Akash Gupta

CONTACT INFORMATION

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RESEARCH INTERESTS

My research lies at the intersection of physics, chemistry and machine learning, specifically, astrophysics and planetary geosciences, and explores the origin of Earth- & Neptune-like planets across our galaxy. In particular, I am interested in understanding the fundamental physical and chemical processes that dictate a planet's formation and subsequent evolution, and how this ultimately leads to an environment and ingredients suitable for life.

APPOINTMENTS

51 Pegasi b Fellow, 2023 -
Harry H. Hess Postdoctoral Fellow, and
Future Faculty in Physical Sciences Fellow
Princeton University
Department of Astrophysical Sciences & Department of Geosciences

NASA Future Investigator (FINESST grantee) 2020-23
Graduate Student Researcher 2017-23
University of California, Los Angeles
Department of Earth, Planetary, and Space Sciences (EPSS)

Research Associate 2016-17
Undergraduate Researcher 2013-16
Indian Institute of Technology, Kanpur
Mechanics & Applied Mathematics Group & Dept. of Aerospace Engineering

EDUCATION

University of California, Los Angeles (UCLA) 2017-23
Ph.D., M.S., Planetary Science
Thesis: Unraveling the evolution of super-Earths and sub-Neptunes
Advisors: Prof. Hilke E. Schlichting

Indian Institute of Technology, Kanpur (IIT-K) 2011-16
B.Tech. - M.Tech. Dual degree, Aerospace Engineering
Thesis: Dynamics of rings around minor planets
Advisors: Prof. Ishan Sharma & Prof. Sharvari Nadkarni-Ghosh

SELECT AWARDS & HONORS

Summary: **Awarded several international, national and university-level awards and fellowships** by organizations such as **NASA, Heising-Simons Foundation, Princeton and UCLA**, with the **total award prize amounting to over USD 0.8 million**[†].

- ***51 Pegasi b Fellowship***, Heising-Simons Foundation 2023 -
- ***Future Faculty in Physical Sciences Fellowship***, Princeton University 2023 -

[†]including awarded fellowships that are to disbursed in the future

- ***Harry H. Hess Postdoctoral Fellowship***, Princeton University 2023 -
- *American Astronomical Society (AAS) International Travel Grant* (declined) 2024
- ***Future Investigators in NASA Earth & Space Science & Technology (FINESST) grant*** 2020-23
- *Exoplanet Summer Program Mini Grant* by Heising-Simons Foundation & UC Santa Cruz 2023
- *AAS Rodger Doxsey Travel Prize* awarded annually to 10 early-career researchers for presenting their PhD dissertation at the AAS meeting 2023
- *UCLA EPSS Outreach Award* in recognition of DEI initiatives 2022
- Travel grant awarded by the Munich Institute for Astro-, Particle and BioPhysics (MIAPbP) to attend and present at the *Planet Formation* Workshop 2022 in Garching, DE 2022
- *Harold and Mayla Sullwold Scholarship* by EPSS, UCLA for excellence in research 2020
- *Constantine and Perina Panunzio Scholarship* by EPSS, UCLA for excellence in research 2019
- ***UCLA's University Fellowship*** 2017-19
- *EPSS Scholarship Award*, UCLA 2017
- Travel grant from IIT - Finnish Consortium of Higher Education program to conduct research with Prof. Heikki Salo, University of Oulu, Finland 2015
- Placed in the top ~ 1% in the Indian national exam GATE[‡] (Aerospace Engineering) 2015
- **Secured 99.6+ percentile among ~ 0.5 million candidates** in the national exam **IIT-JEE**[§] 2011

PEER-REVIEWED PUBLICATIONS

Summary: **10 papers, incl. 8 published** and 7 conference proceedings.
738 total citations and 617 citations on first-author papers.
Source: Google Scholar, Sep 2024

Journal Publications (*students directly mentored*: *)

1. Fernandes et al. (including **Gupta, A.**). In review. *AAS journals*.
   Signatures of atmospheric mass loss and planet migration in the time evolution of short-period transiting exoplanets

2. **Gupta, A.**, Stixrude, L. and Schlichting, H.E. 2024. In review. arXiv:2407.04685
   The miscibility of hydrogen and water in planetary atmospheres and interiors

3. Owen, J. E., Murray-Clay, R. A., Schreyer, E., Schlichting, H. E., David, A., **Gupta, A.**, Loyd, R. O. P., Shkolnik, E. L., Sing, D. K., Swain, M. R., 2023. *MNRAS*. 518, 4357-4371.
   The fundamentals of Lyman-alpha exoplanet transits

4. **Gupta, A.**, *Nicholson, L. and Schlichting, H. E. 2022. *MNRAS*, 516, 4585-4593.
   Properties of the radius valley around low mass stars: Predictions from the core-powered ...

