

# YAO-LUN YANG

[yy6mw@virginia.edu](mailto:yy6mw@virginia.edu) | [yaolunyang.astro@gmail.com](mailto:yaolunyang.astro@gmail.com) | <https://yaolun.github.io>

## CONTACT INFORMATION

---

Department of Astronomy, University of Virginia  
530 McCormick Road, Charlottesville, VA 22904, USA

+1 (512) 574-9925

## RESEARCH INTERESTS

---

Astrochemistry, Infall & Outflows, Early Stage Star Formation, Radiative Transfer Modeling, Atomic and Molecular Spectroscopy, and Infrared & Radio Astronomy.

## PROFESSIONAL APPOINTMENTS

---

Feb. 2020 – present      [Virginia Initiative on Cosmic Origins \(VICO\)](#) Postdoctoral Fellow  
University of Virginia, USA

Aug. 2019 – Jan. 2020    [Japan Society for the Promotion of Science \(JSPS\)](#) Postdoctoral Fellow  
Host: [Nami Sakai](#); RIKEN, Japan

## EDUCATION

---

### 2019    Ph.D. Astronomy

The University of Texas at Austin, U.S.A.    Advisors: [Prof. Neal J. Evans II](#) and [Dr. Joel D. Green](#)  
Dissertation: *The Three-dimensional Structure and Kinematics of Protostellar Envelopes*

### 2015    M.A. Astronomy

The University of Texas at Austin, U.S.A.    Advisor: [Prof. Neal J. Evans II](#)  
Thesis: *The Class 0 Protostar BHR71: Herschel Observations and Dust Continuum Models*

### 2012    B.S. Physics

National Taiwan University, Taiwan    Advisor: [Dr. Ciska Kemper](#)  
Project: *Molecular Hydrogen in Diffuse Interstellar Medium of the Large Magellanic Cloud*

## AWARDS AND RECOGNITIONS

---

SOFIA Cycle 9 GO Grant - (\$7,000 as PI)	SOFIA 2021
Virginia Initiative on Cosmic Origins (VICO) Postdoctoral Fellowship	University of Virginia 2019
Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellowship	Japan 2019
Concentration in Teaching and Mentoring	UT-Austin 2018
Professional Development Award (\$600)	UT-Austin 2018
University Graduate Continuing Fellowship (\$80,000)	UT-Austin 2017–2019
SOFIA Cycle 6 GO Grant - (\$41,000 as PI and \$39,000 as co-I)	SOFIA 2017
Fred T. Goetting, Jr. Memorial Endowed Presidential Fellowship (\$10,000)	UT-Austin 2016
Summer Internship (\$14,120)	STScI 2016
Outstanding Thesis Award (\$1,000)	School of Graduate Studies, UT-Austin 2016
SOFIA Cycle 4 GO Grant - (\$56,000 as PI and \$33,000 as co-I)	SOFIA 2015
Summer Student Fellowship (\$1,300)	ASIAA 2011
College Student Research Training Fellowship (\$1500)	National Science Council, Taiwan 2011

## PUBLICATIONS

---

### First-Author and Significant Contribution Refereed Journal Articles

- [7] **Yang, Y.-L.**, Evans, N. J. II, Karska, A., et al. 2021, “Atomic Shocks in the Outflow of L1551 IRS 5 Identified with SOFIA-upGREAT Observations of [O I]”, *submitted to ApJ*
- [6] **Yang, Y.-L.**, Sakai, N., Zhang, Y., et al. 2021, “The Perseus ALMA Chemistry Survey (PEACHES). I. The Complex Organic Molecules in Perseus Embedded Protostars”, [ApJ, 910, 20](#)
- [5] **Yang, Y.-L.**, Evans, N. J. II, Smith, A. et al. 2020, “Constraining the Infalling Envelope Models of Embedded Protostars: BHR71 and its Hot Corino”, [ApJ, 891, 1](#)
- [4] **Yang, Y.-L.**, Green, J. D., Evans, N. J. II, et al. 2018, “CO in Protostars (COPS): *Herschel*-SPIRE Spectroscopy of Embedded Protostars”, [ApJ, 860 174](#)
- [3] **Yang, Y.-L.**, Evans, N. J. II, Green, J. D. et al. 2017, “The Class 0 Protostar BHR71: *Herschel* Observations and Dust Continuum Models”, [ApJ, 835, 259](#)
- [2] Green, J. D., **Yang, Y.-L.**, et al. 2016, “The CDF Archive: Herschel PACS and SPIRE Spectroscopic Data Pipeline and Products for Protostars and Young Stellar Objects”, [AJ, 151, 75](#)
- [1] Larson, R. L., Evans, N. J., Green, J. D., **Yang, Y.-L.** 2015, “Evidence for Decay of Turbulence by MHD Shocks in the ISM via CO Emission”, [ApJ, 806, 70](#)

