

# Cover Letter

Matias Relyea

Dear Dr. Steven J. Miller,

My name is Matias Relyea, and I am a freshman at the University of North Carolina at Chapel Hill pursuing a B.S. in Mathematics. I am writing to apply to SMALL 2026, where I hope to work with Dr. Steven J. Miller on a project relating to number theory and probability. Having conducted independent number theory research culminating in publication in *Mathematics Magazine* and completed a directed reading program on category theory, I am eager to participate in SMALL to do real original collaborative math research and form a brilliant mathematical community in number theory. SMALL will provide me with the concrete skills and dedication to thinking long and hard about difficult math that I need to develop as a researcher.

At Euler Circle in the summer of 2022, I wrote a 44-page paper on quadratic reciprocity and presented a 15-minute talk. I developed this interest by reading Rosen and Ireland's *A Classical Introduction to Modern Number Theory* under the guidance of Professor Tamar Avineri, who taught an illuminating elementary number theory course at the North Carolina School of Science and Mathematics before her passing in mid 2025. Professor Avineri's mentorship culminated in two papers, with *The Quadratic and Cubic Characters of 2* being accepted for publication to *Mathematics Magazine* in 2025. I also collaborated with two classmates on an original research project concerning polyomino placement in colorings of square and triangular grids during the January term, resulting in a paper that was accepted to the NCSSM scientific journal, *Broad Street Scientific*.

At UNC, I have pursued coursework in analysis and advanced linear algebra, served as an undergraduate learning assistant for a discrete mathematics course, and completed a directed reading program on Tom Leinster's *Basic Category Theory*. Adjusting to advanced proof-based coursework presented challenges in my first semester at UNC, but this experience has strengthened my mathematical maturity and approach to problem-solving. In the spring, I am taking topology, algebraic geometry, and algebraic structures. I am also preparing two one-hour talks on the contents of my paper accepted to *Mathematics Magazine* for presentation to the university math club. As I study mathematics relating to my prior work, I have developed early-stage interests in algebraic geometry, modular forms, class field theory, and representation theory. The broad focus of Dr. Miller's project on L-functions and random matrix theory is of great appeal to me and will further or deepen my interests in these fields. Altogether, my DRP in category theory, work in algebraic number theory, interest in adjacent fields, and upcoming spring coursework prepare me well to approach and contribute meaningfully to a project in number theory at SMALL.

I am confident that SMALL will be a valuable experience as I prepare for graduate study in mathematics, and I am excited about the opportunity to meet like-minded students from varying backgrounds and develop as a mathematician. Thank you for your time and consideration.

Sincerely,  
Matias Relyea