KENNESAW STATE UNIVERSITY ORAL HISTORY PROJECT

INTERVIEW WITH NIKOLAOS KIDONAKIS

CONDUCTED, EDITED, AND INDEXED BY THOMAS A. SCOTT

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TS: Today the interview is with Nikolaos Kidonakis who won the Distinguished Scholarship Award for 2008. Nikolaos, why don't we begin as we do with everybody, just asking you about your background, where you grew up and where you went to school and things like that.

NK: I was born and raised in Greece. My home city is called Thessaloniki.

TS: That's an historical, Biblical city.

NK: It is. It's the second largest city in Greece after Athens, the capital. It goes back to 315 B.C., so the time of Alexander the Great, basically.

TS: Right, it's right on that major highway that used to run through east-west. I guess it still is a major highway through the east-west. Paul wrote two letters that are part of the Bible to the Thessalonians.

NK: That's right.

TS: Okay, so you were in a very historic location.

NK: That's right. It's full of history, full of monuments. Well, the whole country is very historic everywhere and, yes, I was born there in 1969. I was raised there, so I went to school there. I left when I was seventeen and a half, and I left to study in the U.S. I went to the California Institute of Technology, Caltech.

TS: How did you make that decision to go there?

NK: Well, I did a lot of research about schools. I was always interested in America, the U.S., so I wanted to see new things. I always liked travel, and then, specifically, why Caltech? I did a lot of research about schools, and I thought it was the best science school in the U.S.

TS: Oh, yes, it's hard to beat Caltech.

NK: Yes. So I applied, and I got a scholarship, and that's how I went. I wouldn't have been able to go without a scholarship because it's very expensive.

TS: Your English is as good as a native speaker. Did you have a strong background in English growing up?

NK: Well, English is taught in public schools, but, traditionally, many Greek children also go to a private school a few hours per week for English, to learn it even better, because in public school it's not taught so well. People go to this kind of school to learn English better, but also many children, though not me, also go to other private schools to basically go over again the material they are taught in public school to enhance their chances of going to a university because university admissions are very competitive. I didn't actually go to that kind for just general education, but only for English. I was quite good with languages in general.

TS: Before we get you to Caltech why don't we talk a little bit about did your parents encourage you strongly toward getting an education?

NK: Yes, for one thing, my mother was an elementary schoolteacher. She is retired now.

TS: What is her name?

NK: Dimitra. In fact she was my teacher for three years in elementary school.

TS: Oh my goodness.

NK: So first, second, and fourth grade.

TS: Poor kid! You could never cut up in school!

NK: No. But, yes, I was quite fine about it; it wasn't a problem. So, of course, we focused on education a lot. My father also—my father was an officer in the military when I was in elementary school. Then he retired quite young at around forty-one or forty-two. Then he became a businessman, he opened a business, a store, and then he . . .

TS: What kind of store?

NK: Well, drinks, both alcoholic and non-alcoholic, retail and wholesale. Actually when he started, he started selling olive oil, which is big in Greece.

TS: What's his name?

NK: Ioannis. That's the Greek of John, basically. It's the original version, I guess. I also have a sister, Marianna.

TS: I guess you know you're not the first person born in Greece to win one of our Distinguished Faculty Awards here; Vassilis C. Economopoulos won the Distinguished Teaching Award back in '95.

NK: Yes, I guess I came too late; he had already passed away, but I met his wife [Marjorie], actually.

TS: She's just retired. So you have a strong background—how did you get interested in physics?

NK: As soon as I can remember, myself, since I was a little child, about five or six, I was always interested in the universe, in physics, in the planets, the stars, and so on. I was watching all these science programs like *Cosmos*, Carl Sagan, so I was always interested in science. Then even in the specific topic of theoretical particle physics, when I was in high school, I was already interested in that. So when I was sixteen or seventeen I already knew.

TS: I didn't even know there was such a thing when I was in high school. [Laughter]

NK: Also, there was an American cultural center in Thessaloniki where I did research about the American universities. There was an American consulate, but there was also a separate cultural center with a library. I remember going there and reading *Physics Today*, which is the professional journal of the American Physical Society [and American Institute of Physics], so I was already . . . .

TS: You know, that's not what a normal high school kid usually does in America at any rate?

NK: Yes, but in Greece it's not so unusual that you may be interested early on because you have to decide from high school already what you want to do in the university. It's not like here, where you go, and the first three years of college are, basically, high school where you discover yourself and decide what major. There you have to know from high school what your major will be. When you go to the university, if you go to physics, you just do physics, physics and maybe some math and chemistry. You don't do history, English, whatever.

TS: Oh, so no liberal arts core courses.

NK: No, because that's what you did in high school. High school is very broad, and everybody takes everything. So, actually in high school you don't have any choice in what you take; you take everything. High school is very broad, and then you go to the university, and you specialize.

TS: Do you think we take too long getting people to their majors here?

NK: I think so, yes. It looks to me almost backwards that in high school you have a choice not to take physics, for example, like many of my students say they have never taken physics. I say, "How come? In Greece, you take three or four years of physics; everybody takes physics, and everybody takes English, everybody takes psychology, Greek, and many other subjects."

TS: When I went through high school close to fifty years ago, everybody who was going to college, I think, took biology in the tenth grade, chemistry in the eleventh, and physics in the twelfth, and I guess we had a general science in the ninth grade. So we had a little bit, but three years of physics in high school is tremendous.

NK: Yes, but I think, because I've talked with some Americans, I guess here when you take biology or you take physics you take it every day, five hours a week. But in Greece you don't do it like that; you maybe take two or three hours per week, but then you take more subjects, and you take them every year. So maybe that's why you can do so many years because it's not so intensive. But I think it is better like that because you're not yet specializing. It's supposed to be high school education where you learn a little bit of everything.

TS: And if you do a little bit each year you don't forget it.

NK: Exactly. It reinforces it, so I think all in all it's a better way.

TS: Sounds good to me. So you applied to Caltech and got accepted.