#### Other Refereed Journal Articles

- [11] Yun, H.-S., Lee, J.-E., Evans, N. J. II, **et al.** 2021, “TIMES II: Investigating the Relation Between Turbulence and Star-forming Environments in Molecular Clouds”, accepted to ApJ, [arXiv:2107.13323](#)
- [10] Bouvier, M., López-Sepulcre, A., Ceccarelli, C, **et al.** 2021, “ORion Alma New GEneration Survey (ORANGES) I. Dust continuum and free-free emission of OMC-2/3 filament protostars”, accepted to A&A, [arXiv:2107.10743](#)
- [9] Yun, H.-S., Lee, J.-E., Choi, Y., **et al.** 2021, “TIMES I: A Systematic Observation in Multiple Molecular Lines Toward the Orion A and Ophiuchus Clouds”, accepted to ApJS, [arXiv:2106.04111](#)
- [8] Liu, M., Tan, J. C., De Buizer, J. M., **et al.** 2020, “The SOFIA Massive (SOMA) Star Formation Survey. III. From Intermediate- to High-Mass Protostars”, [ApJ, 904, 75](#)
- [7] Hsu, S.-Y., Liu, S.-Y., Liu, T., **et al.** 2020, “ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP) I. Detection of New Hot Corinos with ACA”, [ApJ, 898, 107](#)
- [6] Liu, H. B., Mérand, A, Green, J. D., Pérez, S., Hales, A. S., **Yang, Y.-L.**, et al. 2019, “Diagnosing 0.1-10 au Scale Morphology of the FU Ori Disk using ALMA and VLTI/GRAVITY”, [ApJ, 884, 97](#)
- [5] Yi, H.-W., Lee, J.-L., Liu, T, **et al.** 2018, “Planck Cold Clumps in the  $\lambda$  Orionis complex. II. Environmental effects on core formation”, [ApJS, 236, 2](#)
- [4] Karska, A, Kaufman, M. J., Kristensen, L. E., **et al.** 2018, “The Herschel-PACS Legacy of Low-mass Protostars: Far-IR Gas Properties and Their Origin in FUV-illuminated C-shocks”, [ApJS, 235, 30](#)
- [3] Liu, T, Kim, K.-T., Juvela, M, **et al.** 2018, “The TOP-SCOPE Survey of Planck Galactic Cold Clumps: Survey Overview and Results of an Exemplar Source, PGCC G26.53+0.17”, [ApJS, 234, 28](#)
- [2] Green, J. D., Jones, O. C., Keller, L. D., **et al.** 2016, “The Mid-infrared Evolution of the FU Orionis Disk”, [ApJ, 832, 4](#)
- [1] Naslim, N., Kemper, F., Madden, S. C., **et al.** 2015, “Molecular Hydrogen Emission in the Interstellar Medium of the Large Magellanic Cloud”, [MNRAS, 446, 2490—2504](#)

