**Why did you choose these research fields? \***

Articulate why the research fields chosen on the previous page are intriguing and exciting to you. For each sub-field, state what you perceive as the one or two most interesting questions or problems in this area.  Explain why these sorts of questions interest you. Your responses are shared with mentors. Please respond with clarity and specificity, including what specific prior research/coursework/etc experiences have prepared you to "hit the ground running" in these fields at RSI.

**Math:**

My genuine interest in mathematics blossomed during my 8th-grade year. Recognizing that the middle school math curriculum failed to fully engage me, I am grateful for my math teacher's guidance. Encouraging me to self-study high school math topics, my teacher presented challenging questions that went beyond the standard class content. These thought-provoking problems, often linked to our coursework but demanding more advanced knowledge, provided a source of deep satisfaction upon resolution. This experience laid the foundation for my continued exploration of mathematics.

I consistently view math as both intriguing and challenging. When faced with difficulties or the temptation to give up, I instinctively ponder, "Do I truly love math?" This internal query lingered until the summer of 2023 when I joined the Ross Mathematics Program. Progressing from the fundamentals of number theory and abstract algebra, we delved deeply into proofs of lemmas, propositions, theorems, and PODASIPs (Prove Or Disprove And Salvage If Possible). Our journey culminated with the proof of Quadratic Reciprocity, yet my mathematical pursuits didn't cease there. I independently delved into various sub-fields such as quadratic forms, elliptic curves, p-adic numbers, and abstract algebra. The thrill of applying prior knowledge to solve theorems captivates me, with particular interest in quadratic forms and abstract algebra. The less-explored realm of quadratic forms, especially Conway's Topograph and its application to solving Pell's Equation, captivates my current research focus.

Among its various sub-fields, my interest is particularly drawn towards the profound realms of group theory and Galois groups in abstract algebra. Abstract algebra, with its intricate web of mathematical structures and elegant proofs, continues to captivate my intellectual curiosity. Having delved into the pages of "Abstract Algebra" by Dummit and Foote, I found myself immersed in the rigorous beauty that characterizes pure mathematics.

The meticulous proofs presented in the realm of abstract algebra resonate with me, showcasing the discipline's commitment to precision and logical reasoning. One aspect that particularly stood out was the ingenious application of group theory to establish the impossibility of coming up with an expression for solutions of polynomial with power equal to or greater than 5. The revelation of such a fundamental limitation through the lens of group theory is nothing short of brilliant and, to me, exemplifies the power of abstract algebra in unraveling the secrets of mathematical structures. I would like to do more research about group theory.

**Physics:**

Immersed in the captivating domain of physics, my focal point is the intricate landscape of fluid mechanics. My academic journey has been a dynamic exploration, with previous research dedicated to unraveling the enigmatic dynamics of stably stratified flow. This particular study delved into the interplay of sediment-rich river water injected into seawater, shedding light on the complexities of this fluidic dance. Fluid mechanics, as a sub-field requiring much math is inherently rife with uncertainties, serving as an ever-present source of inspiration for my inquisitive mind. My interest, now piqued by the complexity inherent in multiphase flows, was previously channeled into research involving a binary system of two distinct phases. This exploration marked the inception of a profound question: How to solve the multiphase flows? Venturing into the unexplored terrain of multiphase flows with an augmented number of phases promises not only to expand our understanding of these systems but also to confront the challenges posed by heightened complexity. This ambitious journey is propelled by the anticipation of uncovering novel insights that extend beyond conventional boundaries.

**What are your long-range goals? \***

My long-range goal is to become a leading researcher in number theory and abstract algebra and contribute to advancements in algebra. I see RSI as a pivotal step toward achieving this goal due to its exceptional focus on the quality of research and mentors’ professionalism and specialization, which can provide great support and guidance for my research experience. I am committed to continuing to learn new knowledge to overcome challenges and contribute meaningfully to the scientific community. RSI's rigorous environment and collaborative opportunities make it the ideal platform to nurture my aspirations.

**What activities and/or hobbies demonstrate your leadership, creativity and uniqueness? \***

I am the founder and director of Shanghai International Math Circle | SIMaC. The motivation for establishing SIMaC is because I discovered that our social range is mainly among our school, while rare people do competitions and it’s hard to form a team. For example, my team members of HMMT are found on social media by sending my previous research on it. However, it is inconvenient, and compared to our status, my friends have their math circle based on state, and I want to establish a similar platform for people to communicate and share math content and team up. I sent POTW and POTM and handouts to enhance members’ ability of problem-solving and set a customized calendar for competitions.

**Describe your participation in extracurricular or community outreach activities? \***

I participate in different activities. I am the president of school math and physics club, teaching members competition content and advanced content extended from IB math. For example, we have a calculus crash course and BPhO training session, while also teaching random interesting content such as elliptic curve cryptography and introduction to quantum mechanics and fluid mechanics. I am also the lecturer in a program called X-program to teach advanced students selected from middle school and activate their interest in mathematics. I taught the course *Numbers, Mappings, and Groups: An investigation into the beauty of mathematics through the scope of abstract algebra.* Other than teaching, I am interested in creative activities. I like coffee-making and drawing, those creative works require calm mind. When I'm making coffee, I feel serene. I'll put all my attention into how to compact the ground coffee, how to froth it better, and blend and pull it better. When drawing, I like to focus myself on the composition of the whole art piece. The process fo frequent viewing and adjusting are similar to what I did when constructing a proof and required careful observation. I am also the co-author and illustrator of the cover for the book *The Mathematics Competition Omnibook: Volume 1 – Geometry*.