OSU REU Personal Statement

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I applied to Reed College decidedly a physics major; made fervent by the airy musings of physicists in little scraps that I found on YouTube throughout high school. Sagan told me that I was star stuff, that I was a way for the cosmos to know itself; but after my first four semesters at Reed, this star stuff (me) could at best tell a relatively complete story of throwing rocks. The first four semesters of the Reed physics major make up a fixed gauntlet, each semester covering in turn: throwing plain rocks, throwing charged rocks, throwing rocks connected to springs, throwing very very small rocks, throwing lots of rocks at the same time, and throwing rocks very very fast[1]. Suffice it to say, I became disillusioned. I did not feel like I was interacting with the putatively awe inspiring 'nature of nature' to which Feynman seemed to suggest I was entitled.

My disillusionment, however, ran only skin deep. Indeed, what we studied in each course was clearly no rock at all; rather in an intro mechanics course, one takes a rock and strips it of all of its irrelevant properties–it becomes merely a point. Suddenly the right way to think of the rock is as an element of a vector space; and somehow its position, velocity, etc. are one parameter mappings into the space. When one wishes to give the rock a charge, one supplies the ambient vector space with a mapping to itself (i.e. a vector field); and suddenly the study of the charged rock is encoded into the study of the rock-point's relationship with the supplemented mapping. Each course would return some of the so said 'irrelevant' information to the rock by supplying more structure to the abstract rock-point's universe. So I trekked though Reed's gauntlet and for all of my disillusion with the *subject* of the physics courses I took, came n-fold (for n large) fascination with the *development of methods* required to build up the subject. In this respect, I was not as much disillusioned with physics as I was uncomfortable studying something one step removed from my true love, mathematics. Now, I am applying to this REU decidedly a mathematics major; this time made fervent by nearly three years of deliberate study, and an intimate working relationship with several subdisciplines of math.

While attending Budapest Semesters in Mathematics (BSM), I had the pleasure of taking a course in quantum informatics and probability. In it we motivated and then constructed the nondistributive ortholattice of orthoprojections on a (finite dimensional) Hilbert space to model the structure of events in a quantum system. Among the things we did on this lattice are the following: use Gleason's theorem to identify all 'physical' probablity functions with unique density operators, identify physical quantities with self adjoint operators, and model physical measurements as projection valued measures (partitions of unity). Using such tools, we modeled several physical systems (EPR paradox, zero total spin state systems, etc) and were ultimately able to discuss the limits of information storage in an n level quantum system in the context of various games. Insofar as my second paragraph has established that I have a strong affinity for studying the physically motivated imposition of structure on sets, this course was an absolute joy; and after reviewing the pertinent projects that Professor Kovchegov has overseen in past years, I believe that I have the background[2], motivations, and technical skill to be a strong member of his research team.

Unfortunately, I do not yet have any research experience in mathematics, but I am absolutely itching for that to change. My freshman summer I was still convinced I wanted to major in physics, and I elected to spend last summer taking a course in computer science at Portland State University so that I might be a more useful member of a research team this summer. Moreover, Reed College does not offer any research opportunities in mathematics. It is my intention to enter graduate studies in mathematics, and I recognize my responsibility to have some practical understanding of what graduate students actually *do* (i.e research).

That the OSU REU exists is a great boon to me. I am originally from a small town in Indiana and after moving to Portland, I have in some sense fallen in love with the culture and attitude of the Pacific Northwest–specifically Oregon. Consequently I expect to be applying predominantly to graduate schools in the Pacific Northwest next year. I will, if accepted to your REU, cherish the opportunity to grow more familiar to/with OSU and perhaps solidify my candidacy for graduate studies there. It is for this reason, as well as my personal interest in the methods and development of quantum informatics, that if I am accepted to your program I will, without question, attend.

[1] The titles of these courses were more formally: classical mechanics, electromagnetism, differential equations, and an overview of modern physics (basic quantum mechanics, statistical mechanics, and special relativity).

[2] From both the aformentioned mathematical physics course, and a physics course in quantum mechanics.