Charles J. Law – Curriculum Vitae

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EDUCATION

Ph.D., Astronomy and Astrophysics, Harvard University, Cambridge, MA — 2018 – Present
Thesis: Zooming in on the Chemistry of Star and Planet Formation
Advisor: Prof. Karin I. Öberg

B.A., Physics and Astrophysics, Harvard University, Cambridge, MA — 2013 – 2017
Thesis: Carbon Chain Molecules Toward Embedded Low-Mass Protostars
Advisor: Prof. Karin I. Öberg

AWARDS

ALMA Ambassador	2022
NSF Graduate Research Fellowship	2019
Smithsonian Astrophysical Observatory Research Fellowship	2017
Leo Goldberg Prize in Astronomy, Harvard University	2017
Thomas Temple Hoopes Prize, Harvard University	2017
Phi Beta Kappa, Harvard University	2017
Frederick Tarantino Memorial Scholarship Award, USRA	2016
PRISE Undergraduate Research Fellowship, Harvard University	2016
Detur Book Prize, Harvard University	2014
John Harvard Scholar, Harvard University	2014

PUBLICATIONS

Author of 39 publications (refereed or under review), including **10 as first author** and 4 as second/third author with major contributions. See a full listing at the end of CV and ADS library for more details.
[h-index = 15; 534 total citations (as of Sept 26, 2022)]

SELECTED TALKS

I have given **44 talks**, including 8 invited and 11 public talks. See a full listing at the end of CV.

Invited

Lunch Talk, University of Virginia/NRAO	Nov 2021
Astrochemistry Discussions	Nov 2021
Leiden Astrochemistry Seminar	Oct 2021
Origins Seminar, University of Arizona	May 2021

Contributed

From Clouds to Planets II, Berlin, Germany [*expected*]	Oct 2022
Exoplanets IV, AAS Topical Conference Series, Las Vegas	May 2022
AstroCheminar, American Chemical Society	Jan 2022
Chemical processes in Solar-type star forming regions, Turin, Italy	Sept 2021
Space Telescope, 2021 Spring Symposium	Apr 2021
Science with the SMA: Present and Future, Taipei, Taiwan	Oct 2019

Public

Atwood Museum (July 2022), Cape Cod Museum of Natural History (Nov 2021, July 2022),
Cape Cod Astronomical Society (Jan 2021), Gloucester Area Astronomy Club (Sept 2018, May 2020)

TELESCOPE OBSERVING & PROPOSALS

PI of **10 programs** and Co-I on an additional 42 programs for access to observing facilities.

PI

1.	Linking Ice and Complex Molecule Inventories in MYSOs	**ALMA**, A, 5.4 hrs, Cycle 9
2.	Witnessing Giant Planet Formation in the Act	**ALMA**, B, 6.0 hrs, Cycle 9
3.	Search for a Surviving Stellar Companion of Nearby SNRs E0102/N132D	**Magellan**, 2.5 nights, 2022B
4.	Connecting Scaling Laws between Exoplanets and Young Disks	**SMA**, B-Tracks, 2020B+21A
5.	Jet-like, IR-bright Ejecta in O-rich LMC Supernova Remnant N132D	**Magellan**, 3 nights, 2021B
6.	Jet-like, IR-bright Ejecta in O-rich LMC Supernova Remnant N132D	**Magellan**, 4 nights, 2020B
7.	Ionized Accretion Flows around 0.1 pc Scale Clusters with O-Type Stars	**ALMA**, C, 14.8 hrs, Cycle 7
8.	Jet-like, IR-bright Ejecta in O-rich LMC Supernova Remnant N132D	**Magellan**, 3 nights, 2019B
9.	Formation of O Stars by Accretion of Ionized Gas	**VLA**, A, 11 hrs, 2019A
10.	Ionized Accretion Flows around 0.1 pc Scale Clusters with O-Type Stars	**SMA**, B-Trakcs, 2018B+19A

