Statement of Purpose
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I remember the moment I first learned about the intricacies of time. At thirteen years old, I stumbled across a YouTube video that portrayed the classic story of young Alice and Bob. In it, Alice spends five years traveling near the speed of light and returns to find that Bob has aged ten times this. I remember feeling a melange of emotions—the tension between fascination and disbelief, freedom of extending beyond my previous paradigm, and even frustration that no one had bothered to tell me this inconceivable fact. Most importantly, I encountered a deep sense of connection to the world, as though it had just confided in me a deep and beautiful secret about itself. Of course, I soon learned this was only the beginning of the story, and while relativity may have been idling just outside my umwelt, it was far from secret.

I amassed as much relativistic information as my developing brain could handle before moving on to quantum physics. Amazed by the strange ways in which the world seems to work, I continued with the digestible descriptions until I found myself cornered by the Schrodinger Equation and the Standard Model—the symbols were intimidating, and there were too many particles whose origins I couldn't trace. At the time, I wasn't ready for a deeper mathematical explanation and, frankly, I didn't know one existed. Confronted with this barrier, my interest in physics settled to a low hum until years later, as a senior in high school, I took a course called Physical Universe. The course dove into all the peculiarities I had encountered previously while still ebbing around the lure of mathematics. That same year, after deciding I would study physics at university, my attention was piqued as my calculus teacher stated, "...this will be very useful for those taking physics next year." This was all I needed to take the leap into the vibrant world of mathematics. In hindsight, I was primed to dive into this world as soon as I learned there was water beneath.

Upon graduating, I spent much of the summer studying MIT Linear Algebra lectures to prepare for the coming year. The next few summers were no different. After my first year, I self-taught multivariable calculus from Shifrin's book so I could pursue vector calculus upon entrance into the honours math and physics program that fall. I then bit off a little more by self-teaching McGill's Analysis I and II (following Abbott) in order to proceed with Honours Analysis III (Measure Theory). While my confidence was running high, my mathematical proficiency was not quite ready for the rigor I met in this course. I was ultimately guided to success by my curiosity and excitement for the new ideas, but the difficulty I experienced read like a faint warning sign.

In struggling to master Analysis among other things—I had recently founded a podcast and was now competing in Jiu Jitsu—I began to neglect some of my other courses with the idea that I would soon make up for the lost time. This moment never materialized, and my audacious plan resulted in a failure of Thermal Physics—perhaps a second lesson on the intricacies of time. This experience has left a deep impression on my outlook and approach to math and physics. I have since not shied away from significant academic undertakings, but developed more patience and intimacy with the process of acquiring mathematical knowledge.

As a result of my shortcoming, I was unable to stay in the honours program. My passion for math and physics had only grown stronger since I started university, but I suddenly felt struck by rejection. Thankfully, two things came to my aid: Edward Frenkel's Love and

Math, and Prague. The book introduced me to the Langlands Program and professed the deep connections between mathematics and fundamental physics. Similar to my experience as a child, I found myself captivated by the novelty of these grand ideas. Equipped once again with excitement and momentum, I departed for my exchange in Prague.

Upon my arrival, I registered for seven courses—one of them General Relativity, a full circle moment for my thirteen-year-old self—and later decided to participate in an eighth: Advanced Concepts in Symmetry. These courses were structured similarly to my Thermal Physics course at McGill, for which the grade depended only on the final exam. Despite my lack of experience with oral assessments, I flourished. I made a point to progressively audit my understanding of the material. Through this act, I learned to unravel my confusion by asking and answering pointed questions to approach the roots of my uncertainty. This is where I developed the aforementioned patience and intimate understanding of the process of mathematics. I truly hope that my transcript from Charles University is taken as a testament to my passion, curiosity, and love for mathematics as well as a display of perseverance after a cold wake-up call.

Last summer, I returned home to Minneapolis to work under Professor Li Wang, whom I was initially put in contact with through a serendipitous interaction with a McGill professor: I was attending office hours to discuss numerical methods for the Laplace Equation after completing a 25-hour physics "hackathon" on the topic. My professor then directed me toward the current research at the University of Minnesota without knowing it to be my home. With Professor Wang, I have been working to prove convexity and convergence results of a novel particle method developed by her and her colleagues for certain Wasserstein gradient flow equations. I previously knew almost nothing about gradient flow, so this research has given me the opportunity to employ and further develop my self-teaching skills. A practice adjacent, but distinct, to self-teaching, is that of a mathematician where one investigates a theory in which the results are yet to be worked out by anyone. In this context, we knew convexity must be proven and we had papers on similar methods to help us, but we did not know how it would unravel and what assumptions and intermediate results we would require along the way. The work I have done with Professor Wang has been instrumental in my development as a young mathematician and has shed a brilliant, captivating light on what mathematics—outside of a lecture or textbook—actually is.

In my next chapter, I hope to return to the idea of mathematics as a fibration over physics. This concept is what initially pulled me back from relativity and quantum theory, into the vibrant world and it is on these fibers that I intend to focus. Specifically, I am interested in questions of geometry, topology, their algebraic counterparts, and gauge theory as they pertain to mathematical physics. In this vein, I now understand the Schrodinger Equation and the Standard Model to be less *a posteriori* than I previously thought, but I have many more questions to answer and if anything, more confusion to unravel. I also understand that my academic path is unique, but I hope my love for the field, my dedication to it, and my deep curiosity resonate well. To quote Richard Feynman, "Study hard what interests you the most in the most undisciplined, irreverent and original manner possible." I strive to do mathematics in my own way. I believe it's a necessary step to becoming friends with the objects in question, for only then will they admit to you their secrets.