

Your Complete Name: Matthew Zhao

Current Grade level: Junior

Hobbies (List things that you enjoy doing outside of school. Examples include: tennis, ultimate frisbee, video games, reading, etc...)

Programming, Running, Snowboarding, Tennis

Clubs (List organizations to which you belong. Examples include: Robotics Team, Quiz Bowl Team, Swim Team, Tennis Team, Chess Club, Band, Orchestra, etc...)

Math team, Science Olympiad, BTYE Coding, Chess, Track, Cross Country

Contest/Competition Experience or Honors (List honors you have received or other contests in which you participated. Examples include: National Merit Scholarship recipient, Honor Society, Destination Imagination, U.S. Math Olympiad, etc...)

US Physics Team (2021, 2022), USAPhO Book Prize Winner (2021), USAPhO Qualifier (2019-2022), USAPhO Honorable Mention (2019), USAMO Qualifier (2022), USAJMO Qualifier (2019-2021), AMC 10 Perfect score (2021), AP CS A Perfect Score (2021)

Autobiography (Write a short autobiography that can give others some insight into why you are participating in this event, as well as insights into your personality and beliefs. This should not just be a rewrite of the information you have put in the above categories. Approximate length: 500 words)

I've always been obsessed with how things work. In 5th grade, I did my capstone project on how planes fly. I was so amazed when I found out that airplanes were actually lifted by pressure differences and was eager to share this knowledge with my classmates by presenting slides about the lift equation and explaining how increasing certain variables affect the lift force.

In middle school, I frequently created physics-based games, but the physics were almost always inaccurate. In 8th grade, I started learning mechanics and was intrigued by how accurately the laws of physics could predict the outcomes of different situations in the real world. I became fascinated and started experimenting on my own. I created string pendulums to measure the gravitational constant. I compared the coefficient of friction of various shoes on different surfaces. Equipped with the knowledge, I tried to rebuild these games and worked for months on a javascript physics library that I could use to create simulations. With this library, I programmed various games including a recreated hill climb racing game, a bridge strength simulator, and a 2D physics engine to simulate collisions. The visual effects of these games were very accurate and real thanks to the physics engine behind them.

That year, I took the $F=ma$ exam and was surprised that I qualified for the USAPhO exam and even made an honorable mention afterward. I only knew basic mechanics and I resolved to do better next year. I started studying other subjects such as electricity and magnetism from college-level textbooks. When I was learning mechanics, it was easy to observe objects moving and applying forces on each other. However, when I moved on to electricity and magnetism, I struggled to understand the laws and equations even though they were responsible for things we use on a daily basis. In addition, Maxwell's equations involved complicated del operators, line integrals, surface integrals, and so on, which I felt challenging to comprehend. To understand these advanced mathematics concepts, I took a CTY online course on multivariable calculus and did an independent study on differential equations with Dr. Kumaresan, one of my high school teachers. I eventually came to appreciate the beauty of these fundamental equations and their ability to so fully describe the complicated behavior of electromagnetism. With all these preparations I managed to qualify for the USAPhO camp in 2022. I'm really excited to attend and meet others who are also eager to learn physics.

Even though learning new concepts is very tough, I want to continue to learn more to unlock the workings of the universe. I do not know how far I can go, but I know I will keep going.