






Shubh AGRAWAL

Physics Senior at the California Institute of Technology

🔗 Google Scholar  [linkedin.com/in/shubhagrawal30](https://www.linkedin.com/in/shubhagrawal30)  github.com/shubhagrawal30
📞 +1 626 365 2490  shubh@caltech.edu  shubhagrawal30@gmail.com
📍 1200 East California Boulevard, MSC 122, Pasadena, CA - 91125  Citizen of India


RESEARCH INTERESTS



- Astronomical Instrumentation
- Superconducting Detectors
- Observational Cosmology
- Exoplanet Direct Imaging
- Statistics and Computation
- Open-Source Software




EDUCATION

Present September 2018	CALIFORNIA INSTITUTE OF TECHNOLOGY, Pasadena, CA, USA <div>Bachelor of Science  Physics Major  Astrophysics Minor  Computer Science Minor</div> <div>Relevant Coursework:<ul style="list-style-type: none">➤ Classical Mechanics and Electromagnetism, Quantum Mechanics, Particle Physics, Quantum Algorithms, Quantum Hardware, Astronomy and Cosmology➤ Astronomical Instrumentation Lab, Senior, Sophomore, and Freshman Physics Labs, Signal Processing➤ Differential Equations, Bayesian Statistics, Physical Methods, Information and Logic, Discrete Math➤ Data Structures, Decidability and Tractability, Algorithms, Systems Architecture</div> <div>Activities:<ul style="list-style-type: none">➤ Academic Honor Code Committee, Physics Student-Faculty Committee, Undergraduate Admissions Ambassador, Undergraduate Physics Mathematics and Astronomy Committee➤ Peer Advocate, Ricketts Hovse Vice President, Review Committee Chair</div>	GPA: 4.2
December 2021 October 2021	UNIVERSITY OF CAMBRIDGE, Cambridge, United Kingdom <div>Natural Sciences Tripos  Corpus Christi College</div> <div><ul style="list-style-type: none">➤ Caltech Cambridge Scholars Program (One Term Study Abroad Exchange Fellow)➤ <u>Coursework</u>: Particle Physics, Field Theory, Relativity, Relativistic Astrophysics, Statistical Physics</div>	

PUBLICATIONS




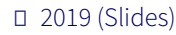
- STRONG NEGATIVE ELECTROTHERMAL FEEDBACK IN THERMAL KINETIC INDUCTANCE DETECTORS** 2021
 [arXiv preprint](#)
Shubh Agrawal, Bryan Steinbach, James J. Bock, Clifford Frez, Lorenzo Minutolo, Hien Nguyen, Roger O'Brient, Anthony Turner, Albert Wandui
Submitted as an Article to the *Journal of Applied Physics* in July 2021. Publication expected in September - October 2021.

Observational Cosmology  BICEP Array  TKIDs
- PLANET DETECTION & ANALYSIS AND INSTRUMENT CALIBRATION MODULES FOR HIGH RESOLUTION SPECTROSCOPY** 2022
(In progress)
Shubh Agrawal
Senior Major Thesis. Defense expected in June 2022.

Direct Imaging  IFS  OSIRIS  reads

Present June 2021	OSIRIS Direct Imaging Group, EXOPLANET TECHNOLOGY LABORATORY, Caltech, Pasadena, CA  github.com/jruffio/breads <ul style="list-style-type: none"> ➤ Created the open-source Broad Repository for Exoplanet Analysis, Discovery, and Spectroscopy. ➤ Discovered and analyzed a binary stellar companion around HD 148352. ➤ Detected Kappa Andromedae b in J band for the first time, using Keck-OSIRIS data. ➤ Created modules to perform FOV-dependent wavelength and resolution calibration in data from Integral Field Spectrographs. ➤ Developed modules to detect and analyze companions in IFS data using MCMC and forward modelling <div> Direct Imaging IFS OSIRIS Python Git Open-Source MCMC </div>
August 2021 June 2020	TKID Group, BICEP KECK COLLABORATION, Caltech Observational Cosmology, Pasadena, CA <ul style="list-style-type: none"> ➤ Demonstrated and analyzed negative electrothermal feedback in Thermal Kinetic Inductance Detectors in the high readout power regime. ➤ Designed configurations that speed up the detector by ≈ 16 times, makes response linear to 0.1% in a nominal incident power range, and maintains the noise levels below design photon noise. ➤ Implemented methods that could use existing cryostat setups at Caltech and JPL to characterize a TKID, perform non-linear frequency sweeps, measure time constants and noise levels, and demonstrate linearity. <div> TKID Cryostat Data Science Python Bash Jupyter Manuscript Writing </div>
June 2020 March 2020	Undergraduate Researcher, LIGO ASTROPHYSICS GROUP, Caltech, Pasadena, CA  Google Colaboratory <ul style="list-style-type: none"> ➤ Developed computational tools to help analyze stochastic gravitational wave backgrounds, and perform automated fitting of merger and ringdown in GW signals. ➤ Completed independent reading through the LIGO GW Open Data platform to learn techniques in signal processing and GW data reduction. <div> GW LIGO Data Science Simulation Signal Processing </div>
March 2020 January 2019	Receiver Group, BICEP KECK COLLABORATION, Caltech Observational Cosmology, Pasadena, CA <ul style="list-style-type: none"> ➤ Designed and constructed an assembly that achieved the angular calibration of the first receiver of the BICEP Array using far field beam characterization. ➤ Machined parts, integrated the assembly with cryostat and thermal test source, and designed a gearbox to achieve precision of 10 arcminutes on optical plane. ➤ Developed firmware for stepper motors. Implemented Python interfaces for assembly code on Arcus controllers, running grid beam maps, and executing C scripts for collecting receiver data. <div> Characterization Angular Calibration Python C/C++ Firmware Assembly SolidWorks Machining </div>

