

Aneesh Baburaj

(he/him/they)

Email: ababuraj@northwestern.edu ♦ Website: aneeshb97.github.io ♦ ORCID: 0000-0003-3708-241X

Research Interests: Exoplanets, Planet formation, High-contrast techniques, Atmospheric composition, Astrometry, High-resolution spectroscopy, Stellar abundances, Protoplanetary disks, Exoplanet demographics, Software Development

EDUCATION

UC San Diego, La Jolla, CA, USA

July 2022 – August 2025

Ph.D., Physics

Thesis: “Two Halves of a Whole: Constraining Planet Formation via High-Resolution Spectroscopy of Host Stars and their Companions”

UC San Diego, La Jolla, CA, USA

September 2019 – June 2022

M.S., Physics

Indian Institute of Science, Bengaluru,

Karnataka, India

August 2015 – May 2019

Bachelor of Science (Research), First Class with Distinction

Major : Physics

RESEARCH EXPERIENCE

Center for Interdisciplinary Research in Astrophysics (CIERA),

Northwestern University

September 2025 – present

Postdoctoral Scholar (w/ Dr. Jason Wang)

- Spectroscopy mode development for the Roman Coronagraphic Instrument data reduction pipeline.
- Develop astrometric detection pipeline for Gaia DR4.
- High-contrast spectroscopy with JWST/NIRSpec.

Department of Astronomy & Astrophysics,

UC San Diego

July 2020 – August 2025

Graduate research (Advisor: Dr. Quinn Konopacky)

- Atmospheric characterization of directly imaged companions and their host stars to constrain planet formation pathways.
- Analysis of high-resolution host star spectra from the Levy spectrograph at Lick and the GHOST spectrograph at Gemini South (Baburaj et al. 2025, 2026a).
- High-contrast spectroscopy and atmospheric retrievals of JWST NIRSpec IFU data for GJ 504b (Baburaj et al., 2026b) and HD 206893B (Baburaj et al., in-prep).

HONORS & AWARDS

1. Future Investigators in NASA Earth and Space Science and Technology (FINESST) 2023–2025
2. UC San Diego Physics Chairs Challenge Travel Award 2025
3. Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship 2015–2019
4. National Talent Search (NTS) fellowship 2013–2015

*Principal-Investigator***JWST Cycle 5 GO 10963****2026***“A Glimpse into Circumbinary Planet Formation at sub-100 au scales with HD 143811 AB b”***XSEDE allocation PHY260112****March 2026 – March 2027**1,500,000 SUs for project *“Atmospheric modeling of the substellar companion HD 206893B with JWST spectra”***XSEDE allocation PHY250125****May 2025 – May 2026**1,500,000 SUs for project *“Atmospheric Modeling of the exoplanet GJ 504b with JWST spectra”* (Co-PI; PI Konopacky)**JWST Cycle 3 GO 5485****2024***“How big can you make a planet? Spectroscopic characterization of HD 206893B”***XSEDE allocation PHY230140****August 2023 – December 2025**200,000 SUs for project *“Constraining Directly Imaged Planet Formation using High-Resolution Spectroscopy of Host Stars”***FINESST Graduate Fellowship****2023–2025****Gemini South/GHOST****2024–2025**

3.6 nights from 2024B–2025B

CTIO/CHIRON**2022–2023**

4.2 nights from 2022A–2023A

Lick Observatory/APF Levy**2022–2024**

7 nights from 2022A–2024B

*Co-Investigator***JWST Cycle 4 GO 8063****2025***“Beyond C/O and metallicity: Can refractory abundances reveal the origin of the largest planets?”* (PI Ruffio)**JWST Cycle 2 GO 3522****2023***“Spectroscopic characterization of the smallest and coolest directly imaged exoplanet 51 Eridani b”* (PI Ruffio)**CTIO/CHIRON****2021**

1 night in Semester 2021B (PI Konopacky)

Lick Observatory/APF Levy**2021**

1.5 nights from 2021A–2021B (PI Konopacky)