Co-I

ALMA (375.9 hrs), **ACA** (63.6 hrs), **SMA** (208 hrs), **VLA** (16.5 hrs), **NOEMA** (56 hrs), **GBT** (13.75 hrs), **VLBA** (72 hrs), **IRAM 30m** (49.7 hrs), **JWST** (20.6 hrs), **Chandra** (190 ks), **HST** (3 orbits), **VLT** (12 hrs), **Gemini** (5 hrs), **WIYN** (1.5 nights), **Lick/Shane 3m** (10 nights), **MMT** (0.5 nights)

Observing Experience:

SMA,15 nights (2016 – 2018); **Magellan**, 5.5 nights (2019, 2021, 2022); **MMT**, 1 night (2016)

Funding:

ALMA Ambassador, Research Grant (**$10,000**)
Harvard Data Science Initiative Research Fund, Regularized Maximum Likelihood Imaging: A New Method for Detecting Planets (**$9,700**; Collaborator, PI: R. Teague)
NRAO Student Observing Support, VLA 2019A, 2019 (**$33,601**; Advisor: Q. Zhang)
ALMA Student Observing Support, ALMA Cycle 4, 2016 (**$9,000**; Advisor: Q. Zhang)

MAJOR COLLABORATIONS

Molecules with ALMA at Planet-forming Scales (MAPS) 2018 – Present
PI: Karin I. Öberg; co-PIs: Yuri Aikawa, Edwin A. Bergin, Viviana V. Guzmán, Catherine Walsh
ALMA Cycle 6 Large Program to study the chemistry of five protoplanetary disks at 10-20 au scales

N132D Chandra Legacy Team 2019 – Present
PI: Paul P. Plucinsky
Chandra Cycle 20 Large Program legacy observations of N132D at unprecedented depth

TEACHING

Teaching Fellow

Interstellar Medium and Star Formation (Graduate, Harvard University)	Spring 2021
Stellar and Planetary Astronomy (Undergraduate, Harvard University)	Spring 2020
Introduction to Scientific Programming in Python (Harvard Pre-College Program)	Summer 2019, 2020
Physics I (Lab): Mechanics, Elasticity, Fluids, and Diffusion (Harvard University)	Fall 2017

Instructor

Introduction to Scientific Programming in Python (Harvard Pre-College Program)	Summer 2021, 2022
Scientific Computing with SciPy, Python Workshop (SAO Latino Initiative Program)	Summer 2021, 2022

Pedagogy Training and Teaching Awards

Science Education Undergraduate Mentoring Workshop Series (Harvard University)	Spring 2022
Derek Bok Teaching Certificate (Harvard University)	2021
Derek Bok Certificate of Excellence and Distinction in Teaching (Harvard University)	Spring 2021

OUTREACH

Course Coordinator, Beacon Hill Seminar, Unveiling the Cosmos	Spring, Fall 2021
Guest, Down to Earth with Terry Virts, Podcast	Feb 2022
Contributing Author, Astrobites	Jan 2019 – Present
AAS Astronomy Ambassador	Jan 2019 – Present
Volunteer, CfA Public Observatory Night	Fall 2017 – Present
Astronomy Advisor, Harvard Undergraduate Science Olympiad	2018 – 2020
Presenter, Flipped Science Fair, John F. Kennedy School	June 2018, May 2019
Speaker, Science Research Mentoring Program, Cambridge Rindge and Latin School	Mar 2018
Seminar Leader, Harvard Summit for Young Leaders in China	Aug 2017

PROFESSIONAL ACTIVITIES

Referee, A&A, A&A Letters, ApJ, ApJS	2018 – Present
AAS Chambliss Competition Poster Judge	Summer 2022
Co-Organizer, CfA Star Formation Journal Club	2022 – Present
Subject Matter Expert, NASA Community College Network	2022 – Present
Subject Matter Expert, NASA JWST Community Events	2021 – Present
Member, CfA APS-IDEA, Accessibility Subcommittee	2021 – Present
Peer Mentor, Harvard Astronomy Department	2021 – Present
Co-Organizer, Grad School Visitation Days	Spring 2020
Co-Organizer, Student-Faculty Lunch Series	Spring 2020