PRESENTATIONS AND CONFERENCES

SOUTH CALIFORNIA CONFERENCE FOR UNDERGRADUATE RESEARCH  sccur.org Presented "Angular Calibration of the BICEP Array receivers using Far Field Beam Map Characterization" <div> Observational Cosmology BICEP Array Angular Calibration </div>	2019
CALIFORNIA INSTITUTE OF TECHNOLOGY SUMMER UNDERGRADUATE RESEARCH SEMINAR DAY  2021  2020 (Video+Slides)  2019 (Slides) Presented "Planet Detection & Analysis and Instrument Calibration Modules for High Resolution Spectroscopy using Integral Field Spectrographs" in 2021. Presented "Strong Negative Electrothermal Feedback in Thermal Kinetic Inductance Detectors" in 2020. Presented "Angular Calibration of the BICEP Array receivers using Far Field Beam Map Characterization" in 2019. <div> Observational Cosmology BICEP Array Angular Calibration TKIDs Exoplanet Technology breads </div>	2019-2021

QUANTUM COALITION HACK

2021

quantumcoalition.io [Video](#)

Selected from about 80 projects and invited to present a talk.

Presented "Microsoft Quantum Development: Grover's Algorithm for the Graph Edge Coloring Problem and Fast Hamiltonian Compilation".

Quantum Algorithms Python Q#

SAGAN EXOPLANET WORKSHOP

2021

nexsci.caltech.edu

Exoplanet Technology breads

NETWORK OF YOUNG RESEARCHERS IN INSTRUMENTATION FOR ASTROPHYSICS WORKSHOP

2021 (EXPECTED)

[nyriastronomy](https://nyriastronomy.org)

Exoplanet Technology breads

AWARDS AND HONORS

2021	RITA A. AND ØISTEIN SKJELLUM SURF FELLOW	California Institute of Technology
2020	DR. GARY STUPIAN SURF FELLOW	Caltech & The Aerospace Corporation
2018, 2019, 2020	MILTON & ROSALIND CHANG SCHOLARSHIP	California Institute of Technology
2018	INDIAN OCSC MEMBER	International Olympiad of Astronomy and Astrophysics
2016	GOLD MEDAL AND INTERNATIONAL RANK 1	SOF's Science Olympiad
2017, 2018	KVPY RESEARCH FELLOWSHIPS	Indian Institute of Science
2016, 2017	RANK 1 AND QUALIFIER	National Standard Exam in Physics, and Astronomy (Indian stages of IPhO and IOAA)
2017	SAKURA PROGRAM FELLOW	Japan Science and Technology Agency
2017	INTERNATIONAL SCHOLAR WITH DISTINCTION	Advanced Placements

OBSERVATION TIME

August 2021	OSIRIS (Keck)	TWO HALF-NIGHTS: Characterization of exoplanetary system Kappa Andromedae b
July 2021	OSIRIS (Keck)	THREE HALF-NIGHTS: Characterization of exoplanetary system HR 8799 bcde
July 2021	KPIC/NIRC (Keck)	FOUR HALF-NIGHTS AND TWO FULL-NIGHTS: Known high-contrast targets, brown dwarves, free-floating, and young stellar binaries
June 2021	OSIRIS (Keck)	THREE HALF-NIGHTS: 12 targets in the Ophiuchus star-forming region
August 2019	WIRC (Palomar)	TWO HOURS: SURF Observation Proposal: "Characterizing Cosmic Dust Emission"

TEACHING EXPERIENCE

Summer 2021	Teaching Assistant & Organizing Staff	CODE/ASTRO: Open-Source Code Deployment Workshop for \approx 100 Astrophysicists
Spring 2021	Teaching Assistant	PHYSICS 3: Introductory Physics Laboratory
Winter 2021	Teaching Assistant	PHYSICS 6: Physics Laboratory
Fall 2020	Grader	PHYSICS 2: Waves, Quantum Mechanics, and Statistical Physics
Fall 2019	Teaching Assistant	COMPUTER SCIENCE 1: Introduction to Computer Programming
2018-19	Volunteer	CALTECH Y RICE PROGRAM: Tutor underprivileged high-school students in STEM
2018-21	Volunteer/Mentor	SELF-GUIDED: Tutor high-school students from India for study-abroad applications