5. Rogers, J. G., **Gupta, A.**, Owen, J. E. and Schlichting, H. E. 2021. *MNRAS*, 508, 5886-5902.
   Photoevaporation vs. core-powered mass-loss: Model comparison with the 3D radius gap

6. **Gupta, A.** and Schlichting, H. E. 2021. *MNRAS*, 504, 4634-4648.
   Caught in the act: Core-powered mass-loss predictions for observing atmospheric escape

[‡]Graduate Aptitude Test in Engineering
[§]Indian Institute of Technology - Joint Entrance Examination (for admission to science & engineering colleges in India)

7. **Gupta, A.** and Schlichting, H. E. 2020. *MNRAS* 493, 792-806.
   Signatures of the core-powered mass-loss mechanism in the exoplanet population: Dependence on stellar properties and observational predictions

8. Estrada, R. Swain, M., **Gupta, A.**, Sotin, C. and Valio, A.. 2020. *ApJ*. 898, 104-109.
   Evolutionary tracks of H/He envelopes of the observed pop. of sub-Neptunes and super-Earths

9. **Gupta, A.** and Schlichting, H.E. 2019. *MNRAS* 487, 24-33.
   Sculpting the valley in the radius distribution of small exoplanets as a by-product of planet formation: The core-powered mass-loss mechanism

10. **Gupta, A.**, Nadkarni-Ghosh, S. and Sharma, I. 2018. *Icarus* 299, 97-116.
    Rings of non-spherical, axisymmetric bodies

Select Conference Proceedings

1. Tang, H., **Gupta, A.**, Schlichting, H.E. and Young E.D., 2020., 51st Annual Lunar and Planetary Science Conference, 1481
   Escape from a Transient Rock Vapor Atmosphere as the Mechanism for Fractionation of the Moon's Moderately Volatile Elements

OBSERVING PROGRAMS AWARDED

Summary: **6 observing proposals awarded, including the largest Exoplanet Science proposal ever awarded by NASA's Hubble Space Telescope to-date**

1. Hubble Space Telescope Cycle 32/33/34 Treasury Program — 2024
   600+ primary orbits
   Co-I[¶] (PI[‖]: R. O. Loyd, Eureka Scientific Inc. & Shreyas Vissapragada, Harvard U.)
   STELα: Survey of Transiting Exoplanets in Lyman-alpha

2. W.M. Keck Observatory — 2024
   3 nights
   Co-I (PI: Erik Petigura, UCLA)
   The KPF Disordered Multis Survey II

3. James Webb Space Telescope, Cycle 3 — 2024
   Archival proposal
   Co-I (PI: Shreyas Vissapragada, Harvard U.)
   TUNES: The Unintentional NIRISS Escape Survey

4. W.M. Keck Observatory — 2023
   3 nights
   Co-I (PI: Erik Petigura, UCLA)
   The KPF Disordered Multis Survey I

5. Gemini MAROON-X — 2022
   25.7 hrs
   Co-I (PI: Erik Petigura, UCLA)

[¶] Co-Investigator
[‖] Principal Investigator

Probing the Role of Mass Loss in the Formation of Super-Earths and Sub-Neptunes with MAROON-X

6. Hubble Space Telescope Cycle 28 — 2020
   15 primary orbits
   Co-I (PI: Paul Cauley, UC Boulder)
   Measuring mass loss via metal lines from the very young planet AU Mic b

