

## AJAY GILL

Department of Astronomy & Astrophysics  
University of Toronto  
50 St. George Street  
Toronto, ON, Canada M5S 3H4

145 St George Street  
Toronto, ON M5R 2M1  
437-985-4209  
ajay.gill@mail.utoronto.ca  
ajaygill.com

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### EDUCATION

**Doctor of Philosophy**, Astronomy & Astrophysics, **Univ. of Toronto** Sep 2018 - Nov 2023  
**Master of Engineering**, Electrical & Computer Engineering, **Univ. of Toronto** Sep 2016 - June 2018  
**Bachelor of Science**, Electrical & Computer Engineering, **Univ. of Manitoba** Sep 2010 - June 2015

### RESEARCH INTERESTS

Cosmology, astronomical instrumentation, detector characterization, small satellites, optical communications

### RESEARCH EXPERIENCE

**Postdoctoral Research Associate** Nov 2023 - present

**Department of Aeronautics and Astronautics, MIT, Cambridge, MA**

Working on coronagraphs, algorithms for exoplanet imaging, cubesats for laser communications in the MIT STAR lab with Dr. Kerri Cahoy.

**Graduate Research Project** May 2019 - Sep 2023

**Department of Astronomy & Astrophysics, Toronto, ON**

Instrumentation, calibration, and analysis for the *SuperBIT* project with the Balloon Astrophysics Group under the supervision of Dr. Barth Netterfield. *SuperBIT* is a near-UV to near-IR high resolution, wide field of view balloon-borne telescope with the goal of observing weak gravitational lensing around clusters of galaxies. *SuperBIT* will launch on a 100-night flight from Wanaka, NZ with a NASA's superpressure balloon in the spring of 2023.

**Graduate Research Project** June 2021 - Present

**Department of Astronomy & Astrophysics, Toronto, ON**

Modelling of the thermal Sunyaev-Zeldovich (SZ) and kinematic SZ effect of galaxy clusters and filaments using the *Atacama Cosmology Telescope*, under the supervision of Dr. Adam Hincks.

**Graduate Research Project** June 2021 - June 2022

**Department of Astronomy & Astrophysics, Toronto, ON**

Independently developed a low-cost characterization system (photon transfer, noise, quantum efficiency) for CMOS/CCD UV to IR detectors, useful for balloon-borne & small-satellite projects.

**Graduate Research Project** Sep 2018 - April 2019

**Dunlap Institute of Astronomy & Astrophysics, Toronto, ON**

Build the software and hardware infrastructure for the localization of Fast Radio Bursts using *CHIME* and *Algonquin Radio Observatory* under the supervision of Dr. Keith Vanderlinde.

**Visiting Scholar** May - Aug 2018

**Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts**

Investigations on performing wideband VLBI correlation on the cloud under the supervision of Dr. Jonathan Weintraub and Dr. Sheperd Doeleman for the *Event Horizon Telescope*.

**Summer Research Project** May - Aug 2017

**National Radio Astronomy Observatory, Socorro, New Mexico**

Study of water vapor radiometry to calibrate radio wave phase fluctuations caused by variations in tropospheric water vapor for the *Karl G. Jansky Very Large Array* under the supervision of Mr. Robert Selina and Dr. Rick Perley.

**Summer Research Project** May - Aug 2016

**Department of Physics and Astronomy, University of Manitoba**

A Chandra X-ray study of 3C radio galaxies and their environments under the supervision of Dr. Chris O’Dea and Dr. Stefi Baum. Thee work suggests that there is anisotropic diffuse X-ray emission in 3C radio galaxies, with higher emission along radio jet axes due to inverse Compton scattering of CMB photons.

**Summer Research Project**

May - Aug 2014

**Thermodynamics Lab, HRW Weingarten, Germany**

Study of the energy efficiency of a pelton generator under the supervision of Dr. Gerd Thieleke through the Baden-Württemberg Foundation Scholarship.

**PROFESSIONAL EXPERIENCE**

**Intern**

Oct 2015 - Feb 2016

**United Nations Headquarters, Manhattan, NY**

Assist the Engineering team under Ms. Mary Hutchinson and Ms. Liana Santoro.

**Junior Fellow**

May - Aug 2013

**Engineers Without Borders Canada, Chereponi District, Ghana**

Under the supervision of Dr. Mark Boots, research and implement wireless communication system, VOTO Mobile, to allow rural Ghanaians who own cellphones to communicate their health care needs with the local government. VOTO Mobile has since then evolved into *Viamo* and reaches millions of people per month in Africa and Asia.