MENTORING

I have served as a primary science advisor for four students and co-advisor for one student:

Sarai Rankin (Morgan State University, REU Undergraduate) — Summer 2022 – Present
SMA survey of protoplanetary disks in the Cepheus OBb3 star-forming region

Arielle Frommer (Harvard University, Undergraduate) — Summer 2022 – Present
Spatially-resolved nitrile chemistry in a sample of massive young stellar objects

Sage Crystian (Harvard University, Undergraduate) — Summer 2021
Mapping the vertical structure of protoplanetary disks with CO line emission

Prabidhik KC (Harvard University, Undergraduate) — Spring 2020 – Spring 2022
SMA survey of complex chemistry in ultra-compact HII regions

Devin Sullivan (Harvard University, Undergraduate / co-advised with K. Öberg) — Fall 2019
Junior Thesis on the distribution of HCN gas in protoplanetary disks

PUBLICATIONS

A full listing of my publications can be found on ADS.
[Mentees are marked with †]

First Author

1. **Law, C. J.**, Teague, R., Öberg, K. I., et al. 2022. ApJ, subm.
   Mapping Protoplanetary Disk Vertical Structure with CO Isotopologue Line Emission
2. **Law, C. J.**, Crystian, S.†, Teague, R., et al., 2022. ApJ, 932, 114
   CO Line Emission Surfaces and Vertical Structure in Mid-Inclination Protoplanetary Disks
3. **Law, C. J.**, Loomis, R. A., Teague, R., et al., 2021. ApJS, 257, 3
   MAPS III. Characteristics of Radial Chemical Substructures
4. **Law, C. J.**, Teague, R., Loomis, R. A., et al., 2021. ApJS, 257, 4
   MAPS IV. Emission Surfaces and Vertical Distribution of Molecules
5. **Law, C. J.**, Zhang, Q., Öberg, K. I., et al., 2021. ApJ, 909, 214
   Subarcsecond Imaging of the Complex Organic Chemistry in Massive Star-Forming Region G10.6-0.4
6. **Law, C. J.**, Milisavljevic, D., Patnaude, D. J., et al., 2020. ApJ, 894, 73
   Three-dimensional Kinematic Reconstruction of the Optically-Emitting, High-Velocity, Oxygen-Rich Ejecta of Supernova Remnant N132D
7. **Law, C. J.**, Zhang, Q., Ricci, L., et al., 2018. ApJ, 865, 17
   Submillimeter Array Observations of Extended CO (J = 2 – 1) Emission in Interacting Galaxy NGC 3627
8. **Law, C. J.**, Öberg, K. I., Bergner, J. B., et al., 2018. ApJ, 863, 88
   Carbon Chain Molecules Toward Embedded Low-Mass Protostars
9. **Law, C. J.**, Ricci, L., Andrews, S. M., et al., 2017. AJ, 154, 255
   An SMA Continuum Survey of Circumstellar Disks in the Serpens Star-Forming Region,
10. **Law, C. J.**, Milisavljevic, D., Crabtree, K. N., et al. 2017. MNRAS, 470, 3
    TRES Survey of Variable Diffuse Interstellar Bands

Second or Third Author

1. Muñoz-Romero, C. E., Öberg, K. I., **Law, C. J.**, et al., 2022. subm.
   Cold Deuterium Fractionation in the Nearest Planet-Forming Disk
2. Teague, R., **Law, C. J.**, Huang, J., et al., 2021. JOSS, 6, 67
   disksurf: Extracting the 3D Structure of Protoplanetary Disks
3. Zhang, K., Booth, A., **Law, C. J.**, et al., 2021. ApJS, 257, 5
   MAPS V. CO Gas Distributions
4. Guzmán, V. V., Bergner, J. B., **Law, C. J.**, et al., 2021. ApJS, 257, 6
   MAPS VI. Distribution of the Small Organics HCN, C_2H, and H_2CO