NK: Yes, I applied to other schools as well and got accepted, like Stanford and MIT, but Caltech was my choice.

TS: They gave you a scholarship?

NK: I got a scholarship, yes, because it was financially difficult of course, going from Greece to California. The climate was very similar, so that's one thing that I liked.

TS: Really?

NK: Yes. California's climate is like that of Greece.

TS: What city is Caltech in?

NK: It's in Pasadena, which is Los Angeles, basically.

TS: So that's a pretty warm climate.

NK: Pretty warm and relatively dry and desert also. Greece is not a desert, but it's very dry compared to northern Europe.

TS: In Thessaloniki, you're not far from the mountains though are you?

NK: No. And actually Thessaloniki is not as dry as southern Greece, so Athens is much drier. Actually Thessaloniki is a little bit more like northern Europe in that it's more green.

TS: You're a few miles from the sea one way and a few miles from the mountains the other way?

NK: Actually we're right between the sea and the mountains. It's right on the sea, but then it goes uphill. The city is actually built uphill, so you get both simultaneously within a couple of miles.

TS: It sounds like a great place to grow up.

NK: Yes, and I enjoy going back all the time. I love the sea. I love cities that are built by the sea, so you can just walk by the sea.

TS: Right. So you get to Caltech, let's see, what year was it that you got there?

NK: Nineteen eighty-six.

TS: You spent four years there and graduated in 1990.

NK: Yes, a Bachelor of Science with Honor in Physics.

TS: One of the things we ask people along the way is about mentors; do you have any mentors this early on that kind of shaped you?

NK: Actually, yes. I had an advisor, although I didn't have that much interaction with him. He won the Nobel Prize a few years ago, [H.] David Politzer. He won the Nobel Prize in Physics in 2004. Although I didn't know it at the time, his specialty is actually what I'm doing now. What he won the Nobel Prize for was the theory of QCD, Quantum Chromodynamics, which is a theory that I'm working on now, although at the time I wasn't really specialized enough to . . .

TS: So he was doing that, but you weren't aware of it at the time.

NK: I was aware that he was doing theoretical particle physics, which is what I was interested in, but I didn't know this very specific….

TS: Did you take any courses from him?

NK: No, I didn't actually.

TS: But he was your advisor?

NK: He was my advisor, so, basically, it was signing papers, and I talked to him a few times, but I didn't really have much interaction. At the time it was more amazing that Richard [P.] Feynman was still alive; I don't know if you've heard of him. He was probably the greatest American physicist. He actually died when I was at Caltech in '88.

TS: He was at Caltech?

NK: Yes. He is probably the most famous American physicist, Richard Feynman, and he was a Nobel laureate, of course [1965], and then another famous one was Murray Gell-Mann, another Nobel laureate [1969]. He's also very famous, and he was actually responsible for QCD. He started the theory of quarks. Then David Politzer worked more on that. So especially at that time Caltech was really, really the best place for physics. All the famous people were there. Kip [S.] Thorne was there. I also took classes by him, he was famous. He was working with Stephen Hawking on black holes and cosmology, and actually he taught me a class. Richard Feynman actually gave a guest lecture when we were freshmen. That was the year before he died, and he just liked to interact, and even though he didn't have to, he liked to teach freshmen a little bit and expose us to physics. In the 1960s he taught freshman physics, and his lectures were made into books, the famous Feynman lectures on physics. This is a standard back from the 1960s for freshman physics.

TS: That's really remarkable to get somebody that prominent to be teaching freshman courses.

NK: Yes, but it's not that unusual. I know other people as well who, I mean, they don't do it every year, but they want to do it. I think there is a tradition in America that they pay a lot of attention to the first year physics. It's kind of a traditional course, more I think than in Europe, and they pay a lot of attention and even luminaries will think it's important to teach it. So, yes, it was a very impressive place, and I was really happy to be there at the time. It was a lot of hard work though—very hard work. The thing is that you go there, and you think you're the smartest kid in the world because you were in high school, and you really were very smart, but then you go there, and everybody is just like you. So it's really impressive in the beginning how everybody is smart. But, on the other hand, it's not cut-throat competitive; it's competitive, but people help each other. It's not like there's cut-throat competition. The climate was nice, and you would help each other with homework and so on—one reason being that you wanted to survive. So it was nice that people helped each other.

TS: You spent four years there and probably went to the beach a time or two as well.

NK: Only a time or two, probably because I didn't have a car, so I depended on friends and didn't have time.

TS: You spent a lot of time in the lab?

NK: Yes, and homework and many nights staying up doing homework.

TS: In 1990 you graduate from there. Then before you go to State University of New York at Stony Brook you went several other places.

NK: I went to the University of Cambridge in England.

TS: That was straight from Caltech?

NK: That was straight from Caltech. That was a one-year course I did at Cambridge. That's called Part III of the Mathematical Tripos, which is a very old, distinguished and traditional course. What you get when you finish it, the degree you get is called the Certificate of Advanced Study in Mathematics. So that's what I received a year later. In the UK sometimes theoretical physics is grouped under mathematics, not under natural science. So there's experimental physics, which is under the natural sciences, and then you have theoretical physics, which in some places goes under math. So, in fact, [Sir Isaac] Newton also was the Lucasian Professor of mathematics. This department was called the Department of Applied Mathematics and Theoretical Physics.

TS: Applied mathematics?

NK: Yes, there's also pure mathematics, but Applied Mathematics and Theoretical Physics.

TS: Meghan [A.] Burke [professor of Mathematics at KSU] studied applied mathematics.

NK: Yes, it was in Oxford [Center for Mathematical Biology]. I've talked to Meghan, and she was at Oxford. So this is the department [at Cambridge] where Stephen Hawking is, so I saw him many times. And the other thing with Cambridge is you don't just belong to a department, you also have to belong to a college. You know the college system . . .

TS: Which college were you in?

NK: I was in Gonville and Caius.

TS: I'm not even familiar with that one.