SEMINARS

Summary: **17 talks at universities and research institutes**

Princeton University, *Chemistry in Solution and at Interfaces (CSI) Seminar*	2024
Penn State, *Center for Exoplanets and Habitable Worlds (CEHW) Seminar*	2024
NSF Center for Matter at Atomic Pressures (CMAP) *Seminar*	2024
MIT Kavli Institute, *Brown Bag Lunch Seminar*	2022
NASA Jet Propulsion Laboratory, *Exoplanet Journal Club Seminar*	2022
University of Arizona, *Origins Seminar*	2022
University of Texas, Austin *Stars and Planets Seminar*	2022
Caltech, *Dix Planetary Science Seminar*	2022
Yale, *Exoplanets and Stars Seminar*	2022
Cornell, *Planetary Lunch Seminar*	2022
UC Berkeley, *Center for Integrative Planetary Science Seminar*	2022
Princeton, *Exoplanet Discussion Group Seminar*	2022
Carnegie Earth & Planets Laboratory, *Astronomy Seminar*	2021
University of Arizona, *Disks and Exoplanets Group Seminar*	2020
McMaster University, *Astronomy Seminar*	2020
MIT, *Planetary Lunch Seminar*	2020
UCLA, *Planetary Science Seminar*	2018, '19, '21

CONFERENCES

Summary: **18 conference presentations (10 talks and 8 posters)**

Talks

Future Faculty in Physical Sciences Symposium, Princeton University, NJ	2024
241st AAS Meeting, Seattle, WA	2023
Planet Formation Workshop by MIAPbP[‡], Munich, Germany	2022
240th AAS Meeting, Pasadena, CA, US	2022
Exoplanets IV, Las Vegas, NV, US	2022
Stars and Planets in the Ultraviolet, online conference	2021
Exoplanet Demographics, online conference	2020
Exoplanets III, online conference	2020
Bay Area Exoplanet Meeting, online conference	2020

New Horizons in Planetary Systems, Victoria, BC, Canada 2019

Posters

Extreme Solar Systems V, Christchurch, New Zealand 2024

TESS Science Conference II (NASA/MIT), online conference 2021

ExSoCal 2020, virtual conference 2020

Extreme Solar Systems IV. Reykjavik, Iceland 2019

NASA Sagan Summer Workshop, Pasadena, CA, US 2019

Kepler & K2 Science Conference V, Pasadena, CA, US 2019

11^{th} *Annual EPSS Student Research Symposium, UCLA*, Los Angeles, CA, US 2018

48^{th} *DPS Meeting and* 11^{th} *EPSC*, Pasadena, CA, US 2016

TECHNICAL SKILLS

Programming languages: Python, C, MATLAB, FORTRAN, IDL, Bash.

Select softwares/codes: VASP, DeePMD, REBOUND, MESA, emcee, dynesty.

TECHNICAL WORKSHOPS

OWL Exoplanet Summer workshop by UC Santa Cruz and Heising-Simons 2022

Planet Formation workshop by MIAPbP in Garching, Germany 2022

Sagan Exoplanet Workshop: Astrobiology for Astronomers by NExSci at Caltech 2019

Communicating Science Effectively in Today's World by UCLA and EPSS 2019

XSEDE HPC Workshop: Summer Boot Camp by XSEDE & PSC at UCLA 2018

High Performance Computing Workshop by Intel at IIT Kanpur 2015

MENTORING & TEACHING

Summary: (1) **Research advisor to 4 undergraduate and 1 PhD student to-date, and mentor to 10+ students**, and (2) **teaching assistant for courses and guest lecturer for 1.**

Mentoring (research):

- Roberto Tejada Arevalo (Princeton University, PhD student) 2024 - Present
  Project: *Evolution of water-worlds with hydrogen-rich atmospheres*
- Mariana Ordonez (Princeton U., Undergrad; co-mentor: Dr. Yubo Su) 2024 - Present
  Project: *Exoplanet atmospheres X dynamics*
- Malik Booker (Delaware State U. UG, Princeton USRP Program; with PhD student Caleb Lammers) 2024 - Present
  Project: *Applying ML techniques to AIMD derived data on material interactions*
- Lorraine Nicholson (UCLA Undergrad and UC LEADS fellow → NSF GRFP** fellow and Ph.D. student at U. of Florida) 2020-22
  Project: *Planet evolution under core-powered mass-loss around ultra-cool M-dwarfs*
- Sohanjit Ghosh (IIT Kanpur/IIEST UG → Ph.D. student at Johns Hopkins U.) 2017-18

