During my sophomore year, I often found myself stepping out of my dorm at three in the morning, letting the cold air fill my lungs and clear my mind. These late-night walks became my refuge whenever I felt demotivated or struggled to visualize mathematical concepts. What kept me going was a quote: “In mathematics, you don't understand things. You just get used to them.” This comforting wisdom, from the inventor of von Neumann algebra, became a temporary mantra for me. Sometimes, you need the courage to take the next step even when the path ahead is unclear. But, as I’ll explain later, another force pulls me in the opposite direction with equal strength.

In short, I have now firmly chosen mathematics. It is the theory of theories.

Among all branches, geometry has always fascinated me the most. This interest traces back to my childhood, when LEGO and a passion for Architecture sparked my imagination. I saw the golden ratio in the facade of Notre-Dame before that destructive fire, and marveled at Da Vinci’s double helix staircase at Château de Chambord. These experiences continued as I engaged in architectural drawing and modeling, tackling classic problems like angle trisection and constructive geometry in CAD Rhino. Thus, even though I entered WashU as an architecture major, my interests soon shifted to the more rigorous realm of mathematics.

My freshman algebraic topology course sparked an interdisciplinary engagement with mathematics. Prof. Quo-Shin Chi tasked us with writing for high-schoolers about how mathematicians connect seemingly unrelated problems. I corrected a numerical value in David Gale’s “The Game of Hex and The Brouwer Fixed-Point Theorem” and detailed YouTuber 3Blue1Brown’s proof of equivalence between the necklace division problem and the Borsuk-Ulam theorem. Embracing Feynman’s philosophy of teaching as a method of learning, I served as a TA for a differential topology course and helped high school friend at CMU with Fourier analysis in signal processing. These experiences underlined how reorganizing previous problems from a more advanced perspective strengthens understanding and helps maintain an evolving learning system.

I continued this journey with studies in Riemannian geometry. In the summer of 2023, I joined the Freiwald Scholars Program led by Prof. Renato Feres, studying Cayley graphs of abelian and nilpotent groups and their Markov-based-curvatures in the sense of Ollivier, Yau, and others. I presented this research at Midstates Consortium for Math and Science 23 at UChicago. Working on linear optimization solvers for the curvatures, I was thrilled by the synergy between continuous and discrete geometries, as well as the blend of theoretical and applied perspectives.

During the same summer, I was lucky to attend the Noncommutative Geometry Festival 2023 at WashU, where I witnessed renowned mathematicians like M. Gromov and A. Connes present their work. Although I couldn’t fully grasp their talks, I was deeply inspired by their passion and dedication. A memorable presentation was on the quantum central limit theorem by Prof. Arthur Jaffe and Dr. Kaifeng Bu at Harvard, which led me to further readings with Dr. Bu on information theory. During the reading, I was amazed by the elegance of entropy proof of Brégman’s Theorem and geometric structure arising from Fisher information metric.

My interest in symplectic geometry was ignited when doing the final project in Math547 Theory of Polytopes. Based on Khovanskii and Pukhlikov’s paper “Riemann-Roch Theorem for Integrals and Sums of Quasipolynomials over Virtual Polytopes,” I presented a theorem on integer-point counting of Delzant polytopes. During the study, I picked up Delzant theorem on classification of symplectic toric manifolds and sought out Prof. Xiang Tang to supervise my undergraduate thesis based on this topic. Interestingly, Prof. Tang introduced me to a different mindset—what I mentioned earlier as the “opposite direction with equal strength.” He insisted that I understand every skipped step and complete all exercises in Ana Cannas da Silva’s lectures. This tension—between moving forward even without complete understanding and meticulously filling in all gaps—creates a richer dynamic to learning. The process was difficult but fruitful: it provided a concrete focus to delve into broader Lie theories, for which I took two companion courses. I was also formally introduced to J-holomorphic curves and Kähler structures. I realized that moment polytopes encode quantum information about group actions via geometric quantization. This project connected many topics I had learned and sparked new interests I want to explore further.

Last summer, I was fortunate to be selected as a fellow for the MIT Summer Geometry Initiative (SGI). Among the four projects I participated in, two focused on signed distance functions (SDFs). In one project, led by Prof. Oded Stein (USC) and Prof. Silvia Sellán (Columbia), we designed our own SDFs and used the marching squares algorithm to reconstruct them. Another project with Prof. Amir Vaxman employed shallow neural networks to model SDFs of surfaces. I was thrilled when I used Gauss's lemma to prove that the Eikonal equation and the closest point condition together characterize SDFs on a plane, which underscored the importance of physical intuition in problem-solving. Additionally, the use of visualization tools like Polyscope and Adobe Illustrator played a crucial role in these projects.

This experience further cemented my belief that geometry lies at the heart of many seemingly disparate areas in mathematics. While my interests span several fields, geometry remains central to my mathematical journey. I am particularly fascinated by how different perspectives—analytic, topological, algebraic, and physical—intertwine through geometry. For example, I am drawn to the dynamical and visual landscape of low-dimensional manifolds, the classical and quantum aspects of symplectic geometry, and the interplay between large-scale geometry and group theory. My recent exposure to algebraic geometry through a graduate course has also sparked a deeper interest in areas like K-theory and Hodge theory, showing me how these fields can further enrich the geometric framework. Through these explorations, I have come to appreciate how geometry serves as a central language for connecting diverse mathematical tools and ideas.

UC Berkeley is an ideal environment for pursuing these interests, with its renowned faculty and strong research groups in geometry and analysis. I am particularly excited about the work of Professor John Lott, whose research on Wasserstein geometry has deeply influenced my own work. Additionally, the department's strength in symplectic geometry is a major draw for me, given my exposure to this field under the supervision of Professor Tang, who completed her graduate work at Berkeley under Alan Weinstein. I would be excited to learn from and collaborate with leading experts like Michael Hutchings and David Nadler, who are working on cutting-edge problems in symplectic geometry, as well as Constantin Teleman and Alexander Givental, whose research in the physical and quantum aspects of geometry aligns with my growing interest.

I am confident that Berkeley’s dynamic environment and the breadth of its faculty will provide the ideal setting to develop my skills further and tackle challenging problems in mathematics. I am eager to contribute to and learn from this vibrant community, and I am excited to face the intellectual challenges that lie ahead.