YAO-LUN YANG

yao-lun.yang@riken.jp | yaolunyang.astro@gmail.com | https://yaolun.github.io

CONTACT INFORMATION

Star and Planet Formation Laboratory
2-1 Hirosawa, Wako, Saitama 351-0198, Japan
+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

Mar. 2022 – present	Research Scientist (*indefinite term*) Star and Planet Formation Laboratory, RIKEN
Feb. 2022 – present	Visiting Scholar University of Virginia, USA
Feb. 2020 – Feb. 2022	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, FUNDING (TOTAL: $403,462), AND RECOGNITIONS

JWST Cycle 1 GO Grant - ($187,562 as PI)	STScI 2021
SOFIA Cycle 9 GO Grant - ($24,500 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. 2022, "Atomic Shocks in the Outflow of L1551 IRS 5 Identified with SOFIA-upGREAT Observations of [O I]", ApJ, 925, 93

[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

[15] Bouvier, M., Ceccarelli, C., López-Seplucre, A., Sakai, N., Yamamoto, S., & **Yang, Y.-L.** 2022, "The chemical nature of Orion protostars: Are ORANGES different from PEACHES? ORANGES II", accepted to ApJ, arXiv:2202.13835

[14] van Gelder, M. L., Nazari, P., Tabone, B., **et al.** 2022, "Importance of source structure on complex organics emission. I. Observations of CH_3OH from low-mass to high-mass protostars", accepted to A&A, arXiv:2202.04723

[13] Hsu, S.-Y., Liu, S.-Y., Liu, T., **et al.** 2022, "ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): A Hot Corino Survey toward Protostellar Cores in the Orion Cloud", accepted to ApJ, arXiv:2201.02497

[12] Liu, H. B., Tsai, A.-L., Chen, W. P., **et al.** 2021, "Millimeter-sized Dust Grains Appear Surviving the Water-sublimating Temperature in the Inner 10 au of the FU Ori Disk", ApJ, 923, 270

[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", ApJ, 921, 31

[10] Bouvier, M, López-Seplucre, 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", A&A, 653, A117

[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", ApJS, 256, 16

[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 λ 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., **el 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

SELECTED OBSERVING PROGRAMS (AS PI OR SIGNIFICANT CO-I)

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)

- *Testing the origin of warm carbon-chain chemistry in Perseus protostars*

Cycle 8 (as PI, 54.5 hrs of ACA)

- *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 GREAT)
- *The Evolution of FU Orionis Disks*
  Cycle 4 & 6 (as co-I, PI: Joel Green, 3 hrs & 3.9 hrs FORCAST)

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$^+$, 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 (*virtual*), USA 2021
Astrochemistry Seminar,	NAOJ (*virtual*), 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

Workshop on Interstellar Matter 2021, Hokkaido (*hybrid*), Japan 2021
Astrochemistry in the JWST Era, Leeds (*virtual*), UK 2021
2021 COSPAR, virtual space, Earth 2021
237$^{\text{th}}$ 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$^{\text{rd}}$ AAS Meeting, Seattle, WA 2019
2018 ALMA EA Science/Development Workshop, Osaka Pref. University, Osaka, Japan 2018
TUNA Talk, NRAO/UVa, VA 2018
6$^{\text{th}}$ GMT Science Meeting: Stars Birth & Death, Honolulu, HI 2018
231$^{\text{st}}$ AAS Meeting, National Harbor, DC 2018
2017 Asia-Pacific Regional IAU Meeting, Taipei, Taiwan 2017
72$^{\text{nd}}$ International Symposium on Molecular Spectroscopy, UIUC, IL 2017
230$^{\text{th}}$ 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 Perfecture University

STUDENTS MENTORING

- Pichaya Tositrakul (undergraduate, UVA, 2021-present):
  Characterize the impact of dust optical depth to measurements of molecular abundance.
- Lianis Reyes Rosa (graduate student, UVA, 2021-present, co-advised with Prof. Jonathan Tan):
  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 graudate fellowship
- Memeber of the ISSI International Team "Provenances of our Solar System's relics"
- Affiliate of the eDisk ALMA Large Program
- SOC of *Astrochemistry Discussions*
- Organizer of astro-ph and astrochem-ph discussion at UVA
- Organizer of UVA/NRAO Star Formation Group Meeting
- Member of the American Astronomical Society, 2017–
- AAS Meeting Chambliss Judge, 2019

OUTREACH ACTIVITY

- Talk, "*JWST and Snow-covered Baby Stars*", Massanutten Regional Library, Nov. 2021
- 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 March 1, 2022)