

# Statement of Purpose

## of Dante Buhl (Applied Math PhD applicant for Fall—2024)

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Growing up in the Greater Sacramento Area and coming from a low-income family, I had never thought that I would want to become an academic, or at least get a PhD one day. And yet, here I am at 22 years of age with a drive to learn more and make new insights in the field of fluid dynamics. I went to the University of California Santa Cruz as a first-gen student for my undergrad in Mathematics and graduated in 3 short years with a GPA of 3.74 and highest honors in the major. Before my departure, I found a department that was doing a really interesting fusion of mathematics and computer science. This was, of course, the Applied Mathematics Department (later referenced as A.M. Department), which happened to have an amazing 4+1 master's program. This is my current academic position as I am writing this: a graduate student in UC Santa Cruz's A.M. Department.

Towards the end of my undergraduate career, I took two graduate level fluid dynamics courses. One was an introductory course taught by Nicholas Brummell from the A.M. Department, and the other by Chris Edwards from the Ocean Sciences department and focused on Geophysical Fluid Dynamics. These courses cemented my interest in the general subject of fluid dynamics while also preparing me for work in the field of study.

Upon graduating from UC Santa Cruz in June 2023, I participated in a summer REU program at Towson University in Maryland. The principal investigator for this research was Herve Nganguia, a fluid dynamicist who specializes in math-bio related problems. Our work was focused on using Deep-Learning to find a numerical model which complemented prior analytical work published in a paper by Nganguia concerning the propulsion efficiency of ciliated spherical “squirmers” in Stokes Flow. This program was also focused on preparing participants in research-focused mathematical work and featured several presentation opportunities. The most notable presentation on this work is scheduled to be at the Joint Mathematics Meeting in San Francisco this coming January 2024. The REU ended at the beginning of August, and I soon after started a new research project in Santa Cruz.

Currently, I am in my first quarter of graduate studies and plan to complete a master's thesis on the effect of rotation on stratified turbulence in stellar fluids under the guidance of Pascale Garaud, a well-published researcher in astrophysical and geophysical fluid dynamics. This research involves both Direct Numerical Simulations (abbreviated DNS) and analytical work that will append to Garaud's prior findings on stratified turbulence. Some details of this work includes multi-scale analysis of the governing equations and investigation of the regimes that originate from relevant non-dimensional numbers. Features of the DNS design, in this project include stochastic forcing methods with Gaussian Processes, Spectral Integration Methods, and triply-periodic domains. In addition to my thesis, I plan to take another course in fluid dynamics titled, “Waves, Instabilities, and Turbulence”, in order to prepare for a PhD on the subject. I will also be working as a Teaching Assistant in order to fund my degree, gain teaching experience, and support lower division mathematics courses within the department. The expected time of completion for the degree is the spring or summer of 2024.

Moving into the future, I could see myself fitting in very well at UC Berkeley. I very much want to remain in California, the state I grew up in and Berkeley is not very far from where I live now in Santa Cruz. Berkeley is also known to be a great institution for Fluid Dynamics with a large list of faculty to support the field of study. Of the many names at Berkeley, some of those that stand out are Alexis Kaminski, Simo Mäkiharju, and Jon Wilkening.

Ultimately, I'm a proud and hard-working student who has, within the last year, developed a passion for working with Navier-Stokes and Fluid Dynamics. My recent academic experiences have culminated into a well rounded foundation for PhD research and I look forward to navigating opportunities in the future.