Dennis Lee

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Research Interests

polarization, star formation, magnetic fields, interstellar medium, dust, astrophysical instrumentation, data reduction, software pipelines

Education

2018 – 2024 (expected)
Northwestern University – Evanston, IL
PhD, Astronomy
Advisor: Giles Novak

2012 – 2016
Harvard University – Cambridge, MA
Bachelor of Arts, Astrophysics and Physics
Thesis Advisor: Cara Battersby

Research Experience

Sep 2018 – present
Northwestern University - Dept. of Physics and Astronomy
Graduate Student, *Advisor: Prof. Giles Novak*
Led the construction, installation, and commissioning of the half-wave plate rotator for the TolTEC instrument. Reduced and analyzed polarization data from the HAWC+ instrument.

Sep 2015 — Sep 2016
Center for Astrophysics | Harvard & Smithsonian
Undergraduate Researcher, *Advisor: Dr. Cara Battersby*
Imaged interferometric data from the CMZoom SMA Legacy Survey supplemented with single-dish data from the Bolocam Galactic Plane Survey and Atacama Pathfinder Experiment.

Sep 2014 — May 2015
Center for Astrophysics | Harvard & Smithsonian
Undergraduate Researcher, *Advisor: Dr. Martin Elvis*
Determined the convergence of near-Earth object orbital parameters to assess objects for future mission planning using a software pipeline by using both preexisting C++ and python software.

Professional Experience

Mar 2018 – Jul 2018 **Senior Analyst, Business Intelligence – Wayfair, LLC** – Boston, MA
Provided accurate reporting for the marketing department with a focus on email and notification marketing. Constructed and maintained a central, authoritative source of email marketing data for the company.

Jul 2016 – Mar 2018 **Analyst, Business Intelligence – Wayfair, LLC** – Boston, MA
Managed and analyzed marketing datasets with billions of data points regularly. Conducted ad-hoc analyses for both marketing and operational verticals of the company. Rebuilt existing OLAP reporting tools for email and other marketing notifications to be more accurate, timely, and responsive

Principal Investigator Proposals Awarded

2023 **Dust Polarization of Rho Oph A: Probing the Missing Spatial Scales**
ALMA Cycle 10, 33 hours.

2023 **Characterizing the Multiplicity of Protostellar Systems in Mon R2**
Keck Observatory, NIRC2, 0.5 nights.

Teaching Experience

Spring 2020 **Teaching Assistant, Northwestern University**
ASTRON 220: Introduction to Astrophysics

Winter 2020 **Teaching Assistant, Northwestern University**
ASTRON 102: Milky Way Galaxy

Fall 2019 **Teaching Assistant, Northwestern University**
PHYSICS 136: General Physics Laboratory (Mechanics)

Oral Presentations

25 May 2023 **A far-infrared view of the magnetic field in star formation: comparing SOFIA/HAWC+ polarization measurements with simulations**
Midwest Magnetic Field Workshop
University of Wisconsin–Madison, Madison, Wisconsin (Virtual)

2 Mar 2022 **Relative Orientation of Magnetic Field and Cloud Structure in L1688**
Our Galactic Ecosystem: Opportunities and Diagnostics in the Infrared and Beyond
UCLA Lake Arrowhead Lodge, Lake Arrowhead, California

16 Feb 2022 **Relative Orientation of Magnetic Field and Cloud Structure in L1688**
SOFIA Community Tele-Talk Series *(Virtual)*

23 Jun 2021 **Magnetic Field and Elongated Cloud Structure in L1688**
Magnetic Fields and the Structure of the Filamentary Interstellar Medium
SOFIA Science Series (Virtual)

11 Dec 2020 **Polarization Modulation and Half-Wave Plate Rotator**
TolTEC National Science Foundation Annual Site Visit
University of Massachusettes, Amherst (Virtual)

Poster Presentations

26 Jun 2023 **Relative Orientation of Magnetic Field and Cloud Structure in L1688**
Stars @ Lyon 2023
CPE Lyon, Villeurbanne, France