Other Co-Authored Publications

1. Banovetz, J., et al. (incl. **Law, C. J.**), 2022. ApJ, subm.
   HST Proper Motion Measurements of Supernova Remnant N132D: Center of Expansion and Age
2. Calahan, J. K., et al. (incl. **Law, C. J.**), 2022. Nature Astronomy, subm.
   UV-driven Chemistry Marks the Late-stages of Planet Formation
3. Pegues, J., et al. (incl. **Law, C. J.**), 2022. ApJ, subm.
   An SMA Survey of Chemistry in Disks around Herbig AeBe Stars
4. Bae, J., et al. (incl. **Law, C. J.**), 2022. ApJL, 934, L20
   MAPS. A Circumplanetary Disk Candidate in Molecular Line Emission in the AS 209 Disk
5. Anderson, A. R., et al. (incl. **Law, C. J.**), 2022. ApJ, in press
   Protostellar and Protoplanetary Disk Masses in the Serpens-Aquila Region

6. Sharda, P., et al. (incl. **Law, C. J.**), 2022. MNRAS, 509, 2
   First extragalactic measurement of the turbulence driving parameter: ALMA observations of the star-forming region N159E in the Large Magellanic Cloud
7. Martín Doménech, R., et al. (incl. **Law, C. J.**), 2021. ApJ, 923, 155
   Hot corino chemistry in the Class I binary source Ser-emb 11
8. Öberg, K. I., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 1
   MAPS I. Program Overview and Highlights
9. Czekala, I., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 2
   MAPS II. CLEAN Strategies for Synthesizing Images of Molecular Line Emission in Protoplanetary Disks
10. Bosman, A. D., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 7
    MAPS VII. Substellar O/H and C/H and Superstellar C/O in Planet-feeding Gas
11. Alarcón, F., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 8
    MAPS VIII. CO Gap in AS 209 – Gas Depletion or Chemical Processing?
12. Ilee, J. D., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 9
    MAPS IX. Distribution and Properties of the Large Organic Molecules HC_3N, CH_3CN, and c-C_3H2
13. Cataldi, G., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 10
    MAPS X. Studying Deuteration at High Angular Resolution toward Protoplanetary Disks
14. Bergner, J. B., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 11
    MAPS XI. CN and HCN as Tracers of Photochemistry in Disks
15. Le Gal, R., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 12
    MAPS XII. Inferring the C/O and S/H Ratios in Protoplanetary Disks with Sulfur Molecules
16. Aikawa, Y., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 13
    MAPS XIII. HCO^+ and Disk Ionization Structure
17. Sierra, A., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 14
    MAPS XIV. Revealing Disk Substructures in Multiwavelength Continuum Emission
18. Bosman, A. D., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 15
    MAPS XV. Tracing Protoplanetary Disk Structure within 20 au
19. Booth, A., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 16
    MAPS XVI. Characterizing the Impact of the Molecular Wind on the Evolution of the HD 163296 System
20. Calahan, J., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 17
    MAPS XVII. Determining the 2D Thermal Structure of the HD 163296 Disk
21. Teague, R., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 18
    MAPS XVIII. Kinematic Substructure in the Disks of HD 163296 and MWC 480
22. Huang, J., et al. (incl. **Law, C. J.**), 2021. ApJS, 257, 19
    MAPS XIX. Spiral Arms, a Tail, and Diffuse Structures Traced by CO around the GM Aur Disk
23. Schwarz, K. (incl. **Law, C. J.**), 2021. ApJS, 257, 20
    MAPS XX. The Massive Disk Around GM Aurigae
24. Sano, H., et al. (incl. **Law, C. J.**), 2020. ApJ, 902, 53
    ALMA CO Observations of Gamma-Ray Supernova Remnant N132D in the Large Magellanic Cloud: Possible Evidence for Shocked Molecular Clouds Illuminated by Cosmic-Ray Protons
25. Le Gal, R., et al. (incl. **Law, C. J.**), 2020. ApJ, 898, 131
    A 3mm chemical exploration of small organics in Class I YSOs