NK: It's a very distinguished college; I think it's the second or third most distinguished in terms of awards and reputation. Those are the names of the founders. [Edmund] Gonville was the founder [in 1348], and then [John] Caius [Latinized version of John Keys], I think a couple of centuries later [in 1557], basically refounded it and extended it. It's a very old college; it dates back to 1348, if I'm not mistaken, so it's a very old college, very distinguished. The building is very beautiful, and it has a very high reputation in math, physics, and also in medicine. Apart from Stephen Hawking who is the most famous fellow there now, there was Sir Nevill [F.] Mott who got a Nobel Prize in Physics [1977]. Even before, in the 1920s and 1930s [Sir James] Chadwick was there, the discoverer of the neutron. There were also medical people—the person who discovered the circulation of blood, William Harvey if I'm not mistaken, was a member centuries ago. [John] Venn, the mathematician, Venn of Venn diagrams. So, in Cambridge colleges you have a hall where all the college eats, and there's a high table where all the professors eat. For example, Stephen Hawking would be there many times, and then the students eat in other tables. Then the graduate students had a gallery, actually, overlooking everybody in the hall; so we would sit there. There were stained glass windows that would show, for example, the discovery of the neutron or Venn diagrams or other things, so it showed the history of the college.

TS: In the stained glass windows?

NK: Yes. So these figures would be in the windows.

TS: How about that? Neat place.

NK: Yes, it was quite nice. Yes, so, for one thing I had the college life, and on the other hand I had the department and courses and so on. Then at the end of the year you have to take the exam on all the courses. I took six courses. It's not like here where you have mid-terms and finals. There, you do a whole year, and then at the end of the year you get examined on everything.

TS: One exam.

NK: Yes. One exam per course; there were six exams over a few days.

TS: Right. But no weekly quizzes along the way.

NK: No, no, nothing like that.

TS: American law school is probably the closest thing to that where you get all these exams at the end of the semester and just hope you've been studying along the way.

NK: Yes. I was very happy in Cambridge; it was quite an experience, a very beautiful place and very historic.

TS: But that's scary to take those exams at one time.

NK: Yes, but if you're interested in that subject then that's . . . yes.

TS: Well, great experience in Cambridge. Then how did you get to State University of New York?

NK: Well, I was thinking of staying in Cambridge or moving, and one reason I decided to go back to the States was financial. They don't have as much money to support students in the UK, and I didn't really want to keep depending on my parents. So I decided that I wanted a fellowship, so I applied to various schools.

TS: I'm surprised the UK doesn't have fellowships like that.

NK: They have some limited, but they don't cover everything. For example, even that year in Cambridge I did get some money actually from the local council because I'm a European Union citizen. So I was treated partly like a Brit. It would pay for my tuition expenses, but not for living expenses. So I think if I had gone for the Ph.D. again it would be the same deal that I would get paid for tuition, but not necessarily for living expenses.

TS: So you had some bills to pay.

NK: Yes, plus I wanted to go back to the U.S. anyway. So I applied to various schools. The State University of New York at Stony Brook has a great Physics department, especially theoretical physics. The department is one of the top ten or twenty in the country, but specifically they have an Institute for Theoretical Physics. The director at the time was C.N. [Chen-Ning] Yang. He is a Nobel laureate [1957]. He was the director of the institute [now named the C. N. Yang Institute for Theoretical Physics]. Then there were many other very good people. My Ph.D. advisor there was Jack Smith, and then I also worked with George Sterman. I worked mostly with these two, and officially Jack was my advisor. The first two years it was mostly classes, you know, classes and comprehensive exams. Then the last three was basically research. I did a lot of research mostly on the top quark production, heavy quarks in general, and I wrote three papers, and I got my Ph.D. in May of 1996.

TS: What was your dissertation?

NK: It was called "QCD Resummation and Heavy Quark Cross Sections."

TS: QCD, for Quantum Chromodynamics, Resummation. In laymen's terms what does that mean?

NK: Okay, well, it would take a while to explain. What I'm doing is I'm studying how when protons and anti-protons collide together they can produce new particles. There are some very big labs. There's one in the U.S. called the Fermilab Tevatron [Batavia, Illinois] where they have a very big tunnel underground, and they circulate beams of protons and anti-protons, and they collide in certain regions. When they collide, they smash together very violently, and they can produce new particles. Some of these particles are heavy quarks.

TS: Okay, so quarks are the particles that come from the splitting of protons?

NK: Yes, actually the proton itself is made out of quarks and gluons. There are three quarks that the proton is made of, two up quarks and one down quark. And also neutrons are made out of these light quarks. But there are also heavier kinds of quarks. These can only be produced with high energies because they're very massive. When you smash together protons and anti-protons, they can create new kinds of quarks, heavier quarks. The top quark is the heaviest one. It's very, very heavy. It's like two hundred times heavier than a proton even. Although it's a fundamental particle, it's extremely heavy. So when you smash these protons and anti-protons at very high speeds you give them enough energy to produce very heavy quarks. That's what I'm studying. I'm doing theoretical calculations of the cross-section—that is a measure of the probability of producing these heavier particles. QCD Resummation is a way to calculate what are called radiative corrections. So when you have this theory of calculating you have what's called perturbation theory; so that means you calculate, let's take an easy term, like the dominant term first, and then you calculate some corrections on top of that. This gets increasingly difficult to calculate, to refine your answer. Resummation is one way of dealing with this, of calculating more refined, higher corrections to do a more refined calculation. So that's what I was working with.

TS: What is the history of all this? The last physics course I took was probably 1963 or '64, and we knew all about protons and neutrons and electrons and all that, but I don't remember anybody talking about quarks back then.

