

Saloni Agrawal

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<https://saloniagrawal04.github.io/>

Research Interests

I am interested in using simulations to study the formation and dynamics of super-massive black holes and galaxies. My current research spans analyzing Active Galactic Nuclei using integral-field spectroscopy and studying globular cluster dynamics using N-body Monte Carlo simulations.

Education

Bachelor of Science in Physics, Minor in Computer Science Sep 2021 – Jun 2025
University of California, San Diego
GPA: 3.4 / 4.0

Awards and Honors

[Undergraduate Summer Research Award](#) (\$7500) 2024
[Triton Research & Experiential Learning Scholars](#) (TRELS; \$1000) 2023
[PSCFA Scholar Award](#) (Pacific Southwest Collegiate Forensics Association) 2023

Publications

Coil, A., **Agrawal, S.**, Rupke, D., “Widespread Shocks in an Odd Radio Circle Host Galaxy,” Year (2025) [\(in preparation\)](#).

Coil, A., **Agrawal, S.**, Perrotta, S., “Kinematics and Extent of AGN Outflows with KCWI ” Year (2025) [\(in preparation\)](#).

Research Experience

Dynamics of Globular Clusters using CMC-COSMIC Jun 2025 – Present
Post-Baccalaureate Researcher, PI: [Prof. Kyle Kremer](#) UCSD

- Set up and executed CMC-COSMIC simulations on the San Diego Supercomputer Center (Expanse) to investigate dense stellar clusters.
- Investigated how varying binary mass fractions and black hole retention affect long-term cluster evolution.

Active Galactic Nuclei using KCWI Spectroscopy Aug 2023 – Present
Undergraduate Researcher, PI: [Prof. Alison Coil](#) UCSD

- Built Python pipelines for KCWI data reduction and emission-line fitting (continuum modeling, Gaussian decomposition).
- Mapped spatial kinematics and outflow velocities across multiple AGN host galaxies and characterized black hole-driven outflows using multi-component velocity and dispersion fields.

Dark Matter Backgrounds in the XENONnT Detector Jun 2022 – May 2023
Undergraduate Researcher, PI: [Prof. Kaixuan Ni](#) UCSD

- Designed algorithms to identify sources of single-electron backgrounds in XENONnT.
- Presented findings at the XENON Collaboration Meeting; authored internal reports under TRELS fellowship.

Machine Learning for Particle Physics (JetNet) Dec 2021 – Jun 2022
EXPAND Mentee, PI: [Prof. Javier Duarte](#) UCSD

- Contributed to **JetNet**, a machine learning library for particle jet classification.
- Trained convolutional neural networks for high-dimensional jet image recognition.

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| Teaching Experience | <u>Analytical and Writing Program (AWP) Mentor</u> | Sep 2022 – Mar 2023 |
| | University of California, San Diego <ul style="list-style-type: none"> Mentored students in AWP 4A and 4B, strengthening analytical writing skills. Guided students in preparing writing portfolios to satisfy the UC Entry Level Writing Requirement. | |
| Talks and Posters | <i>“Supermassive Black Hole Driven Outflows in Nearby Galaxies”</i> | Sep 2024 |
| | Summer Program for Undergraduate Research in Science, UCSD | |
| | <i>“Suggested Solution to Eliminate Background Noise in XENONnT”</i> | Jun 2023 |
| | XENON Collaboration Meeting | |
| | <i>“Investigating Background Emission in the XENONnT Detector”</i> | Oct 2022 |
| | Gulf Coast Undergraduate Research Symposium, Rice University | |
| | <i>“Progress on JetNet Development”</i> | May 2022 |
| | EXPAND Program Research Presentation, UCSD | |
| Relevant Coursework | <p>Physics: Classical Mechanics, Electromagnetism, Quantum Mechanics, Statistical Mechanics, Optics, Computational Physics I/II</p> <p>Astrophysics: Galaxies, Black Holes, Stars, Observational Astrophysics</p> <p>Math: Calculus, Differential Equations, Linear Algebra, Probability/Statistics</p> <p>Computer Science: Data Structures, Algorithms, Computer Organization, Theory of Computation, Discrete Math</p> | |
| Skills | <p>Programming: Python, C/C++, IDL, Assembly</p> <p>Libraries: NumPy, SciPy, Matplotlib, Astropy, pandas, h5py, PyTorch</p> <p>Tools: Git, SLURM, Jupyter, LaTeX, Unix/Linux, KCWI/PyPeIt Pipeline</p> <p>High-Performance Computing: MPI workflows, parallel job scheduling, scaling, memory optimization on SDSC/Expanse</p> | |
| Outreach | <i>Instructor/Mentor</i> , STEM Girl Summer | Summer 2023 |
| | <ul style="list-style-type: none"> Taught physics using hands-on demonstrations for high school students. | |
| | <i>Volunteer</i> , Barrio Logan Science and Art Expo | 2022 |
| | <ul style="list-style-type: none"> Led interactive demonstrations explaining mechanics and planetary systems. | |
| | <i>Volunteer</i> , Young Scientist Club, Caramel Creek Elementary | 2022 |
| | <ul style="list-style-type: none"> Assisted students in carrying out scientific demonstrations to understand basic scientific concepts | |
| | <i>UCSD Blackstone LaunchPad</i> | 2022–2023 |
| | <ul style="list-style-type: none"> Developed a startup for creative and affordable campus merchandise. Gained experience in entrepreneurship, innovation, and project development. | |
| Extracurricular Activities | <i>Society of Physics Students (SPS)</i> | 2022 |
| | <ul style="list-style-type: none"> Organized and hosted undergraduate research events and lightning talks. | |
| | <i>UCSD Speech and Debate Team</i> | 2021–2023 |
| | <ul style="list-style-type: none"> Won Silver in NPDA debate(Novice division) at PLNU Forensics tournament Won Gold in Impromptu Speech(Open Division) at PSCFA Spring Champs 2023 Won Gold in NPDA debate(Open Division) at UCSD intra-mural competition | |