PROFESSIONAL EXPERIENCE

Present	Admissions Ambassador, UNDERGRADUATE ADMISSIONS OFFICE, Caltech, Pasadena, CA
April 2019	<ul style="list-style-type: none">Design and lead campus tours, student panels, and social blogs to prospective students, families, teachers, faculty, counselors, and alumni.Run the front desk of the Caltech Admissions office. <p>Social Outreach Management Communication Writing</p>
March 2020	Undergraduate Assignment, DIVISION OF PHYSICS, MATHEMATICS & ASTRONOMY, Caltech, Pasadena, CA
January 2020	<ul style="list-style-type: none">Designed and managed websites for courses in math and physics.Implemented web-scrappers to automate the archiving of old assignment data, course listings, and department webpages.Wrote email marketing and listings for the physics and math departments. <p>Web Development Python Management Communication Social Outreach</p>

January 2020
October 2019

Undergraduate Assignment, FELLOWSHIPS AND STUDY ABROAD OFFICE, Caltech, Pasadena, CA

- Facilitated communication with about 6 partner universities and created outreach materials for several exchange and fellowship programs.
- Managed the course listings, webpages, office, and library of the Caltech FASA program.

Management Communication Writing

September 2017
January 2017

Developer, INDIAN INSTITUTE OF TECHNOLOGY, DELHI, New Delhi, India

[Abstract & Certification](#) [Virtual Labs](#)








- Worked on the end-user testing of the Virtual Labs project, run by the Government of India, that addresses the lack of good lab facilities and trained teachers, by allowing remote experimentation.
- Responsible for development of 3 virtual labs, each with about 10 experiments, in satellite modeling and simulation, astrophysics, instrumentation, & communications.








Social Outreach Python Web Development

PROGRAMMING

LANGUAGES

English 
Hindi 
Sanskrit 
French 

Python/iPython 
C/C++ 
Mathematica 
Java 
R 
SolidWorks 
Q# 

Bash 
Mathematica 
BASIC 
LaTeX 
CSS/HTML 
Android 
x86-64 

PROJECTS

DWAAR LUCKNOW

2017 - 2020

[Abstract](#) [dwaarlucknow](#)

- Co-founded and ran a non-profit initiative that connects people to credible social help organizations. Connected with over 20 national non-profits and generated an outreach of nearly 50,000 through our 25 partners.
- Created a novel system for a geographically based social petition platform, which was recognized by the **Indian Institute of Technology at Kanpur** as one of the national best student ideas at its collegiate competitions.
- Co-developed a website and Android application featured on radio and in newspapers.

Non-Profit Management Website Development Android Social Outreach

QUANTUM HACK MICROSOFT CHALLENGE: GROVER'S ALGORITHM

2021

 github.com/shubhagrawal30/qchack-microsoft-challenge

Implemented quantum oracles to be used with Grover's algorithm to solve a range of classical problems. Selected from about 80 projects to be a presenter at the closing proceedings of the conference.

Quantum Algorithms

FAST QUANTUM HAMILTONIAN COMPILATION

2020

 github.com/gianelgado12/cs101-Fast-Hamiltonian-Project

Analyzed the complexity of two methods of quantum hamiltonian compilation: First Order Trotter Suzuki and qDRIFT.

Quantum Algorithms

SERVICE

2019 - 2020	Undergrad Rep	PMA ADVISORY BOARD: Advise the division administration about mentorship, career and professional development, community outreach, diversity and inclusion issues that impact the undergraduate student experience.
2018 - 2022	Club Leader	CALTECH PHYSICS CLUB: Organized research talks, faculty seminars, outreach, & advisory panels.
2021	Undergrad Rep	PHYSICS STUDENT FACULTY CONFERENCE: Advise the physics option administration about academic life and curriculum review.
2021 - 2022	Chairperson	ASCIT REVIEW COMMITTEE: Administer the elections of the campus-wide student government of Caltech.
2020 - 2022	Vice President	RICKETTS HOUSE AT CALTECH: Responsible for the housing allotments and needs of about 70 students and physical upkeep of an undergraduate dorm at Caltech.
2019 - 2020	Campus At-large Rep	BOARD OF CONTROL: Adjudicate academic Honor Code violations.
2019 - 2020	Peer Advocate	RICKETTS HOUSE AT CALTECH: Support a community of over 100 students as a resource for mental and emotional health.
2018-19	Volunteer Tutor	CALTECH Y RICE PROGRAM: Tutored underprivileged high-school students in STEM.

REFERENCES

James J. Bock

Professor of Physics, CALTECH/JPL



jjb@astro.caltech.edu



Observational Cosmology

Dimitri Mawet

Professor of Astronomy, CALTECH/JPL



dmawet@astro.caltech.edu



Exoplanet Technology Group