dust properties of nearby galaxies derived from hierarchical Bayesian SED fitting*, *MNRAS*, 489, 3
12. **Brown, T.** & Wilson, C.D., 2019, *Extreme CO Isotopologue Line Ratios in ULIRGS: Evidence for a Top-heavy IMF*, *ApJ*, 879, 17
11. Stevens, A.R.H.; Diemer, B.; Lagos, C.d.P.; Nelson, D.; Pillepich, A.; **Brown, T.**; Catinella, B.; Hernquist, L.; Weinberger, R.; Vogelsberger, M.; Marinacci, F., 2019, *Atomic hydrogen in IllustrisTNG galaxies: the impact of environment paralleled with local 21-cm surveys*, *MNRAS*, 483, 5334
10. Roberts, I.D.; Parker, L.; **Brown, T.**; Joshi, G.; Hlavacek-Larrondo, J.; Wadsley J., 2018, *Quenching low-mass satellite galaxies: evidence for a threshold ICM density*, *ApJ*, 873, 42
9. Ellison S.L.; **Brown, T.**; Catinella, B.; Cortese, L., 2018, *Atomic gas fractions in active galactic nucleus host galaxies*, *MNRAS*, 482, 5694
8. Saintonge, A.; Wilson, C.D.; Xiao, T.; Lin, L.; Hwang, H.S.; Tosaki, T.; Bureau, M.; Cigan, P.J.; Clark, C.J.R.; Clements, D. L.; De Looze, I.; Dharmawardena, T.; Gao, Y.; Gear, W.K.; Greenslade, J.; Lamperti, I.; Lee, J.C.; Li, C.; Michałowski, M.J.; Mok, A.; Pan, H.A.; Sansom, A.E.; Sargent, M.; Smith, M.W.L.; Williams, T.; Yang, C.; Zhu, M.; Accurso, G.; Barmby, P.; Brinks, E.; Bourne, N.; **Brown, T.** and the JINGLE Survey Team, 2018, *JINGLE, a JCMT legacy survey of dust and gas for galaxy evolution studies - I. Survey overview and first results*, *MNRAS*, 481, 3497
7. Pan, H.A.; Lin, L.; Hsieh, B.-C.; Xiao, T.; Gao, Y.; Ellison, S.L.; Scudder, J.M.; Barrera-Ballesteros, J.; Yuan, F.; Saintonge, A.; Wilson, C.D.; Hwang, H.S.; De Looze, I.; Gao, Y.; Ho, L.C.; Brinks, E.; Mok, A.; **Brown, T.**; Davis, T.A.; Williams, T.G.; Chung, A.; Parsons, H.; Bureau, M.; Sargent, M.T.; Chung, E.J.; Kim, E.; Liu, T.; Michałowski, M.J.; Tosaki, T., 2018, *The Effect of Galaxy Interactions on Molecular Gas Properties*, *ApJ*, 868, 132
6. **Brown, T.**; Cortese, L.; Catinella, B.; Kilborn, V.A., 2018, *The role of atomic hydrogen in regulating the scatter of the mass–metallicity relation*, *MNRAS*, 473, 1868
5. Stevens, A. & **Brown, T.**, 2017, *Physical drivers of galaxy atomic gas content: exploring environmental and evolutionary effects with Dark Sage*, *MNRAS*, 471, 447
4. Lutz, K. A.; Kilborn, V.A.; Catinella, B.; Koribalski, B. S.; **Brown, T.**; Cortese, L.; Denes, H.; Jozsa, G. I. G.; Wong, O. I., 2017, *The HIX galaxy survey I: Study of the most gas rich galaxies from HIPASS*, *MNRAS*, 467, 1083

3. Janowiecki, S.; Catinella B.; Cortese, L.; Saintonge, A.; **Brown, T.**, Wang, J., 2017, *xGASS: Exceptionally gas-rich central galaxies in small groups and their connections to pre-processing and galaxy evolution*, MNRAS, 466, 4795
2. **Brown, T.**; Catinella, B.; Cortese, L.; Lagos, C.d.P. ; Dave, R.; Kilborn, V.A.; Haynes, M.P.; Giovanelli, R.; Rafiee-Rantsoa, M., 2017, *Cold gas stripping in satellite galaxies: from pairs to clusters*, MNRAS, 466, 1275
1. **Brown, T.**; Catinella, B.; Cortese, L.; Kilborn, V.A.; Haynes, M.P.; Giovanelli, R., 2015, *The effect of structure and star formation on the gas content of nearby galaxies*, MNRAS, 452, 2479

## WHITE PAPERS

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1. Ngo, H.; Kirk, H.; **Brown, T.**; Woods, T.E.; Eadie, G.; Lawler, S.; Spencer, L., 2019, *Opportunities and Outcomes for Postdocs in Canada*, arXiv:1911.10320
2. Spekkens, K.; Chiang, C.; Kothes, R.; Rosolowsky, E.; Rupen, M.; Safi-Harb, S.; Sievers, J.; Sivakoff, G.; Stairs, I.; van der Marel, N.; Abraham, B.; Alexandroff, R.; Bartel, N.; Baum, S.; Bietenholz, M.; Boley, A.; Bond, D.; Brown, J.; **Brown, Toby**; ..., 2019, *Canada and the SKA from 2020-2030*, arXiv:1911.03250