20 Jul 2022 **Polarimetric Commissioning for TolTEC**
SPIE Astronomical Telescopes + Instrumentation 2022
Montréal, Québec, Canada

Mentorship

2021 – 2022 **Research Mentor for Hailin Wang, Northwestern University**
Master's Thesis: *Probing the Submillimeter Polarization Spectrum of Bright Galactic Clouds*
Currently: Ph.D. Student at Northwestern University

Service and Outreach

2022 – present **CIERA Connections**, Founding Organizer
Organized the logistics and visit of individuals with astronomy or physics graduate degrees, but currently work outside of traditional academia.

2021 – present **Harvard College**, Alumni Interviewer
Interviewed applicants in the Chicago area applying to Harvard College as undergraduates.

2018 – present **Astronomy on Tap**, Organizer, Host
Serve as the host for free public events with scientific talks broadly accessible to the public.

2022 – 2023 **Research Experiences in Astronomy at CIERA for High School Students (REACH)**, Organizer, Speaker
Reviewed applications and gave introductory scientific talks about astronomy.

2021 **Data Science for the Public Good Conference**, Organizer, Speaker
Developed and taught material at a conference exposing high school students to broad applications of data science.

Professional Affiliations

2023 – present **American Astronomical Society**, *Graduate Student Member*

2022 – present **TolTEC Collaboration**, Atmosphere Removal Working Group, *Coordinator*

2021 – present **Pan-Experiment Galactic Science Group**, *Member*

2021 – present **TolTEC Collaboration**, Science Team, *Member*

2018 – present **TolTEC Collaboration**, Instrument Team, *Member*

2023 **SPIE**, *Student Member*

Technical Skills

Programming Languages

Python: Experience with data reduction, analysis, and package development.
C/C++: Experience in writing control software.
SQL: Experience with PostgreSQL, Vertica, MySQL, and MS SQL databases.

Software

SolidWorks: Experience with 3D design and modeling.
EAGLE: Experience with circuit board design and manufacturing.
Experience with Matlab and Mathematica.

Laboratory

CNC Machining: Experience fabricating and machining custom components.

Computing

High Performance Computing: Experience with SLURM, OpenMP, and OpenMPI.
Unix-like: Experience with shell scripting.

Telescope Operation

Experience operating the 16-inch Clay Telescope, the 1.2 Meter Millimeter-Wave Telescope, the Submillimeter Array (SMA), and the Large Millimeter Telescope (LMT).

Languages

Fluent in Cantonese and written traditional Chinese.

Refereed Publications

2022 **The Twisted Magnetic Field of the Protobinary L483**
The Astrophysical Journal, 932, 34
Cox, E. G., Novak, G., Sadavoy, S. I., Looney, L. W., **Lee, D.**, Berthoud, M., Bourke, T. L., Coudé, S., Encalada, F., Fissel, L. M., Harrison, R., Houde, M., Li, Z.-Y., Myers, P. C., Pattle, K., Santos, F. P., Stephens, I. W., Wang, H., and Wolf, S.

2021 **HAWC+/SOFIA Polarimetry in L1688: Relative Orientation of Magnetic Field and Elongated Cloud Structure**

The Astrophysical Journal, 918, 39

Lee, D., Berthoud, M., Chen, C.-Y., Cox, E. G., Davidson, J. A., Encalada, F. J., Fissel, L. M., Harrison, R., Kwon, W., Li, D., Li, Z.-Y., Looney, L. W., Novak, G., Sadavoy, S., Santos, F. P., Segura-Cox, D., and Stephens, I.

Refereed Publications In Progress

2023 **Modeling the Far-Infrared Polarization Spectrum of a Heterogeneous Molecular Cloud**

in prep, to be submitted to The Astrophysical Journal

Lee, D., Chen, C.-Y., Novak, G., Chuss, D. T., Cox, E. G., Berthoud, M., Karpovich, K., Ashton, P., Berthoud, M., Guerra, J., Harper, D., Li, Z.-Y., Michail, J.M., Zeng, L.