#### Non-refereed Research Articles

- [7] Sakai, N & **Yang, Y.-L.**, 2021, “Chemical Diversity in Young Protoplanetary Disk”, [ngVLA-J Memo Series](#)
- [6] **Yang, Y.-L.**, Evans, N. J., Smith, A., et al. 2020, “Direct Infall Signatures and Complex Organic Molecules toward an Isolated Embedded Protostar BHR 71”, *Origins: From the Protosun to the First Steps of Life*, Proceedings of the International Astronomical Union, 345, 312. [doi:10.1017/S1743921319001571](#)
- [5] Gutermuth, R., Offner, S., Arce, H., **et al.** 2019, “Dense Cores, Stellar Feedback and the Origins of Clustered Star Formation”, *Astro2020: Decadal Survey on Astronomy and Astrophysics*, science white papers, no. 467, [BAAS](#), 51, 467
- [4] Green, J., **Yang, Y.-L.**, Megeath, T., et al. 2019, “Variability in the Assembly of Protostellar Systems”, *Astro2020: Decadal Survey on Astronomy and Astrophysics*, science white papers, no. 372, [BAAS](#), 51, 372
- [3] Tobin, J., Offner, S., Sheehan, P., **et al.** 2019, “Measuring Protostar Masses: The Key to Protostellar Evolution”, *Astro2020: Decadal Survey on Astronomy and Astrophysics*, science white papers, no. 189, [BAAS](#), 51, 189
- [2] Tobin, J., Kounkel, M., Offner, S., **et al.** 2019, “The Formation and Evolution of Multiple Star Systems”, *Astro2020: Decadal Survey on Astronomy and Astrophysics*, science white papers, no. 187, [BAAS](#), 51, 187
- [1] **Yang, Y.-L.**, Evans, N. J., & Green, J. 2015, “The Structure of Class 0 Protostars: BHR71 in Herschel View”, [Frank N. Bash Symposium 2015 \(BASH2015\)](#), 30

## OBSERVING PROGRAMS (AS PI OR SIGNIFICANT CONTRIBUTOR)

---

### James Webb Space Telescope (JWST)

- *Blazing the Trails of COMs Ices to Gas*  
Cycle 1 (as PI, 24.6 hrs MIRI MRS)
- *Investigating Protostellar Accretion Across the Mass Spectrum*  
Cycle 1 (as co-I, 65.5 hrs MIRI MRS and NIRSpec IFU)

### Acatama Large Millimeter/submillimeter Array (ALMA)

- *Directly measuring the progression of infall from the envelope to the disk-forming region of BHR 71*  
Cycle 7 & 8 (as PI, 18.7 hrs)
- *Direct Detection of Infall in a Protostellar System*  
Cycle 4 (as PI, 0.9 hr)
- *Outflow Launching from a Circumbinary Disk*  
Cycle 8 (as co-I, PI: Yichen Zhang, 10.5 hrs)
- *Pinpointing hot methanol transitions with observational and experimental data*  
Cycle 8 (as co-I, PI: Shaoshan Zeng, 32.7 hrs)
- *Formation of complex organics around protostars in isolated cores*  
Cycle 8 (as co-I, PI: Jes Jørgensen, 7.5 hrs)
- *Spatiochemically Profiling the Inner Coma of C/2021 A1 (Leonard)*  
Cycle 8 (as co-I, PI: Maria Drozdovskaya, 45.7 hrs)

## Very Large Array (VLA)

- *Do Twins Always Look the Same?: Testing the Chemical Difference in a Protobinary*  
2021 A (as PI, 15 hrs)

## Stratospheric Observatory for Infrared Astronomy (SOFIA)

- *Probing the Radiative Cooling from Shocks and PDRs in Intermediate- and High-mass Protostars*  
Cycle 9 (as PI, 23.1 hrs FIFI-LS)
- *Exploring Protostellar Winds with [OI]: Constraining models of shocked gas and PDR using L1551-IRS5*  
Cycle 4 & 6 (as PI, 5.3 hrs & 4.1 hrs)
- *The Evolution of FU Orionis Disks*  
Cycle 4 & 6 (as co-I, PI: Joel Green, 3 hrs & 3.9 hrs)

## Submillimeter Telescope (SMT)

- *Surveying the Chemical Diversity toward Taurus Embedded Protostars*  
2020B (as PI, 60 hrs)

## Gemini-South

- *High Velocity Jets in the Outflow of BHR 71*  
2020A (as co-PI, 6 hrs IGRINS)

APEX/FLASH<sup>+</sup>, 7.5 hrs (as PI)

Harlan J. Smith Telescope/DIAFI, 4 nights (as on-site observer)

IRTF/TEXES, 2014–2016, 4 nights (as Co-I & on-site observer)