LIST OF PUBLICATIONS

Total number of refereed **first author** papers: 3, Total number of refereed papers: 6, h-index: 3

First-author:

1. **Baburaj, A.**, Konopacky, Q., Theissen, C., Gerasimov, R., Xuan, J., Hoch, K., 2026, “*A High-Resolution Spectroscopic Survey of Directly Imaged Companion Hosts: III. Characterization of the Cold Imaged Planet Hosts AF Lep A and ϵ Indi A*”, submitted to AJ
2. **Baburaj, A.**, Ruffio, J.-B., Perrin, M., Xuan, J., Balmer, W., Chachan, Y., Konopacky, Q., Barman, T., Mâlin, M., Hoch, K., Rickman, E., Ward-Duong, K., Pueyo, L., Girard, J., Rebollido, I., Bidot, A., Chen, C., Worthen, K., Lu, C., Kammerer, J., van der Marel, R., Lewis, N., Valenti, J., Seager, S., Stark, C., Soummer, R., Anderson, J., Lajoie, C.-P., Clampin, M., Mountain, M., 2026, “*JWST-TST High Contrast: First Direct Spectroscopy of GJ 504 b reveals Clouds and Possible Metal Enrichment*”, AJ, **172**, 28. doi: 10.3847/1538-3881/ae6919
3. **Baburaj, A.**, Konopacky, Q., Theissen, C., Gerasimov, R., Hoch, K., 2026, “*A High-Resolution Spectroscopic Survey of Directly Imaged Companion Hosts: II. Diversity in C/O Ratios among Host Stars*”, AJ, **171**, 21. doi: 10.3847/1538-3881/ae1a6b
4. **Baburaj, A.**, Konopacky, Q., Theissen, C., Peacock, S., Huseby, L., Fulton, B., Gerasimov, R., Barman, T., Hoch, K., 2025, “*A High-Resolution Spectroscopic Survey of Directly Imaged Companion Hosts: I. Determination of diagnostic stellar abundances for planet formation and composition*”, AJ, **169**, 55. doi: 10.3847/1538-3881/ad8dfc

Co-author:

5. Gibbs, A., Ruffio, J.-B., Bidot, A., Barman, T., Do O. C., Konopacky, Q., Perrin, M., **Baburaj, A.**, Dacus, B., Macintosh, B., Madurowicz, A., Xuan, J., “*Discovery of an Exterior Third Planet Orbiting β Pictoris*”, 2026, ApJL, **1006**, L11.
6. Xuan, J., Ruffio, J.-B., Chachan, Y., Ohno, K., Kesseli, A., Murray-Clay, R., Lee, E., Moses, J., Balmer, W., **Baburaj, A.**, Zhang, Y., Knutson, H., Mawet, D., Beichman, C., Hodapp, K., Blake, G., Konopacky, Q., Meyer, M., Perrin, M., Bryden, G., Greene, T., Johnstone, D., Leisenring, J., Ygouf, M., Benneke, B., Inglis, J., Wallack, N., 2026, “*The volatile-to-refractory abundances of the HR 8799 planets traced by carbon, oxygen, sulfur, and nitrogen*”, ApJ, **1000**, 27. doi:10.3847/1538-4357/ae448f.
7. Madurowicz, A., Ruffio, J.-B., Macintosh, B., Perrin, M., Konopacky, Q., **Baburaj, A.**, Hoch, K., 2025, “*Direct Spectroscopy of 51 Eridani b with JWST NIRSpec*”, AJ, **170**, 326. doi: 10.3847/1538-3881/ae1028

Non-peer-reviewed & Conference Proceedings:

