# Karthik Prabhu Palimar

5307606345 | Davis, CA | karthikprabhu22@gmail.com| LinkedIn:kprabhu22 | GitHub:Karthikprabhu22

## OBJECTIVE STATEMENT

Computational Physicist with expertise in mathematical modeling, generative AI, and high-dimensional data analysis. Experienced in developing scalable computational pipelines, applying advanced machine learning techniques, and presenting research findings to interdisciplinary audiences. Seeking to leverage technical expertise and analytical rigor to contribute to innovative, data-driven solutions in cutting-edge scientific and industry applications.

## EDUCATION

**University of California, Davis:** *Ph.D. (Physics),* ***GPA:3.91/4.0*** Expected graduation: Mar 2025
**University of California, Davis:** *Masters (Physics),* ***GPA:3.91/4.0*** 2021
**Indian Institute of Science Education and Research, Pune:** *BS-MS (Phy & Math)*, ***GPA:9.0/10.0*** 2018

## SKILLS

**Technical Skills:** Forecasting, MonteCarlo Methods, Bayesian Inference, Generative AI (VAEs, DDPMs), PyTorch, Retrieval Augmented Generation, LLM, AWS, CUDA
**Programming Languages:** Python, Julia, MATLAB, SQL, C, C++
**Soft Skills:** Technical writing, Grant Proposal development, Collaboration, Leadership

## PROFESSIONAL EXPERIENCE

**Doctoral Researcher,** University of California, Davis Sep 2018 - Present

- Developed generative models using Variational Autoencoders (VAEs) and Denoising Diffusion Probabilistic Models (DDPMs) to learn and simiulate highly complex distributions, improving data-driven parameter estimation
- Built scalable computational pipelines leveraging GPU acceleration and parallel computing (CUDA) for processing large-scale astronomical data
- Led efforts to optimize survey strategies for the South Pole Telescope, significantly enhancing constraints on cosmological parameters
- Presented research findings at international conferences (APS) and meetings to interdisciplinary audiences
- Organized several workshops on high-performance computing, career development, mentorship, and computational tools
- Took several initiatives to promote equity and diversity, fostering an inclusive research environment

## SELECTED PROJECTS

**Generative Modeling for Galactic dust emission:**

- Developed a deep generative model for Galactic dust maps using **TensorFlow**-based **VAEs**, capable of simulating datasets with realistic statistical properties
- Applied this model to **optimize simulations for downstream scientific analyses**, enhancing the accuracy of cosmological inference

**Cosmological Parameter Estimation:**

- Contributed to the development of a parameter estimation code, MUSE, utilizing **Auto-Differentiation** and **Parallel Computing** to process high-dimensional astronomical maps from the South Pole Telescope
- Achieved the first-ever cosmological parameter inference directly from map-level data, incorporating all higher-order moments for more precise and comprehensive analysis

**Pawsitive Retrieval:** (Erdös Institute deep learning bootcamp Project)

- Processed and cleaned 5.5M Reddit posts, incorporating metadata to enhance embedding relevance
- Fine-tuned an embedding model for query processing in large datasets, achieving a **10-15% performance improvement** over baselines and optimizing retrieval using LanceDB with 160 hyperparameter configurations
- Delivered a scalable Retrieval-Augmented Generation (RAG) pipeline validated through metrics like MRR and NDCG, securing **first place** in the competition.

## SELECTED PUBLICATIONS

- **Testing the ΛCDM Cosmological Model with Forthcoming Measurements of the Cosmic Microwave Background with SPT-3G**, arXiv:2403.17925
- **A generative model of galactic dust emission using variational autoencoders,** arXiv:2101.11181