BENJAMIN L. HANSON

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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

UC San Diego MAE143B Linear Control Teaching Assistant **August 2025 - September 2025**
- Duties included holding office hours, developing solutions sets to homeworks and exams, grading homework and exams, and presenting in lecture

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

J6 **Hanson, B.L.**, Ely, T.A., Bewley, T.R., Rosengren, A.J.: Bayesian benchmarking of GBEES applied to outer planet orbiter estimation. Journal of Guidance, Control, and Dynamics **49**(1), 240–246 (2026) https://doi.org/10.2514/1.G009146

J5 **Hanson, B.L.**, Rubio, C., García-Gutiérrez, A., Bewley, T.: GBEES-GPU: An efficient parallel GPU algorithm for high-dimensional nonlinear uncertainty propagation. Computer Physics Communications **317**, 12 (2025) https://doi.org/10.1016/j.cpc.2025.109819

J4 **Hanson, B.L.**, Zhao, M., Thomas, R.B.: 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 **54**(17), 5480–5505 (2025) https://doi.org/10.1080/03610926.2024.2439999

J3 Haque, M.A., Maestas, J.R., Zhu, X., **Hanson, B.L.**, Wu, D.T., 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., 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 **139**, 109495 (2025) 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., Wu, N.: Synthesis and propulsion of magnetic dimers under orthogonally applied electric and magnetic fields. Langmuir **37**, 9151–9161 (2021) https://doi.org/10.1021/acs.langmuir.1c01329

Submitted Journal Publications

S1 **Hanson, B.L.**, Carton, L., Bewley, T.R., Ely, T.A., Rosengren, A.J.: Hybrid, ephemeris-quality, measurement-free estimation of the potential 2024 YR4 lunar impact. Submitted to the Journal of Astronautical Sciences (2026) https://doi.org/10.21203/rs.3.rs-8196369/v1

Conference Publications

C2 **Hanson, B.L.**, Rosengren, A.J., Bewley, T.R., Ely, T.A.: Non-Gaussian recursive Bayesian filtering for outer planetary orbilander navigation. In: AAS/AIAA Space Flight Mechanics Meeting, p. 194 (2025). https://doi.org/10.13140/RG.2.2.33100.73603

C1 **Hanson, B.L.**, Rosengren, A.J., Bewley, T.R.: State estimation of chaotic trajectories: A higher-dimensional, grid-based, Bayesian approach to uncertainty propagation. In: AIAA SCITECH 2024 Forum, p. 0426 (2024). https://doi.org/10.2514/6.2024-0426

ORAL PRESENTATIONS

P9 *Efficient Prediction of the Gaussianity Validity Time in the Circular Restricted Three-Body Problem*, COPERNAICUS Seminar, Online (Sept 2025)

P8 *GBEES-GPU: An efficient parallel GPU algorithm for high-dimensional nonlinear uncertainty propagation*, Cassyni Computer Physics Seminar Series, https://doi.org/10.52843/cassyni.m84f85 (Sept 2025)

P7 *Predicting the Temporal Limits of Gaussianity in the Saturn-Enceladus System with the Unscented Transform*, Jet Propulsion Laboratory, Pasadena, CA (July 2025)

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)