NK: The quarks were proposed back in the 1960s actually by Murray Gell-Mann, so I think '63 was probably a little too early. Even then it didn't get fully accepted as a theory until the 1970s because there was a lot of work to be done and many consistency checks. So the Standard Model of particle physics which includes QCD and also includes electroweak theory—electromagnetic interactions and weak nuclear interactions, these things didn't solidify into the Standard Model until the 1970s and then experimentally continued being tested. And by the way, QCD, Quantum Chromodynamics, is the theory of the strong nuclear forces, the forces that are responsible for binding quarks into a proton or for having the protons be bound inside a nucleus. So that's what QCD is, the theory of the strong nuclear forces. Then you also have weak nuclear forces, you have electromagnetic forces and you have gravity, and these are the four fundamental forces in the universe, as far as we know. There are only these four. Everything else is really a result of this.

TS: You're doing some very basic theoretical research; let me just ask you, what are the practical implications of all of this?

NK: The practical implications, well, we don't really know. That's the thing with basic science that you may not know the practical applications until fifty years later.

TS: Sure, sure.

NK: There are practical side applications, let's say, in the sense that to build these accelerators, so I'm talking about the Fermilab Tevatron and right now the CERN [European Organization for Nuclear Research] Large Hadron Collider in Switzerland is getting ready for actual events, for collisions. So to build these machines you're pushing the technology because you need superconducting magnets. So you are really pushing technology—it drives technology forward. Also, the need to transfer large data sets between scientists actually pushed the envelope. In fact, the World Wide Web, the "www" was invented, was created by a physicist at CERN.

TS: Somebody in England, wasn't it?

NK: Well, actually he was working at CERN; he's English.

TS: What's his name?

NK: It's Tim Berners-Lee.

TS: This is in the 1990s, isn't it?

NK: Exactly [1991]. The lab had existed for a while. There was a different collider at the time, called the Large Electron-Positron Collider, and now in the same tunnel they're building a new machine, the Large Hadron Collider [LHC].

TS: But your point is that the guy who invented the worldwide web was really doing it for purposes of discussion in physics.

NK: Exactly. So there are all these side applications that can revolutionize the world although they're not direct applications of what happens inside the nucleus. Also, now they're even extending these to what's called the grid, the data grid, because they need to be able to transfer really quickly very large data sets now with the LHC coming online, so they're actually pushing the envelope there.

TS: I guess where my thinking was going when I first was reading through this and trying to figure out what exactly it was that you did, I was thinking in terms of splitting the atom and producing immense energy and the military significance of it.

NK: No, so far, there is no military application or anything like that. That's nuclear physics and what we're doing is really sub-nuclear. It's much smaller scales than the nuclear. I'm looking inside the protons and fundamental particles. Another historic application, and I told you that these things can take awhile, for example, the first accelerators were built in the 1930s, and now these are actually used in medicine. They can be used in medical facilities.

TS: I was wondering if there were medical applications of this.

NK: There are. They can be used for cancer treatments. I'm not an expert on these things, but I know there are medical applications of this.

TS: It's the theory that really grabs you, I guess.

NK: Yes. Exactly. I was always more theoretical; I wasn't so much into experiments although I had to take experimental classes at Caltech.

TS: Right. This is not exactly the kind of stuff—well, I guess you do some lab work but . . .

NK: Well, my theory is related to labs. I do computations that are useful for experimentalists, but I don't actually work on the actual machines. But I do calculations that are relevant. It's not theory in the sky. It's actually calculating things that experimenters use all the time. They take the data, and then they compare it to my calculations, and that's how we know if theory and experiment agree or prove our theory. So it is very experimentally relevant; it's just that I don't actually get my hands in it.

TS: Right. Okay, so you went through their Ph.D. program, and by May 1996 you graduated and went back to Cambridge, wasn't it?

NK: No, actually I went to Edinburgh in Scotland. So I was at the University of Edinburgh.

TS: And this is a post-doc?

NK: That was a post-doc research fellow for two years, '96 to '98.

TS: Why Edinburgh?

NK: Well, that's where I got a position. I knew some people there who were doing work very similar to mine.

TS: Is that a hot spot for theoretical groups?

NK: It is a big group, yes, especially now, it's quite a big group. Actually, there is a very famous physicist who retired the year I went there, and that's Peter [Ware] Higgs who is famous for the Higgs boson which is named after him.

TS: That was mentioned in your curriculum vitae as one of your research interests—Higgs physics.

NK: Yes, I was lucky enough to have met all these giants. Peter Higgs actually retired as I moved in, and actually I shared his office. So, basically, I moved into his office and I was sharing with him although he would show up only sometimes late at night to pick up his mail because he had retired.

TS: Did you get to talk to him very much?

NK: I talked to him a little bit. What is amazing about this is not only that I work in that field, but Higgs actually turns out to be my academic grandfather. He is the Ph.D. advisor of my Ph.D. advisor. He's the Ph.D. advisor of Jack Smith. So that was quite amazing to meet my academic grandpa, so to speak. In fact, at the time the American Physical Society had some kind of contest to trace your academic lineage, to trace your roots. So another student of Jack Smith, Brian [W.] Harris, and I got involved in this. We wanted to trace our roots. So actually talking to Peter Higgs was very helpful because he told me who his Ph.D. advisor was. Then we used the English *Who's Who* to trace, and then I talked to his advisor. I called up his advisor on the phone, quite an old man, and he talked to me. We managed to trace our lineage back all the way to James Clerk Maxwell, who was one of the giants of physics. It was quite amazing going through that history. So we did our little history project there. And it even got published in the *APS News*.

TS: Is that right? Different types of genealogy.

NK: Exactly.

TS: That's an important type.

NK: That was quite nice. And Edinburgh is a very beautiful city, so we had a good time there.

TS: It's cold though, isn't it?

NK: Cold, yes, but not too bad.

TS: Of course, you had been in Stony Brook.

NK: Exactly. Stony Brook, actually, is more brutal in the winters—the snow, and the wind chill would go down to minus forty some days.

TS: What part of New York is Stony Brook?

NK: Stony Brook is on Long Island. It's about sixty miles east of New York City. The first year I visited the city often with a friend, Peter Pfeifenschneider, who was a physicist also. We were in the same year at Stony Brook. He was an experimental particle physicist, and we became best friends. We would go to the city every weekend the first year. Then after the first year he moved back to Germany. Then I stopped going that often to the city also. It got to be very expensive. New York City is very expensive even to visit for a day.