**National Science Foundation – Graduate Research Fellowship Program

Project: *Understanding the dynamics of rings around non-spherical minor planets*

Mentoring (other):

- Mentor, *EPSS Family Mentorship Program (EFMP)*, UCLA 2021-23
- Mentor, *Counseling Service*, IIT Kanpur 2012-13

Teaching:

- Guest Lecturer, Planetary & Orbital Dynamics (EPS SCI 219), UCLA Spring 2019
- Teaching Assistant, Solar System and Planets (EPS SCI 9), UCLA Winter 2019
- Teaching Assistant, Solar System and Planets (EPS SCI 9), UCLA Winter 2018
- Teaching Assistant, Experiments in Aerospace Engineering III (AE451A), IIT Spring 2016
- Teaching Assistant, Experiments in Aerospace Engineering II (AE351A), IIT Fall 2015

PROFESSIONAL SERVICES & OUTREACH

Summary: (1) **Judged/reviewed 12 proposals for funding up to 1.5 million USD for the US and European government organizations such as NASA and the European Research Council**, (2) **refereed 8 publications for journals from Nature, the American Astronomical Society and the Royal Astronomical Society**, and judge for 1 national student competition, (3) founder, member, and representative of various professional and student organizations, and (4) speaker and volunteer for several outreach events.

Reviews:

- Reviewer for the following organizations and programs: *NASA*, *European Research Council (ERC)*, *Hubble Space Telescope* (HST), and *Future Investigators in NASA Space Science & Technology Program (FINESST)* 2022 -
- Referee for the following journals: *Nature* [×1], *Proceedings of the National Academy of Sciences* [×2], *Monthly Notices of the Royal Astronomical Society* [×2], *Astrophysical Journal* [×2]
- Judge, AAS Chambliss Astronomy Achievement Student Awards 2023

Other Diversity, Equity & Inclusion activities

- Founder & Organizing Committee Member, *EPSS Family Mentorship Program* 2021-23
- Department Representative, *Mathematics & Physical Sciences Council*, UCLA 2017-19
- Departmental Undergraduate Committee, Aerospace Engr., IIT Kanpur 2012-13

Other Professional Services and Activities

- Member, *NSF Physics Frontiers Center: Center for Matter at Atomic Pressures (CMAP)* 2023 -
- Member, *American Geophysical Union* 2024-
- Member, *American Astronomical Society* (AAS) 2022-
- Member, *Division for Planetary Sciences* of the AAS 2022-
- Founder & Organizer, *Planets & Exoplanets Journal Club*, UCLA 2020-22
- Global Organizing Committee member, *Exoplanets III* conference 2020

Other Select Outreach Activities

- *Astronomy on Tap*, Trenton, NJ 2024
- Invited speaker, *Planning for Graduate School*, IIT Bombay, India 2021
- Invited speaker, Wildwood Institute for STEM Research and Development Poster Presentation and Lecture Series, Wildwood School, Los Angeles, CA 2019
- Volunteer, International Observe the Moon Night, UCLA 2019
- Participant, *Exploring Your Universe* - UCLA's Annual Science Outreach Festival 2017-20
- Panelist, Key to Success: Life and Physical Sciences. Grad Student Orientation, UCLA 2018

OTHER SELECT ACHIEVEMENTS

Technical Member of the first IIT Kanpur team (*IITK Motorsports*) to 'conceive, design and fabricate a small, Formula-style racing car to compete' at the *Formula SAE*, Italy'13, a European-leg of the international competition organized by SAE[††] International.

'*Sangeet Bhushan*' (equiv. to Diploma in Music) in playing Harmonium, an Indian classical instrument, from *Pracheen Kala Kendra*, India; 9-10 years of training in playing the instrument.

'*Sangeet Bhushan/Visharad II*' (equiv. to Diploma in Music) in playing Tabla, an Indian classical instrument, from *Pracheen Kala Kendra*, India; 6-7 years of training in playing the instrument.

[††]Society of Automative Engineers