Igor Z. Palubski

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Professional Experience

University of California, Irvine - Center for Cosmology   **Irvine, CA**
High-Performance Simulation Development & Doctoral Research   *November 2020 - September 2024*

- **Developed and integrated new physics models** (Monte Carlo scattering for SIDM) into the C GIZMO codebase, focusing on efficient code structure and performance optimization for massively parallel environments.
- **Identified and resolved critical numerical instabilities** arising from mass parallelization in the C simulation framework (GIZMO), eliminating systemic errors without compromising computational scaling or thread-safety trade-offs (leading to the discovery of the core-collapse error growth).
- **Developed new tools in Python** for multivariate analysis (in a 10 dimensional phase space) of terabyte-scale data generated from N-body simulations of isolated self-interacting dark matter (SIDM) halos, increasing the accuracy with fitting halo properties in noisy data sets compared to traditional numerical methods through physically-informed curve fitting, **improving prediction accuracy by a factor of 2**.
- **Designed a dark matter prediction model in Python** resulting in an empirical relation that predicts how dark matter halos evolve under any particle physics model by parameterizing halo properties across a large set of high-resolution cosmological simulations.
- **Led seminars on compiling/running C software on supercomputers** giving numerous undergraduate and graduate students knowledge and expertise in the art of hydrodynamical simulation via containerized GIZMO in unix.

Shields Center for Exoplanet Climate and Interdisciplinary Education   **Irvine, CA**
Doctoral Researcher - Atmospheric Physics   *August 2018 - November 2020*

- **Created a parallelized 1-Dimensional Energy Balance Model in MATLAB** discovering a large set of habitable zones on extreme planetary orbits by analyzing the effects of orbital dynamics.
- **Designed a C tool that generates initial climatic conditions** for synchronously rotating planets with desired spatial resolution, contributing to the development of sophisticated 3D Global Circulation Models (GCMs) for climate simulation on extrasolar planets.

Personal Projects

- **Built a modern snake game** in React/TypeScript with a websocket-based server for training an AI agent using deep Q-learning to compete against the player. **Designed a Transformer-based network that ingests engineered game-state features as tokens to model both temporal and spatial dynamics**. Implemented real-time data exchange and model updates between the game client and a Python training server via websocket communication.

Education

University of California, Irvine   **Irvine, CA**
Ph.D in Physics (Computational/Theoretical)   *September 2024*

Iowa State University   **Ames, IA**
B.S in Physics (with minors in Math and Astronomy)   *Awarded 2017*

Skills

Programming Languages: Python • C • C++ • Matlab • TypeScript • Java
Systems and Practices: Linux Systems • High-Performance Computing • Distributed Systems concepts
Frameworks and Tools: PyTorch • SQL • Tableau • Matplotlib • Scikit-Learn • Pandas • Numpy • Scipy • React • OpenMP • MPI • Jupyter • VSCode • Git • Docker
Natural Languages: English (fluent) • Polish (fluent)
Related Coursework: Graduate level training in ML/AI: CNNs, RNNs, Transformers and other ML methods, applications in computer vision and reinforcement learning