

## Physics Commencement, Friday June 14, 2013

Folks, you're such a GREAT CLASS! I'm pretty sure I know almost all of you. I had so much fun working with you on math methods, then on classical mechanics. And I had the privilege to do research with some of you: with Paul, who is going to Utah for graduate school (Paul don't worry we will get our paper published soon!), with Miles, who will go on to grad school in engineering at University of Texas Austin (and yes, we will publish our paper soon too, Miles!). Brilliant guys.

And folks, thank you so much for inviting me to speak today, I'm really excited! And WOW, thanks for nominating me for the excellence in teaching award! Those who bike or run with me know that I'm not at all a competitive guy (RIGHT EDDIE?) so of course I didn't really care about getting the award... Not true, so thank you so much!

This has been a great year. The first graduate students I "recruited" when I arrived here at UCSC, Tim and Max, are graduating, and moving on to great postdoctoral positions, after a STELLAR graduate career. Tim was offered almost every postdoctoral job in his field this year. If there is a problem of lack of jobs, blame it on Tim, he piled them all up! He ended up accepting a NASA Einstein fellowship that he will take to the University of Chicago. Max, on the other hand, will go to a much better Institution, the University of California, Santa Cruz. The best thing that can happen when a stellar graduate student graduates is when he stays! So thank you Anthony for hiring him as a postdoc!

And Anthony, thank you for sharing with me a fantastic student who is also graduating this year: Jonathan Kozaczuk. Jonathan is helping me with my plot of colonizing the world with my graduate students. He's moving to Vancouver, Canada. My two previous grad students are postdocs in Germany and Japan.

Folks, this is a decisive moment in your life. A decisive moment, one when you will soon have to make decisions that might shape and affect the rest of your life. The months right after my college graduation were for sure the most decisive in my entire life. So I thought I'd share with you what happened to me back then.

I went to college in Italy. College in Italy is different from here. One difference is that if you study physics you ONLY study physics. The “breadth requirement” is a lab course if you’re a theorist, and a theory course if you’re an experimentalist. And this was MY DREAM. I loved physics in high school. I wanted to do ONLY PHYSICS in college.

I went to college in Pisa, the city of the leaning tower, in what is considered an “elite” university, called Scuola Normale. You’ve got a week-long entrance exam with three written tests, taken by about 400 prospective students. Scuola Normale then admits about 8 physics students per year. If you get in it sounds like a really sweet deal: they pay your tuition, room and board, they even give you a salary. But the students are held to the highest academic standards, and there’s an often insane, and unhealthy competition among Scuola Normale students. I ended up doing my master thesis on the most challenging possible topic I could find in theoretical physics, feeling that I had to prove something. It didn’t have anything to do with data, with reality. I was really NOT enjoying doing research.

When I graduated I thought I hated physics. And I thought, that my parents wanted me to have a career in the corporate world, and definitely not in academia. Shortly after graduation I was recruited by a top management consulting company, McKinsey, and I was thrilled about the radical change in my career.

It was 2002, and those were pretty tough times. McKinsey consultants were hired to go into big companies, where they were told by the CEO to cut, say, 20% of the workforce, and to find people to sack. But I REALLY wanted to like that job! It was so hard to come to terms with the fact that it was CLEARLY not for me. It was hard to listen to my gut feeling, which was CRYSTAL CLEAR: I had to give physics a second chance!

And I did. Following the advise of a particle physics experimentalist, I decided to completely switch topics, move away from Pisa for grad school, and work on dark matter. And I still work on dark matter, after more than 12 years. Haven’t found it yet, but I love what I do. It’s been a great journey, and in the process not only did I fall in love with physics again, but also with this country and with my beautiful American wife. And, frankly, I think I have the best possible job!

Folks, this is a decisive moment in your life because you will have to make decisions. And making decisions sucks. It sucks because WE ARE SCIENTISTS. We like variables that we can actually control, outcomes we can predict. Life is not like that. But we do have beacons. One of the beacons I had in my life was to be honest with myself, with how I felt about what I was doing. Letting go of what I thought other people wanted me to do. Let me quote Richard Feynman (I'll do it again later). Feynman said: "You have no responsibility to live up to what other people think you ought to accomplish. I have no responsibility to be like they expect me to be. It's THEIR MISTAKE, not my failing."

I'm really excited about my research, and I hope I conveyed some of this excitement to you guys in my lectures and more directly to those who have worked with me. This has been a memorable year for research in my field, particle physics: the discovery of the Higgs, where many UCSC faculty played a key role; there have been multiple experimental and observational signals that might originate from dark matter. Dark matter might well be the portal to new physics, beyond what we call the "standard model", a theory which we know is incomplete. And we at UCSC are leaders in this field, at many levels: 1. observation; 2. theory; 3. phenomenology; 4. simulations. As Joel likes to say, the cold dark matter paradigm was invented here (and he was one of the co-inventors, together with our chancellor George Blumenthal and astronomy's Sandy Faber).

I think it's great when you experience an environment where people do cutting edge research. It's great when your teacher is not just repeating notions produced by others; she or he is actively engaged in PRODUCING those notions, in writing the next chapter in this great book of science. I hope you have experienced some of this excitement while here at UCSC.

At McKinsey, the only thing that kept me going was having a good salary. And I did! I was quite good at the job, but it truly felt what I like to call "prostitution of the mind". My intellect was serving a cause that I had no interest in, that didn't mean anything more than a way to earn a good wage. Scientific research is not like that. I care about what I do, and I choose to do it, just like you chose the advisor and topic you worked on. I truly wonder what the dark matter is. We're talking 80% of the matter in the Universe! I'm really curious about what the heck it is, I want to find out, I'm so excited about the question my research deals with!

Physics is not about learning facts, remembering formulae or dates. Physics is about mastering a method. We call it the scientific method: it's as simple as: "keep what works, get rid of what doesn't"; it's about falsifying theories and models; the scientific method is about what Galileo called the "lingua matematica", the mathematical language; is about quantitative thinking and modeling. It's about understanding and interpreting statistics; more importantly, the scientific method is about critical thinking, systematically doubting one's conclusions, in a quantitative, objective way. Feynman famously said that "Scientific knowledge is a body of statements of varying degrees of certainty - some most unsure, some nearly sure, but none absolutely certain."

As physicists, whatever lies ahead for you guys, you will have the ability to tackle problems with method, with SCIENTIFIC method. One of our postdocs in the theory group was recruited last year by Morgan Stanley. He didn't know anything about finance, he was a string theorist. He was not recruited for his notions, but, sure enough, for his ability to approach questions in a quantitative, analytic, SCIENTIFIC way. And, unlike me, he's actually enjoying his career away from science.

So embrace this decisive moment of your life. Yes, you will have to make decisions, and the process sucks. I am however sure that in this process you will cherish having experienced what doing research means, and what the scientific method is about.

And I do think there is a beacon. Call it heart. Call it guts. It's a matter of asking yourself: "Do I love what I'm doing?" "Am I passionate about what I do?" "Is the notion of Monday morning acceptable?" It's a matter of being honest with yourself, and to be brave about the consequences. Let me quote Feynman one last time: "Physics isn't the most important thing. Love is."

So, take your destiny in your hands. Work hard. Go out there. Make some damage, make a difference. And enjoy the process!

Congratulations, class of 2013!