TS: You probably didn't have that much time anyway.

NK: No, exactly. So I left Edinburgh in '98 and I moved back again to the U.S. I did a lot of going back and forth between the U.S. and UK. I must have some sort of record for someone who is neither an American citizen nor a UK citizen. So I went back to the U.S. in '98. I had a post-doc at Florida State University.

TS: How did that come about?

NK: My post-doc advisor, Jeff Owens [Joseph Francis Owens, III], was in the same collaboration as my Ph.D. advisor, so he knew about me. So we had things in common. I applied there, and I got the position. I must say that particle physics is extremely competitive. What traditionally happens is you apply to like a hundred places and hope you'll get one or two offers. When you get an offer, you don't really argue.

TS: It's competitive because so many people want to study it and it's overcrowded in the field?

NK: I wouldn't say that it's so many people because we're a very small number of physicists in the world, but the positions are even fewer. So, yes, the number of positions relative to the pool of applicants is very small. So it gets very competitive. Although the pool of applicants in absolute terms is also very small. Physics overall is a very small pool. As you can see, not many people major in physics here. Especially at the Ph.D. level in a specific field it is very few.

TS: A lot of people are concerned about that in America—so few Americans go into the hard sciences.

NK: Exactly. And I'm one of these people who are very concerned. It's really a big concern. I don't know why physics in the U.S. has this reputation of being so insurmountable. It's not so in other countries. Physics, overall, universally is considered a hard subject. And it's true that physics is not easy. But the attitude here is not the same as elsewhere. Elsewhere people will go into physics because it is hard. You want the challenge or it's very interesting. You don't shy away from it. It's stimulating and it's rewarding. For example, in Greece, as many people go into physics as go into chemistry or biology, for example. Here, their numbers are like one to 100.

TS: Well, everybody goes into biology supposedly because the math isn't as demanding.

NK: Exactly. And that's the problem that people are afraid of math. You hear this common saying that people would never admit, for example, that they cannot read, but they do not have a problem saying "I cannot balance my checkbook." Like, it's okay not to be able to do simple arithmetic. Nobody would say that in Greece. They would be ashamed to say something like this. There's a tradition in the U.S. that it's okay not to be good at math, but you wouldn't admit that you cannot read or write. Right? It's okay for some reason. I think that's part of the problem, the attitude. That's sad, I think.

TS: It is sad. I actually always did better on the aptitude tests in math than I did on the verbal part. But I guess I got attracted into history.

NK: There's nothing wrong with that. There's nothing wrong with being attracted to anything as long as you have the basic knowledge at the high school level of everything you are taught.

TS: Unfortunately my math ended after two calculus classes. I did very well….

NK: That's probably more than most people.

TS: But that was it in college was two calculus classes, and then I was on to other things. I can see how you can get excited about something like this. It is a concern in America; something about the culture, I think, that needs to be changed to get people interested in math and science.

NK: And the other reason is that America is so advanced technologically. It's at the forefront. It's almost counterintuitive that people are not more into it. How can a country keep being at the forefront if its citizens . . .

TS: Exactly. With the computer revolution and Silicon Valley and all of that, that's a good part of the wealth of the country today.

NK: Exactly. And it has been common to actually try to attract foreigners. But that eventually will also stop. As other countries increase their economic status probably attracting people will be harder and harder.

TS: Sure. Absolutely. I used Thomas L. Friedman's *The World is Flat* in my survey class last spring. They actually ate it up. I don't know whether any of them will become science or math majors, but they really liked that book, and I do too. He basically warns the same thing that the rest of the world is catching up, and what's going on in India and China and places like that.

NK: Exactly. As they develop they will be able to keep more of their scientists.

TS: Okay. So you go to Florida State.

NK: Yes. I stayed there three years, and then in 2001 I got a temporary position for one year as a visiting assistant professor of physics at Southern Methodist University in Dallas, Texas.

TS: At Florida State, this is a post-doc?

NK: Yes, research associate.

TS: So you weren't teaching?

NK: No, I wasn't teaching.

TS: So you are working on research. But Southern Methodist . . . ?

NK: I was still doing research, but I was hired to also teach. That was my first real teaching job beyond being just a teaching assistant and so on.

TS: You didn't teach any courses at Stony Brook?

NK: No, just teaching assistant, but not to lecture classes. But then at Southern Methodist University, I taught two courses the first semester and then one course the second semester. That was an experience in teaching. That was basically eight or nine months. Then we moved for three months to University of Rochester for the summer of 2002.

TS: You say "we" moved.

NK: My family. I was married in 1995 a few months before I got my Ph.D. to my wife Natalya Myasnikova; she's Russian.

TS: Was she majoring in physics also?

NK: No, but I met her actually in Russia when I was at a physics school there.

TS: Well, we left that out of the story.

NK: Yes, we can go back. In late February of 1995 I went to a physics school, basically a two-week conference for graduate students. In fact, I wasn't planning to go. Brian Harris was planning to go, but then he wasn't able in the end. Something happened, so he asked me to take his place. I said, sure. It was totally unexpected. So I went there. Gatchina is a town about twenty-five kilometers south-southwest of St. Petersburg. It was really impressive for me. St. Petersburg has all these museums, the Hermitage Museum. It's really amazing and a totally different world. It's still recovering from the end of the Cold War. Russia has changed a lot during the last thirteen years that I've been going back. It was a very new experience for me.

TS: Ninety-five is four years after the fall of the Soviet Union, so not long at all.

NK: Exactly. We met there—she's from Gatchina—in March '95. We kept corresponding. Then in the summer of that year I went back to visit her, and she visited me in Greece because I was visiting Greece almost every summer. She met my family there, and then we agreed to get married. In December of '95 we got married, so we married within the year.

TS: How did you meet her?