2023 **An ambient temperature continously rotating half-wave plate rotator for the TolTEC millimeter wave polarimeter**

in prep, to be submitted to the Review of Scientific Instruments

Lee, D., Novak, G., Berthoud, M., et al.

Non-Refereed Publications/Proceedings

2022 **The TolTEC camera: polarimetric commissioning and performance of the continuously rotating half-wave plate**

Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI, 12190, 121901O

Lee, D., Novak, G., Berthoud, M., Bussan, J., Golenia, R., Van Clepper, E., Wilson, G., DeNigris, N. S., Ma, Z., McCrackan, M., Souccar, K., Fissel, L., Bij, A., Thiel, F., Aretxaga, I., Ferrusca, D., Mauskopf, P., Lunde, E., Ade, P., Tucker, C., Pisano, G., Cox, E. G., Sabin, L., Carrasco-Gonzalez, C., Pasetto, A., Gómez-Ruiz, A., Hull, C., Austermann, J., Beall, J., Gao, J., and Vissers, M.

2022 **The TolTEC camera: optical alignment and characterization**

Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy XI, 12190, 1219016

Lunde, E., Berthoud, M., DeNigris, N. S., Doyle, S., Ferrusca, D., Golec, J. E., Kuczarski, S., **Lee, D.**, Ma, Z., Mauskopf, P., McCrackan, M., McMahon, J., Novak, G., Pisano, G., Simon, S., Souccar, K., Tucker, C., Underhill, M., Van Camp, E., and Wilson, G. W.

2022 **The TolTEC camera: the citlali data reduction pipeline engine**
Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 12189, 121891H
McCrackan, M., Ma, Z., DeNigris, N. S., Ryan, C., Souccar, K., Wilson, G. W., Aretxaga, I., Bij, A., Fissel, L., Golec, J. E., Gutermuth, R., **Lee, D.**, Novak, G., Thiel, F., Walker, S., and Zaragoza-Cardiel, J.

2020 **The optical design and performance of TolTEC: a millimeter-wave imaging polarimeter**
Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 11453, 114534A
Lunde, E., Ade, P., Berthoud, M., Contente, R., DeNigris, N. S., Doyle, S., Ferrusca, D., Golec, J., Kuczarski, S., **Lee, D.**, Ma, Z., Mauskopf, P., McCrackan, M., McMahon, J., Novak, G., Pisano, G., Simon, S., Souccar, K., Tucker, C., Underhill, M., Van Camp, E., and Wilson, G.

2020 **The TolTEC data analysis pipeline and software stack**
Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, 11452, 114522O
Ma, Z., McCrackan, M., DeNigris, N. S., Souccar, K., Wilson, G. W., Horton, P., **Lee, D.**, Mauskopf, P., Novak, G., Rodríguez-Montoya, I., and Zaragoza-Cardiel, J.

2020 **The TolTEC camera: an overview of the instrument and in-lab testing results**
Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy X, 11453, 1145302
Wilson, G. W., Abi-Saad, S., Ade, P., Aretxaga, I., Austermann, J., Ban, Y., Bardin, J., Beall, J., Berthoud, M., Bryan, S., Bussan, J., Castillo, E., Chavez, M., Contente, R., DeNigris, N. S., Dober, B., Eiben, M., Ferrusca, D., Fissel, L., Gao, J., Golec, J. E., Golina, R., Gomez, A., Gordon, S., Gutermuth, R., Hilton, G., Hosseini, M., Hubmayr, J., Hughes, D., Kuczarski, S., **Lee, D.**, Lunde, E., Ma, Z., Mani, H., Mauskopf, P., McCrackan, M., McKenney, C., McMahon, J., Novak, G., Pisano, G., Pope, A., Ralston, A., Rodriguez, I., Sánchez-Argüelles, D., Schloerb, F. P., Simon, S., Sinclair, A., Souccar, K., Torres Campos, A., Tucker, C., Ullom, J., Van Camp, E., Van Lanen, J., Velazquez, M., Vissers, M., Weeks, E., and Yun, M. S.