TALKS

1.	Seminar, Carnegie Earth & Planets Laboratory, Washington, D.C. [*expected*]	Dec 2022
2.	ITC Luncheon Talk, CfA [*expected*]	Oct 2022
3.	Contributed, From Clouds to Planets II, Berlin, Germany [*expected*]	Oct 2022
4.	Leiden Astrochemistry Seminar	Sept 2021
5.	Planet and Star Formation Coffee, MPIA/Heidelberg, Germany	Sept 2022
6.	SPF Group Meeting, Garching, Germany	Sept 2022
7.	Contributed, Planet and Binary Formation in GI Discs, Leicester, UK	Sept 2022
8.	*Public Talk*, Tellus Science Museum, Cartersville, GA	Aug 2022
9.	Contributed, Northeast Star and Planet Formation Meeting, Wesleyan, MA	July 2022
10.	*Public Talk*, Cape Cod Museum of Natural History	July 2022
11.	*Public Talk*, Atwood Museum, Cape Cod	July 2022
12.	Contributed, 240th AAS, Pasadena, CA	June 2022
13.	Contributed, VICO-CICO-CASSUM Spring Workshop, University of Virginia	May 2022
14.	Contributed, Exoplanets IV, AAS Topical Conference Series, Las Vegas, NV	May 2022
15.	Contributed, MAYA: Meeting of ALMA Young Astronomers	Mar 2022
16.	Contributed, AstroCheminar, American Chemical Society	Jan 2022
17.	*Public Talk*, Cape Cod Astronomical Society	Jan 2022
18.	**Invited**, Lunch Talk, University of Virginia/NRAO	Nov 2021
19.	*Public Talk*, Cape Cod Museum of Natural History	Nov 2021
20.	**Invited**, Astrochemistry Discussion	Nov 2021
21.	**Invited**, Leiden Astrochemistry Seminar	Oct 2021
22.	*Public Talk*, Beacon Hill Seminar	Oct 2021
23.	Seminar, Exoplanet Pizza Lunch, CfA	Sept 2021
24.	Contributed, Chemical Processes in Solar-type Star-forming Regions, Turin, Italy	Sept 2021
25.	**Invited**, SSP Coffee Talk, CfA	July 2021
26.	Contributed, Emerging Researchers in Exoplanet Science	May 2021
27.	**Invited**, Origins Seminar, University of Arizona	May 2021
28.	Contributed, Space Telescope, 2021 Spring Symposium	Apr 2021
29.	Contributed, Five Years after HL Tau: A New Era in Planet Formation	Dec 2020
30.	Contributed, Harvard-Heidelberg Star Formation Workshop	Dec 2020
31.	Contributed, Astrochemical Frontiers	June 2020
32.	*Public Talk*, North Shore Amateur Astronomy Club	June 2020
33.	*Public Talk*, Gloucester Area Astronomy Club	May 2020
34.	*Public Talk*, Beacon Hill Seminar	Mar 2020
35.	Seminar, SMA Science Seminar, CfA	Feb 2020
36.	Contributed, New England Star Formation Meeting, UConn, CT	Jan 2020
37.	Contributed, 235th AAS, Honolulu, HI	Jan 2020
38.	*Public Talk*, Union County College/AAI, NJ	Dec 2019
39.	Contributed, Science with the SMA: Present and Future, Taipei, Taiwan	Oct 2019
40.	Contributed, ISMS, 74th, Champaign-Urbana, IL	June 2019
41.	Contributed, SNRs II, Chania, Crete, Greece	June 2019
42.	Seminar, Exoplanet Pizza Lunch, CfA	May 2019
43.	**Invited**, ALMA Community Day, MIT	Apr 2019
44.	**Invited**, ALMA Community Day, CfA	Apr 2019
45.	Seminar, High Energy Phenomena Seminar, CfA	Feb 2019
46.	**Invited**, SMA Advisory Committee Meeting, CfA	July 2018
47.	*Public Talk*, Gloucester Area Astronomy Club	Sept 2018