NK: I went out with people from the school. She was out with friends in a café, and we just started talking, and we clicked. That's how we met. We got married in December '95, and I brought her to Stony Brook in January 1996 for my last few months as a student. She was in New York State for a few months, and then we moved to Edinburgh in the fall of '96. Then we became more of us in 2000 when we had twin boys. My wife gave birth to twin boys in October of 2000 while we were at Florida State University. They were born in Tallahassee, Florida, so they are U.S. citizens by birth. But they also have Greek citizenship and Russian, so they can actually have three passports. They have an American passport, a Greek passport and they are written in their mother's passport.

TS: What are their names?

NK: Dorian.

TS: That's an English name.

NK: It's an English name, but it has Greek roots. The Dorians. You know, the ancient Greek groups the Dorians and the Ionians and Aeolians.

TS: Oh, of course.

NK: So it's really an anglicized Greek name, although it's not actually used in Greece as a first name, but it's a Greek name in the sense that it's [an ancient Greek tribe]. The other son is Dimitrios. They were born in 2000, so by the time we moved to Southern Methodist there were four of us. We moved in 2001. Then we left SMU in May of 2002. Then we spent the summer of 2002 at the University of Rochester. I had also been offered a post-doctoral position there, but we were unable to accept because I had to renew my Greek passport, and there were some complications because of having to serve in the Greek military. Eventually, I didn't serve. The law changed, and I actually got a deferment as an outstanding scientist. The Greek Ministry of Defense said that I didn't have to serve for at least two years. Then eventually the law changed, and I don't have to serve at all because if you live abroad for a certain number of years you don't have to serve.

TS: You're getting pretty old for the military by that time anyway.

NK: I'm thirty-nine now. Officially, you still have to serve until you're forty-five. But the law changed recently. Because I live abroad I don't have to serve unless I go back to live there. Anyway I wasn't able to accept the Rochester post-doctoral offer, but I still went there for just the summer. Then after that I went to Cambridge again. I was there as a student back in '90 to '91. In 2002 I went to Cambridge, but now I went to the Cavendish Laboratory. Remember, I told you before that there is the Department of Applied Mathematics and Theoretical Physics, but there is also the Cavendish Laboratory, which is mostly experimentalist, but there is also a theoretical group, it turns out, as well. I didn't know it really before. This group is actually more interested in the exact kind of physics that I do rather than the other group. So I had a post-doctoral position there. This was actually quite prestigious because I was actually funded for that by the European Union. Before going there I applied for the Europe-wide competitive grant called the Marie Curie Fellowship, so I was a Marie Curie Fellow at the University of Cambridge. I actually brought money; basically it was a grant. I was there as a Marie Curie Fellow at the Cavendish Laboratory, which is the Department of Physics, basically, at the University of Cambridge. The supervisor there was Bryan [R.] Webber. The group was small but distinguished. I did all the work there, research; I was very productive. At the time there were many other good post-docs, so it was nice.

TS: Post-docs are not something you can do forever though, are they?

NK: No, unfortunately not. Unfortunately, it's something that's a bit stressful, especially when you have a family, that you have to worry every two or three years about extending it or finding a new position or being totally shut out of the market. It is exciting in the way that you can focus on your research, and you don't have any service requirements or teaching and so on, but it is stressful in the sense that you have to eventually find a job.

TS: You don't get tenure in a post-doc.

NK: Exactly. You don't get tenure as a post-doc. I know there are some research positions, permanent ones, but these are usually soft money. They depend on grants, so if you lose the money, you lose the position. It was a wonderful two years there. My wife loved Cambridge. My kids loved it, again, for the reasons I loved it while I was a student—very historic, beautiful buildings. She likes also the lifestyle.

TS: So your kids by the time they were three or four years old had been in Florida, New York, Cambridge….

NK … Texas and England. And a good many other places because we visited Greece, we visited Russia.

TS: Citizens of the world.

NK: They've been to other countries as well; ten countries they've visited already. They will be eight next month, October, and already they've been to many U.S. states and many countries around the world.

TS: Are they going to grow up speaking more than one language?

NK: Yes, they are multi-lingual already. In fact, when they were very little, because mostly they were talking to their mother, actually I would say Russian was their first language. And now I'll say it's equally between English and Russian, and then Greek also they speak some although they're not as fluent as in the other two. But whenever we go to Greece they pick it up because they have to talk to their cousins and their grandparents. With me they can get away speaking in English. Even when I talk to them in Greek sometimes they may reply in English. But when they go to Greece they pick it much more. They are actually tri-lingual.

TS: Can you speak Russian?

NK: I can speak some, yes. My wife can actually speak Greek quite well. She learned it visiting; she's been to Greece so many times because almost every year we try to go to both Greece and Russia. Not quite every year, but we try, and we've been many times. I've been to Russia ten times overall, and my wife has been to Greece seventeen times. That helps. Another reason we visit is for the kids because we want them to have a more global perspective. We don't just want them to be Floridians or Georgians or even just Americans; we want them to have a global perspective, especially now. That's also a theme at Kennesaw State—you know, the campaign for the Global Perspective here. So we spent those two wonderful years at Cambridge. After that I had to apply again for tenured positions. I applied to Kennesaw, and got a position here. We moved here in 2004.

TS: Why don't you talk about that a little bit? Kennesaw is not defined primarily as a research institution. What attracted you to Kennesaw?

NK: Well, for one thing it's changing, so although it's not primarily, it is becoming more and more research oriented. Second, when I visited here I liked the people. Before I even applied, why did I decide to apply? For example, I saw that there were strong people in physics here. Ted [Theodore N.] LaRosa is doing astrophysics. He's quite published; there was a string theorist when I came here, although he has left now; he was publishing.

TS: Who was that?

NK: Rolf Schimmrigk. He left a year after I arrived. People were enthusiastic. I saw that you can do research here and you can prosper, especially as a theorist. As an experimentalist it would be more difficult. You need equipment. But as a theorist you can work anywhere. You know, I can work on the beach [laughter]. So for me it doesn't really matter if there are big facilities or not because all basically I need is a computer and my head.

