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BENJAMIN L. HANSON

www.benjamin-hanson.com   blhanson@ucsd.edu

EDUCATION

University of California San Diego - La Jolla, CA   **Current Ph.D., Expected May 2027**
Major: Aerospace Engineering
Field: Dynamic Systems and Controls

University of California San Diego - La Jolla, CA   **M.S., June 2024**
Major: Aerospace Engineering   *GPA: 3.744*
Field: Dynamic Systems and Controls

Colorado School of Mines - Golden, CO   **B.S., May 2022**
Major: Engineering Physics   *Summa Cum Laude, GPA: 3.93*
Minor: Robotics and Intelligent Systems
Area of Special Interest: Space and Planetary Sciences Engineering

RELEVANT EXPERIENCE

NSTGRO Visiting Technologist Experience - Jet Propulsion Laboratory   **June 2024 - August 2024, June 2025 - August 2025**
- 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
- Visualized simulation data on the reliability of a single PMT detector vs. a triple PMT detector via Python
- 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 spectrum best fit for age/metallicity
- 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

J4 **Hanson, B. L.**, Zhao, M., and Bewley, T. R., "An extensible framework for the probabilistic search of stochastically-moving targets characterized by generalized Gaussian distributions or experimentally-defined regions of interest," *Communications in Statistics-Theory and Methods*, 2025, pp. 1–26. https://doi.org/10.1080/03610926.2024.2439999.

J3 Haque, M. A., Maestas, J. R., Zhu, X., **Hanson, B. L.**, Wu, D. T., and Wu, N., "High-Density and Well-Aligned Hierarchical Structures of Colloids Assembled under Orthogonal Magnetic and Electric Fields," *ACS nano*, 2025. https://doi.org/10.1021/ acsnano.4c11957

J2 Floriano, B. R., **Hanson, B. L.**, Bewley, T., Ishihara, J. Y., and Ferreira, H. C., "A novel policy for coordinating a hurricane monitoring system using a swarm of buoyancy-controlled balloons trading off communication and coverage," *Engineering Applications of Artificial Intelligence*, Vol. 139, 2025, p. 109495. https://doi.org/10.1016/j.engappai.2024.109495.

J1 Zhu, X., Gao, Y., Mhanna, R., Yang, T., **Hanson, B. L.**, Yang, X., Gong, J., and Wu, N., "Synthesis and propulsion of magnetic dimers under orthogonally applied electric and magnetic fields Authors," *Langmuir*, Vol. 37, 2021, pp. 9151–9161. https://doi.org/10.1021 /acs.langmuir.1c01329

Submitted Journal Publications

S2 **Hanson, B. L.**, Ely, T. A., Bewley, T. R., and Rosengren, A. J., "Sequential Instantaneous-update Filtering Applied to Outer Planet Moon Orbiter Estimation," Submitted to *Journal of Guidance, Control, and Dynamics*, 2025.

S1 **Hanson, B. L.**, Rubio, C., García-Gutiérrez, A., and Bewley, T. R., "GBEES-GPU: An Efficient Parallel GPU Algorithm For High-Dimensional Nonlinear Uncertainty Propagation," Submitted to *Computer Physics Communications*, 2025. https: //doi.org/10.2 139/ssrn.5067608

Conference Publications

C2 **Hanson, B. L.**, Rosengren, A. J., Bewley, T. R., and Ely, T. A., "Non-Gaussian Recursive Bayesian Filtering for Outer Planetary Orbilander Navigation," *AAS/AIAA Space Flight Mechanics Meeting*, 2025, p. 194. https://doi.org/10.13140/RG.2.2.33100.73603

C1 **Hanson, B. L.**, Rosengren, A. J., and Bewley, T. R., "State Estimation of Chaotic Trajectories: A Higher-Dimensional, Grid-Based, Bayesian Approach to Uncertainty Propagation," *AIAA SCITECH 2024 Forum*, 2024, p. 0426. https://doi.org/10.2514/6.2024-0426

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)