

BENJAMIN L. HANSON

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EDUCATION

University of California San Diego - La Jolla, CA
Major: Mechanical and Aerospace Engineering
Field: Control and Dynamics

Current Ph.D., Expected May 2027
GPA: 3.744

Colorado School of Mines - Golden, CO
Major: Engineering Physics
Minor: Robotics and Intelligent Systems
Area of Special Interest: Space and Planetary Sciences Engineering

B.S., May 2022
Summa Cum Laude, GPA: 3.93

RELEVANT EXPERIENCE

NSTGRO Visiting Technologist Experience - Jet Propulsion Laboratory

June 2024 - August 2024

- 10-week summer internship in Section 392K: Mission Design and Navigation System Engineering
- Applied non-Gaussian ensemble and grid-based techniques to the state uncertainty propagation of distant prograde orbits in the Saturn-Enceladus system as a proof of concept for outer planetary orbilander estimation and navigation
- Facilitated efficient communication between JPL's Monte library and C source code via Python wrapper

Air Force Office of Scientific Research (AFOSR) Summer Faculty Fellowship Program

July 2023 - September 2023

- Performed research at the Air Force Maui Optical and Supercomputing (AMOS) site hosted by the 15th Space Surveillance Squadron
- Developed a thorough validation of the landscape of numerical integrators and their respective accuracies relating to the state propagation of cislunar satellites in near-rectilinear halo orbits (NRHOs)
- Used publicly available ephemerides of CAPSTONE to detect orbital-maintenance maneuvers (OMMs) for numerical integration accuracy analysis, specifically comparing REBOUND, ASSIST, and GMAT

Auger@TA Ultra High Energy Cosmic Ray Detector Simulation Analysis

August 2021 - May 2022

- Collaboration between the Pierre Auger Observatory in Argentina and the Telescope Array in Utah to calibrate energy detection method variations
- Collected data using Linux Offline simulations with a varying number of photomultiplier tubes to determine if results were similar
- Analyzed data in Python and converted simulations to usable plots as evidence for or against the reliability of a single PMT detector vs. a triple PMT detector
- Principal Investigator: Dr. Frederic Sarazin, Colorado School of Mines Physics Department

National Science Foundation REU - University of Florida, Astronomy Department

May 2021 - August 2021

- Developed and gave presentation on decomposing galactic spectral energy distributions and inferring properties from the simple stellar populations that make up the galaxies
- Utilized Bayesian statistics programming, specifically Markov Chain Monte Carlo to find best fit for age and metallicity given a spectrum
- Used HiPerGator, UF supercomputer, along with other Python simulation tools and techniques to model galactic behavior
- Principal Investigator: Dr. Paul Torrey, University of Florida Astronomy Department

Electricity and Magnetism/Analog Electronics Teaching Assistant

January 2020 - May 2022/January 2021 - May 2021

- Duties included supervising lab sections, answering lab and homework questions, holding separate office hours for further questioning, and grading homework and tests

HONORS AND AWARDS

- **NASA Space Technology Graduate Research Opportunities (NSTGRO) Fellow** (Grant # 80NSSC23K1219), "A Grid-Based Bayesian Approach to Uncertainty Propagation for Icy-Moon Missions" proposal (August 2023 - August 2027)
- **Chambliss Astronomy Achievement Student Award Honorable Mention**, 240th AAS Meeting Presentation on "A Flexible Approach to Fitting Galactic Spectral Energy Distributions" (June 2022)
- **Colorado School of Mines Undergraduate Research Fellow (MURF)**, "Assembly of Microparticles for Robots and Composite Materials Under Combined Electric and Magnetic Fields" (August 2020 - May 2022)
- **Colorado School of Mines Physics Undergraduate Research Symposium: Best Individual Technical Research Project**, "Optimizing the Selection of Reconstructed Events in Auger@TA for Cross-Calibration Purpose Through Simulations" (April 2022)
- **Colorado School of Mines Dean's List** (August 2018 - May 2022)

PUBLICATIONS

Refereed Journal Publications

J1 X. Zhu, Y. Gao, R. Mhana, T. Yang, **B. L. Hanson**, X. Yang, J. Gong, and N. Wu, "Synthesis and Propulsion of Magnetic Dimers under Orthogonally Applied Electric and Magnetic Fields," *Langmuir*, Vol. 37, No. 30, 2021, pp. 9151–9161.

Submitted Journal Publications

- S2 **B. L. Hanson**, M. Zhao, T. R. Bewley, "An Extensible Framework for Probabilistic Search of Stochastically-moving Targets Characterized by Generalized Gaussian Distributions or Experimentally-defined Regions of Interest," Submitted to *Communications in Statistics - Theory and Methods*, 2024
- S1 B. R. O. Floriano, **B. Hanson**, T. Bewley, J. Y. Ishihara, H. C. Ferreira, "A novel policy for coordinating a hurricane monitoring system using a swarm of buoyancy-controlled balloons trading off communication and coverage," Submitted to *Engineering Applications of Artificial Intelligence*, 2024

Conference Publications

- C1 **B. L. Hanson**, A. J. Rosengren, and T. R. Bewley, "State Estimation of Chaotic Trajectories: A Higher-Dimensional, Grid-Based, Bayesian Approach to Uncertainty Propagation," *AIAA SCITECH 2024 Forum*, AIAA, 2024

ORAL PRESENTATIONS

- P6 *Non-Gaussian Recursive Bayesian Filtering for Outer Planetary Orbilander Navigation*, Jet Propulsion Laboratory, Pasadena, CA (August 2024)
- P5 *xGEO Numerical Integrator Analysis and Maneuver Detection*, REBOUND Conference 2024, Online (July 2024)
- P4 *An Evaluation of Physics Based Force Model Performance in LEO: Implications for Next Generation Space Traffic Management*, Committee on Space Research, Busan, Korea (July 2024)
- P3 *On the Validity of the Gaussian Assumption in the Jovian System: Evaluating Linear and Nonlinear Filters for Measurement-sparse Estimation*, 6th International Workshop on Key Topics in Orbit Propagation Applied to SSA, Universite d'Artois, Arras, France (June 2024)
- P2 *A Flexible Approach to Fitting Galactic Spectral Energy Distributions*, 240th AAS Meeting, Pasadena, CA (June 2022)
- P1 *Synthesis and Assembly of Anisotropic Particles*, Colorado School of Mines Undergraduate Research Symposium, Golden, CO (April 2022)