TS: Was Patti [Patricia H.] Reggio still here when you got here?

NK: No, I think she had recently left.

TS: She was in that same boat that she was in an area where we didn't have lab facilities when she started here, but she was doing pretty much everything on the computer that she needed.

NK: Yes. So I applied. And, again, it's so competitive you don't get much choice; if you get an offer . . . . And also since we had lived in Tallahassee we had been to Atlanta before. So when I saw that this place was in Atlanta, I thought that's a place where we can live. It's a big city. It's more cosmopolitan than a small town somewhere. So we can live there.

TS: So you get here in 2004. What was your teaching load?

NK: It was very heavy actually. The first semester it was extremely heavy; I think I probably had the highest load. It was eighteen contact hours. I was teaching two courses that included four lab sessions. The only thing that saved me was that the courses were the same, so I was teaching two courses, but it was the same course.

TS: Is that the basic Introduction to Physics?

NK: Yes, the Physics 1111. But it was a lot of contact hours. It was eighteen contact hours. I had four labs per week, and these labs are supposed to be three hours each.

TS: How many were in the lecture sections?

NK: Forty-eight students.

TS: So you had twenty-four in each of the labs.

NK: Exactly. So a total of ninety-six—forty-eight in one class, forty-eight in the other class, and each class broke up into two lab sections. I started with that, but still I managed to publish in the very beginning. I went to conferences in the very beginning. I didn't use the teaching load as an excuse. It was very hard, but I thought that I cannot let that stop me. The next semester I went down to fifteen contact hours. It stayed that until I got my grant.

TS: When you go down to fifteen was that one less . . . ?

NK: Lab. I had now two separate courses.

TS: That's still heavy though.

NK: It's still heavy and especially now because it was two totally different courses, so that was different preparations. Then one course had two lab sections and the other had one.

TS: How are our lab facilities for student use?

NK: Well, they're adequate in physics. They're nothing spectacular, but it's an introductory course. You don't need anything spectacular for that. We don't have advanced laboratory courses; for that we would need something more difficult to get, more expensive.

TS: So we're adequate for students and really inadequate for faculty, would you say, as far as lab facilities?

NK: Well, we don't have experimental physicists here. The reason is we don't have labs for them. I know there are labs for biology and chemistry, but there are no labs for physicists.

TS: Aren't there plans on the books to build a new science building or addition to the science building?

NK: Exactly. And one thing we will be discussing is that we would like to have an experimentalist since there will be a possibility of having some lab space in the new science lab building.

TS: Yes. But that's a pretty critical need, isn't it?

NK: It is. Especially, if we want to move on and build a program in physics. We will need to get some experimentalists if we want to progress.

TS: How many people do we have teaching physics?

NK: Well, permanent faculty we have six professors and a couple of part-timers or temporary full-time. But right now we have six permanent faculty. It's a substantial number of physicists; in many universities there are departments with three or four physicists. So already we have a lot of people.

TS: Right. How many would you say there were at Stony Brook?

NK: Stony Brook is a very big, big department; it's probably fifty or sixty. But Stony Brook is one of the biggest physics departments.

TS: So fifty or sixty and we're six in comparison.

NK: Yes, but you're comparing two very different institutions. Most institutions that are not the top twenty, they have small physics departments; they have five or six people. Even Southern Methodist University, which is a doctoral granting research university, I don't think it had more than six or seven, maybe eight, so it wasn't that different.

TS: We're not far behind them.

NK: Exactly, in terms of faculty we're not that far, a little. But I've seen physics departments, especially in undergraduate institutions, with two people or three people.

TS: So we're not the smallest in the world, but if we want to grow we really need that lab space.

NK: Yes. And we need to get a program in physics because right now we don't actually have a program.

TS: We don't have a major in physics?

NK: No, which is really, I think, very sad.

TS: Yes, it is.

NK: We've started this year an MAT, a Master of Arts in Teaching. This is, of course, quote, graduate level.

TS: This is for high school teachers though.

NK: Exactly. The courses are not really what you would call traditional graduate courses. They're probably more like upper undergraduate, but they're at the level necessary for the high school teachers because as a high school teacher you don't need to know research level physics. So it's not traditional graduate courses. But they are now offered, and, hopefully, we'll get students. I think we have one student so far signed up, and we expect five more next year, so then we can start offering something.

TS: Okay, so you're attracted to Kennesaw. Kennesaw was obviously attracted to you. They wanted to give you a job. So you came here knowing that maybe we had a future in research, but you were really coming in on the ground level more or less, would you say?

NK: What do you mean, the ground level?

TS: Well, I mean, in terms of developing a program. I mean, we've been teaching physics for forty years, but in terms of not having a major in physics and that kind of stuff.

NK: That's right. Basically the thing is that there's a promise that this place will change. It's been changing even since I've come here four years now, and it's been changing dramatically.

TS: You've seen changes in four years?

NK: Yes. Just in terms of buildings—even the Convocation Center. I think it was created while I was interviewing.

TS: That was '04, correct?

NK: Yes. Then the . . .

TS: The Social Sciences building.

NK: The Social Sciences, and the building for the sciences will have a lab addition, and so so many new buildings. The place physically has changed.

TS: The Health Sciences building is under construction.

NK: That will be a major one. So there is change. We have a new president; we've got new faculty in physics and new faculty throughout the college, a lot of new faculty, biology and then also chemistry and math.

TS: And you all are together, aren't you, biology and physics?

NK: Right, biology and physics is one department, and it's a very large department.

TS: If you have six you're not too far to where you could break away if you wanted to.

NK: That's right, that's right. It's not really the matter of size. It's the matter of if the administration will support it, the matter of cost. We've always pushed for a program, but some people say that we won't have the requisite number of students because we have Georgia Tech down the road. But we think that as the university grows in terms of enrollment of students and as the university grows in reputation, we should be able to attract students in physics.

TS: I would think. What about Georgia State; what do they have?