**TEACHING EXPERIENCE**

- Teaching Assistant: AST 101: *The Sun and Its Neighbours*, Fall 2018, 2020, 2021, 2022.
- Teaching Assistant: AST 121: *Origin and Evolution of the Universe*, Winter 2021.
- Teaching Assistant: AST 201: *Stars and Galaxies*, Winter 2018, 2020, 2022.
- Instructor: *Dunlap Institute Virtual Summer School*, Summer 2021. I developed and ran the Optical Instrumentation Jupyter Notebook based virtual lab for students from around the world.
- Instructor: *Dunlap Institute Summer School*, Summer 2019. I ran the X-ray detector lab for students from around the world.

**MENTORING EXPERIENCE**

- Aditya Chugh, Undergraduate Student, Department of Physics, Univ. of Toronto, May - August 2022.
- Riley Zurrin, Graduate Student, Department of Physics, Univ. of Toronto, May - August 2022.
- Amber King, Undergraduate Student, Department of Physics, Univ. of Toronto, May - August 2021.
- Matthew Leung, Undergraduate Student, Astronomy Mentorship Program, Winter 2021.
- Katherine Karababas, Undergraduate Student, Astronomy Mentorship Program, Winter 2021.

**EXTRACURRICULAR AND OUTREACH EXPERIENCE**

- Regularly volunteered at *Astronomy on Tap*, Toronto.
- Assisted with public Planet Viewing parties at the University of Toronto.
- Volunteer and gave public talks as part of the *AstroTours* series.
- Lead the *Astronomy Instrumentation Journal Club* at the University of Toronto. This consists of organizing the schedule of the talks as well as inviting internal and external speakers.
- Member of the *Graduate Astronomy Student Association: Course and Qualifying Exams Committee*.

## HONORS AND AWARDS

- Queen Elizabeth II/ Walter John Helm Graduate Scholarship in Science & Technology (2021, 2022)
- Mary And Ron Martin Graduate Fellowship in Astrophysics (2020, 2021)
- University of Toronto School of Graduate Studies Conference Grant (2018, 2019)
- USNC-URSI 2018 Travel Fellowship for National Radio Science Meeting (2018)
- University of Toronto Electrical and Computer Engineering Fellowship (2016, 2017)
- University of Manitoba Emerging Leader Award (2014, 2015)
- Baden-Württemberg Foundation Scholarship (2014)

## SKILLS

- Hardware: analogue and digital electronics, power systems, gyroscopes, encoders, accelerometers, machine shop skills, radio and optical astronomy instrumentation, detector characterization
- Software: Python, C, Matlab, Solidworks, Latex, Bash, Verilog, and Assembly
- Analysis: Bayesian analysis, maximum likelihood, MCMC, parameter inference, machine learning

## Membership in Scientific Collaborations

- Atacama Cosmology Telescope
- Simons Observatory
- SuperBIT

## REFERENCES

- Prof. Kerri Cahoy, Department of Aeronautics and Astronautics, MIT  
Tel.: 650 814 8148, Email: kerri.cahoy@gmail.com  
Relationship: Postdoc research supervisor
- Prof. Barth Netterfield, Department of Physics/Astronomy and Astrophysics, Univ. of Toronto  
Tel.: 416 845 0946, Email: barth.netterfield@utoronto.ca  
Relationship: Graduate research supervisor
- Prof. Adam D. Hincks, Dept of Astronomy and Astrophysics/St. Michael's College, Univ. of Toronto  
Tel.: 416 926 2074, Email: adam.hincks@utoronto.ca  
Relationship: Graduate research supervisor
- Prof. William C. Jones, Department of Physics, Princeton University  
Tel.: 609 258 4413, Email: wcjones@princeton.edu  
Relationship: Graduate research collaborator
- Prof. Keith Vanderlinde, Dunlap Institute for Astronomy and Astrophysics, Univ. of Toronto  
Tel.: 416 946 5436, Email: vanderlinde@dunlap.utoronto.ca  
Relationship: Graduate research supervisor (AST 1501 project)
- Dr. Sheperd Doeleman, Event Horizon Telescope, Harvard-Smithsonian Center for Astrophysics  
Tel.: 617 496 7762, Email: sdoeleman@cfa.harvard.edu  
Relationship: Summer research supervisor
- Prof. Chris O'Dea, Department of Physics and Astronomy, University of Manitoba  
Tel.: 204 474 9863, Email: christopher.o'dea@umanitoba.ca  
Relationship: Summer research supervisor
- Mr. Robert Selina, Next Generation VLA Project Engineer, NRAO  
Tel.: 505 239 9719, Email: rselina@nrao.edu  
Relationship: Summer research supervisor