## INVITED TALKS

---

SMA Seminar,	SAO/CfA ( <i>virtual</i> ), USA 2021
Astrochemistry Seminar,	NAOJ ( <i>virtual</i> ), Japan 2020
Colloquium,	NTHU, Hsinchu, Taiwan 2020
Seminar at Center of Astronomy and Gravitation,	NTNU, Taipei, Taiwan 2020
Colloquium,	ASIAA, Taipei, Taiwan 2020
ZUNA talk,	NRAO, VA, USA 2020
APEC Seminar,	IPMU, Chiba, Japan 2019
Star Formation Mini Symposium,	Kyung Hee University, Suwan, South Korea 2019
Colloquium,	NTHU, Taiwan 2019
Review talk, From Star to Planet Formation II,	Göteborg, Sweden 2019
CAS seminar,	Center for Astrochemical Studies, MPE, Germany 2019

## SELECTED CONTRIBUTED TALKS

---

Astrochemistry in the JWST Era,	Leeds ( <i>virtual</i> ), UK 2021
2021 COSPAR,	virtual space, Earth 2021
237 <sup>th</sup> AAS Meeting,	virtual space, Earth 2021
Astrochemical Frontier,	virtual space, Earth 2020

2019 ALMA EA Development Workshop,	NAOJ, Tokyo, Japan 2019
Early Planet Formation in Embedded Disks,	University of Tokyo, Tokyo, Japan 2019
233 <sup>rd</sup> AAS Meeting,	Seattle, WA 2019
2018 ALMA EA Science/Development Workshop,	Osaka Pref. University, Osaka, Japan 2018
TUNA Talk,	NRAO/UVa, VA 2018
6 <sup>th</sup> GMT Science Meeting: Stars Birth & Death,	Honolulu, HI 2018
231 <sup>st</sup> AAS Meeting,	National Harbor, DC 2018
2017 Asia-Pacific Regional IAU Meeting,	Taipei, Taiwan 2017
72 <sup>nd</sup> International Symposium on Molecular Spectroscopy,	UIUC, IL 2017
230 <sup>th</sup> AAS Meeting,	Austin, TX 2017
Star Formation 2016, Splinter session,	Exeter, UK 2016
Workshop on Dense Cores,	Monterey, CA 2014
Seminars at UT-Austin, NRAO/UVa, ASIAA, Subaru Telescope, IfA/U of Hawaii, Leiden Observatory, ESO-Garching, MPIA, STScI, East Asia Observatory, CfA/Harvard, U of Arizona, Kyung Hee University, Osaka University, and Osaka Prefecture University	

## STUDENTS MENTORING

---

- Pichaya Tositrakul (undergraduate, UVA, 2021-present):  
Characterize the impact of dust optical depth to measurements of molecular abundance.
- Lianis Reyes Rosa (UVA Bridge student, 2021-present):  
Investigate the feedback of massive protostars from emission of shocks and PDRs
- Jenny Margot Ramos Lázaro (CASSUM summer student, National University of San Marcos, Peru, 2021-present):  
Characterize the carbon-chain chemistry in Taurus embedded protostars using SMT observations.
- Eva Greco (CASSUM summer student, UVA, 2020):  
Study ALMA observations of CO outflows associated with a clustered massive star-forming regions, involving ALMA imaging and spectral analyses.
- Alyssa Ramos (undergraduate, UT-Austin, 2018):  
Exploratory study on the complex organic molecules at the early phase of star formation, involving an archival study using the ALMA archive and simulating synthetic spectra of COMs.
- Rebecca Larson (undergraduate, UT-Austin, 2014–2016):  
Constrain the decay of turbulence shocks with *Herschel* observations of starless molecular clouds.

## SERVICE AND PROFESSIONAL SOCIETY MEMBERSHIP

---

- Referee for ApJ, ApJS, and MNRAS
- Referee/Panelist for NASA ROSES funding and graduate fellowship
- Member of the ISSI International Team “Provenances of our Solar System’s relics”
- SOC of *Astrochemistry Discussions*
- SOC of the VICO workshop: *From Cores to Disks*
- Member of the American Astronomical Society, 2017–
- AAS Meeting Chambliss Judge, 2019

## OUTREACH ACTIVITY

---

- Organizer & Presenter, Astronomy on Tap ATX, Austin, TX, 2016–2019  
*Monthly astronomy talk held in a local bar joined by more than 250 audience*

- Guest Host & Presenter, Astronomy on Tap Taipei, Taipei, Taiwan, 2019, 2020
- Talk, “*How to Make A Star*”, Westcave Preserve, Jan. 2015

(Last update on August 30, 2021)