1. **Baburaj, A.**, Konopacky, Q., Barman, T., Crossfield, I, Hoch, K., Ruffio, J.-B., Sappay, B., Theissen, C., 2023, “*How big can you make a planet? Spectroscopic characterization of HD 206893B*”, JWST Proposal. Cycle 3, 5485
2. **Baburaj, A.**, Konopacky, Q., Theissen, C., Peacock, S., Huseby, L., Gerasimov, R., Barman, T., Hoch, K., 2024, “*Constraining Formation of Directly Imaged Planets through High-Resolution Spectroscopy of Host Stars*”, Extreme Solar Systems V, id. 626.02. Bulletin of the American Astronomical Society, Vol. 56, No. 4

SELECTED TALKS

- “*First Direct Spectroscopy of GJ 504 b reveals Clouds and Possible Metal Enrichment*” Invited Talk. Max Planck Institute for Astronomy, Heidelberg, Germany, July 26

- “*First Direct Spectroscopy of GJ 504 b reveals Clouds and Possible Metal Enrichment*” Invited Talk. Star–Planet Exchange, European Southern Observatory, Garching, Germany, June 26
- “*First Direct Spectroscopy of GJ 504 b reveals Metal Enrichment and Clouds*” Contributed Talk. Exoplanet Atmospheres Conference, Denver, CO, March 26
- “*Wide-Separation Giant Host Stars might not be exactly Sun-like*” Invited Talk. Preparing for Gaia’s Exoplanet Bonanza Workshop, Ringberg, Germany, March 26
- “*Directly imaged host star abundances as tracers for planet formation and occurrence*” Contributed Talk. Know Thy Star, Know Thy Planet 2 Conference, Pasadena, CA, February 25
- “*Two Halves of a Whole: Constraining Planet Formation via High-Resolution Spectroscopy of Host Stars and their Companions*” Dissertation Talk. AAS 245 Meeting, National Harbor, MD, January 25
- “*Constraining Directly Imaged Planet Formation using High-Resolution Spectroscopy of Host Stars*” Contributed Talk. STScI Spring Symposium, Baltimore, MD, May 23
- “*High Resolution Spectroscopy of Directly Imaged Planet Hosts*” Invited Talk. STScI Exoplanets and High Contrast Imaging Group, Baltimore, MD, June 22

PROGRAMMING LANGUAGES AND SKILLS

- Proficient: **Python, MATLAB, Linux, HTML**
- Beginner: **IDL, C/C++**

TEACHING, MENTORING, AND OUTREACH EXPERIENCE

Volunteer, Adler Planetarium, Chicago	<i>October 2025 – Present</i>
UCSD A&A Outreach Committee	<i>September 2024 – August 2025</i>
UCSD Cosmic Tours	<i>September 2024 – July 2025</i>
Undergraduate Research Mentor	<i>June 2024 – January 2025</i>
- Ms. Camila Martinez, UC Santa Cruz (now at The Ohio State University)	
Local Organizing Committee, Cool Stars 22, San Diego, CA	<i>June 2024</i>
Barrio Logan Science & Art EXPO	<i>April 2024</i>
San Diego Festival of Science and Engineering EXPO Day	<i>March 2024</i>
Astronomy on Tap San Diego	<i>February 2024</i>
Teaching assistant (Lower Division Physics)	<i>September 2019 – September 2021</i>

OTHER WORKSHOPS AND CONFERENCES

Cool Stars 22, San Diego, CA	<i>June 24–28, 2024</i>
Protostars and Planets VII, Kyoto, Japan	<i>April 10–15, 2023</i>
AAS 241, Seattle, WA	<i>January 8–12, 2023</i>
Keck Science Meeting, Pasadena, CA	<i>September 15–16, 2022</i>
Cool Stars 21, Toulouse, France	<i>July 4–9, 2022</i>
Spirit of Lyot 2022, Leiden, Netherlands	<i>June 27–July 1, 2022</i>
Keck Science Meeting, San Diego, CA	<i>September 9–10, 2021</i>

REFERENCES

- Dr. Quinn Konopacky (UC San Diego): qkonopacky@ucsd.edu
- Dr. Christopher Theissen (UC San Diego): ctheissen@ucsd.edu
- Dr. Marshall Perrin (Space Telescope Science Institute): mperrin@stsci.edu