

Final Reflection on My 2015 Summer Research Experience at the Stanford Pre-Collegiate Summer Institutes High School Program

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For three weeks this summer, I attended the Stanford Pre-Collegiate Summer Institutes High School Program. I do not really like making comparisons, but . . . THIS WAS THE SINGLE MOST FANTASTIC THING I HAVE EVER TAKEN PART IN DURING SUMMER! The course I took was The Theory of Relativity, which was exactly as scary and as cool as it sounds.

The Classroom

Every weekday, Monday through Friday, class would start at 9:00 a.m. and run until about 11:40 a.m. Our instructor, Dr. Gary Oas, fostered a comfortable learning environment from the start of the program by having us refer to him by his first name, or, if we insisted on formality, it was “The Glorious Ruler Of All Spacetime.”

Gary began most classes with a reintroduction of the previous day’s topics, which could have been anything from the speed of light to the effect of gravitational warping on the GPS. Oftentimes, this transition from morning daze to enthusiastic student took the pleasing form of physics web comics. After answering our questions and ensuring that we had wrapped our heads fully around the previous day’s material, Gary would immediately begin re-blowing our minds with new topics. Each day in class was different from the others. Some days would consist mainly of theoretical discussion and the implications of the discoveries and thoughts we had in our class, while other, more nitty-gritty, days

involved Gary filling up three chalk boards and continuing onto the wall with derivations and equations before erasing it all and continuing a proof or physical definition.

Because Special and General Relativity, which, as I learned, are essentially the studies of different observers' views and measurements of events with respect to velocity or the gravitational field, require truly enormous speeds or masses to have noticeable effects under normal conditions, it is very difficult to conduct real-world laboratory simulations on the classroom scale. As a result, we used what are called Gedankenexperiments (i.e., German for thought experiment) as the basis for most of our learning. Gary made difficult topics, like length contraction and time dilation, even more interesting and definitely more understandable with his Gedankenexperiments, including scenarios involving relativistic beauty treatments and anti-aging methodologies.

I most clearly remember our class's conceptual discussions of topics, such as black holes and Hawking radiation, as well as on current issues, such as the lifespan of a black hole and the information paradox. I was so thrilled to understand and be part of a conversation that was actually relevant to the physics of *now*. Never before this class had I ever come even close to exploring anything that had not already been well established for hundreds and hundreds of years.

After-class Studies

The homework assigned was always challenging, but we, thankfully, had designated time to do it every day and wonderful residential counselors (RCs) who knew exactly how to approach and explain problems to students coming from a variety of different physics backgrounds. The discussions on the problems that I had with them, as well as the talks that we had about the world of academics in general, were very eye opening for me. I learned just as much about relativity and the real world by working with the RCs outside of class as I did during lecture.

Counselors and Peers

When I was not in the classroom learning about mindboggling ideas, such as light speed travel (rather, the impossibility of it) or singularities, I was always having fun and felt like part of a big family. From the moment I met a terrifyingly smart yet incredibly amiable SPCS counselor at SFO International to the drawn-out goodbyes and attack-hugs/wails from campers and counselors when I was leaving for the airport, I felt cared for and loved by the entire house of people whom I grew and bonded with over those amazing few weeks.

My residential experience with the program involved staying in a sorority house with two classes of kids in the program—one of which was my group, which was enrolled in The Theory of Relativity. Even when working difficult problem sets in groups at the house, my classmates and I would always have enlightening side conversations about physics, future plans, and school experiences in general. For fun, we would participate in activities, such as attending a multi-house dance (after taking hip-hop classes, of course), tie-dying, playing Ultimate Frisbee, making s'mores, and even going on excursions to the surrounding areas.

All of my best moments, though, definitely came from interacting with the people at the enrichment program. One of my favorite memories was finding a random fountain on campus and getting soaked while jumping and wading through it with a group of friends. Oh, and there was digging a hole/fortress at the beach that could fit four or five people comfortably, so we decorated it in the name of our house. Did I mention making improvised Kit Kats and ice cream sandwiches? What about lying under the stars and talking about the importance of humans in the universe and why aliens haven't visited Earth? The point is, there were so many fantastic and eye-opening interactions with classmates, counselors, and everyone else, too! I made a lot of lasting friendships at the program, and I will definitely be keeping up with each person.

Take Aways

Loads of great activities and experiences aside, this enrichment program has had a huge impact on me both in terms of academics and personal development. I was not sure about what I wanted to study as a major in college, but, after all the material I learned and people

I talked to at the program, I am almost positive that it will be physics. This class, in addition to teaching me about relativity, also taught me about the field of physics as a whole. Before, I did not know where subjects, such as quantum mechanics, special and general relativity, string theory, or even classical mechanics, fit into the spectrum and how they fed into each other. To me, the knowledge of how each of the specific areas work or do not work together is invaluable. Aside from getting the big picture of physics, the program also taught me the importance of attitude and the power of close friendships, and it has, quite honestly, improved my capacity for interacting comfortably with people. For me, it is definitely not an easy task to interact with new people who are dauntingly intelligent, so it took a lot of self-coercion to get myself to talk to the people at the program during those first few days. Of course, I am extremely glad that I did. I will never, ever forget the friends I made and the lessons—relativistic and personal—that I have taken away from this enrichment opportunity. Thank you again, GFF, for making all of this possible!