## Publications (first author)

- **Gill, A.**, et al. *A Low-Cost Ultraviolet-to-Infrared Absolute Quantum Efficiency Characterization System Of Detectors*, SPIE Astronomical Telescopes and Instrumentation, X-Ray, Optical, and Infrared Detectors for Astronomy, **12191-39**, June 2022.
- **Gill, A.**, Boyce, M. M., O’Dea, C. P., Baum, S. A., Kharb, P., Campbell, N., Tremblay, G. R., Kundu, S., *Extended X-Ray Emission Associated with the Radio Lobes and the Environments of 60 Radio Galaxies*, *ApJ* **912** 88. May 2021.
- **Gill, A.**, Benton, S. J., Brown, A. M., Clark, P., Damaren, C. J., Eifler, T., Fraisse, A. A., M., Galloway, M. N., Hartley, J. W., Holder, B., Huff, E. M., Jauzac, M., Jones, W. C., Lagatutta, D., Leung, J., Li, L., Luu, T., Massey, R. J., McCleary, J., Mullaney, J., Nagy, J., Netterfield, C. B., Redmond, S., Rhodes, J. D., Romualdez, L. J., Schmoll, J., Shaaban, M., Sirks, E., Sivanandam, S., Tam, S. *Optical Night Sky Brightness Measurements From The Stratosphere*. *AJ* **160** 266. Nov 2020.
- **Gill, A.**, Blackburn, L., Roshanineshat, A., Chan, C. K., Doeleman, S., Johnson, M., Raymond, A. W., Weintroub, J. *Prospects of Wideband VLBI Correlation in the Cloud*. *PASP* **131** 124501. Oct 2019.
- **Gill, A.**, Selina, R., Butler, B., Jackson, J., Perley, R., Hennies, C., Koski, W., Peck, G., Grammer, W., Willoughby, B. *A Study of the Compact Water Vapor Radiometer for Phase Calibration of the Karl G. Jansky Very Large Array*. National Radio Astronomy Observatory EVLA Memo Series, EVLA Memo 203. July 2018. arXiv:1807.01690.

#### Publications (co-author)

- Sirks, Ellen L., Massey, R., **Gill, A. S.**, et al. *Data Downloaded via Parachute from a NASA Super-Pressure Balloon*. *Aerospace*, Volume 10, Issue 11, id. 960.
- van Marrewijk, Di Mascolo, J. L., **Gill, A. S.** et al. *XLSSC 122 caught in the act of growing up: Spatially resolved SZ observations of a  $z = 1.98$  galaxy cluster*. *Astronomy and Astrophysics Journal*, Nov 7, 2023.
- McCleary, J. E., Everett, S. W., Shaaban, M. M., **Gill, A. S.**, Vassilakis, G. N., Huff, E. M., Massey, R. J., Benton, S. J., Brown, A. M., Clark, P. et al. *Lensing in the Blue. II. Estimating the Sensitivity of Stratospheric Balloons to Weak Gravitational Lensing*. *Astronomical Journal*, 2023, 166, 13.
- Shaaban, M., **Gill, A.** et al., *Weak Lensing in the Blue: A Counter-intuitive Observational Strategy for Stratospheric Imaging*, *Astronomical Journal*, Volume 164, Issue 6, id.245, 11 pp, 2022.
- Radiconi, F., Vacca, V., Battistelli, E., Bonafede, A., Capalbo, V., Devlin, M., Di Mascolo, L., Feretti, L., Gallardo, P., **Gill, A.**, Giovannini, G., Govoni, F., Guan, Y., Hilton, M., Hincks, A., Hughes, J., Iacobelli, M., Isopi, G., Loi, F., Moodley, K., Mroczkowski, T., Murgia, M., Orru, E., Paladino, R., Partridge, B., Sarazin, C., Orłowski S, J., Sifón, C., Vargas, C., Vazza, F., Wollack, E. J. *The Thermal And Non-Thermal Components Within And Between Galaxy Clusters Abell 399 And Abell 401*, accepted to *MNRAS*, Oct 2022.
- Cassanelli, T. et al. (co-author as part of the **CHIME/FRB collaboration**), *Localizing FRBs Through VLBI With The Algonquin Radio Observatory 10-m Telescope*, *Astronomical Journal*, 163, 65, Jan 2022.
- Sirks, E. et al. (co-author as part of **SuperBIT collaboration**), *Download By Parachute: Retrieval Of Assets From High Altitude Balloons*, *JINST*, 15, P05014, May 2020.
- Romualdez, L. J. et al. (co-author as part of **SuperBIT collaboration**), *Robust Diffraction-Limited NIR-To-NUV Wide-Field Imaging From Stratospheric Balloon-Borne Platforms – SuperBIT Science Telescope Commissioning Flight And Performance*, *RSI*, 92, 0019901, Nov 2019.
- Josephy, A. et al. (co-author as part of the **CHIME/FRB collaboration**), *CHIME/FRB Detection Of The Original Repeating Fast Radio Burst Source FRB 121102*, *ApJL*, 882, L18, Sep 2019.
- **Co-author as part of the CHIME/FRB collaboration**, *A Second Source Of Repeating Fast Radio Bursts*, *Nature*, 566, 235-238, Jan 2019.