NK: They have a program as well. I don't know the number of students they have.

TS: Do they have a graduate program in physics at Georgia State?

NK: I think so. [Ph.D. programs in physics and astronomy]. Also Southern Polytechnic State University has an undergraduate degree. I don't know what the politics of this is at all the levels. I've heard that people don't like competition, but on the other hand, if we're such a big university in terms of enrollment, we're bigger than Georgia Tech and we're certainly bigger than Southern Poly. Our reputation is growing. Certainly in physics, the level of the faculty in terms of research is spectacular. We can go against many top universities. I've published so much since I've been here, and I and other faculty have gotten awards.

TS: Let's talk about your four years at Kennesaw. What courses have you been teaching? You've been doing the basics, 1111 and 1112.

NK: And 2211 and 2212 which is a calculus-based version. They're both Introductory Physics, but there are two versions: one is trigonometry and algebra-based and that's the 1111, 1112 sequence; and then there is the calculus-based sequence, 2211, 2212. I've also taught 3305 which is Modern Physics which talks about special relativity, quantum mechanics, and atomic, nuclear, and particle physics. Then I'm also doing a directed study with students. That's Physics 4400. So I do as a directed study theoretical particle physics. I've managed to get three students so far. I've got my third right now. That involves studying, reading a book, and I talk to them. Then eventually this leads to research. One of them actually did serious research and heavy calculations.

TS: I know you all have done a lot over in the sciences with student research projects, faculty and students working together on a research project.

NK: Yes, I think it's important that a university should offer opportunities for undergraduates. Myself, as an undergraduate of Caltech, I did what was called the SURF Fellowship (Summer Undergraduate Research Fellowship).

TS: Another kind of surf.

NK: Another kind of surf, yes. So there's one kind of surfing and a different kind of surfing. I firmly believe that a university should provide research opportunities, not just for graduate students, but for undergraduates as well. I go out of my way to ask students, to attract them because we don't have a major, so it's actually very difficult. So I actually advertise in my classes. I ask students, "Would you be willing?" So actually I'm very practical, and I go to students and tell them, "Do you want to work with me? Do you want to do this?"

TS: Right. Well, you don't get the run of the mill students anyway because they don't have to take physics.

NK: Well, the science ones do have to take it.

TS: If you major in chemistry you take . . . ?

NK: You have to take physics, yes. And the biology students.

TS: So the biology students are taking the 1111 and the chemistry are taking the 2211.

NK: Not all of them because I think Chemistry has two tracks and some of them take the calculus-based and some of them take the trig-based. Many of the students who actually take the calculus-based want to transfer out to Georgia Tech. Hopefully, as the reputation of Kennesaw increases and as it becomes more and more of a residential school this will change, and we'll be able to give more of these . . .

TS: And once we have a Physics major.

NK: Exactly. I've tried to involve students. Also in 2006 I got my NSF grant—the National Science Foundation.

TS: I was going to ask you when that grant came through.

NK: Yes. I applied for that in the fall of '05 and actually received it in the summer of '06. That was a $100,923 grant from the National Science Foundation and basically covers summer salary, course releases, travel, because I do travel quite heavily. I go to many conferences. I'm invited to many conferences, and still I cannot go to as many as I'm invited. I'm invited to many more than I've been. Still, I go this year probably to five conferences total. I went to three already and I have two more coming up. Not every year is there that many, but I do try to go to keep in touch with people, especially since I'm kind of isolated here. The other good thing is we hired another faculty who is doing particle physics, Phil [Philip J.] Stephens, so I have somebody to talk to which is exciting. We're working together, and we plan to apply for grants together to continue this.

TS: So it sounds like your scholarship hasn't slowed down much since you got to Kennesaw, if at all.

NK: Well, a little bit. I cannot spend as much time, say, as when I was in Cambridge just doing research and no teaching. It slows you down, but I haven't let it slide away. I've kept up with publications. I've published some important papers, peer reviewed, and also conference proceedings and things like that. So I've published quite a few in the last four years.

TS: How would you say you divide your typical week in terms of hours; half teaching, half scholarship?

NK: Something like that.

TS: Or two-thirds, one-third?

NK: Well, it depends on the semester. At the beginning, actually, I probably spent more time teaching, but now I can spend more time on scholarship. The toughest thing when you start is to develop your lectures. And then if it is the same thing over and over, the work goes down, so it's less stressful later on after you get that experience. In fact, my most stressful time was probably not even at Kennesaw with teaching; it was at Southern Methodist University. When I came to Kennesaw actually I could use some of the material because it was the same kind of class. So that's how I survived this eighteen contact hours which was an incredible load. At least I wasn't totally a rookie.

TS: Are you still doing fifteen hours a semester?

NK: No, right now I'm doing nine.

TS: Is the grant paying for some of that?

NK: Yes, the grant is paying for course release, so I'm doing nine. Basically, I have one lecture course that splits into two lab sections. Even one time I had six hours one semester. I managed to get only six. It was one lecture course but it only had one section. I think it was 2212, but the enrollment wasn't high enough. But, yes, nine is the usual now as long as I have the grant. I also know that our department, our college, are trying to make it so that research active faculty will only have nine hours of teaching.

TS: Oh, the track system.

NK: Yes, even if you don't get a grant, that's the plan. We're not there yet.

TS: As long as you take the scholarship track and then you're held to it to produce in scholarship.

NK: Yes, so as long as you produce, yes. We went through this T&P guidelines at the college and department level, and there were various tracks, and it has changed so much. But, yes, basically we're trying to get that. I don't know, it depends on the finances.

TS: Right. The Coles College of Business was the first to do that at Kennesaw, to go to the track system and reduce the teaching load for those that were doing scholarship. I think Health and Human Services has gone that direction too maybe, and so Science & Mathematics has gone that way too, I guess, or thinking about going that way.

NK: Yes. I think there's a purely teaching track, and then there's a teaching and scholarship track. Most faculty, especially the new ones, are supposed to be on the teaching and scholarship track because they are supposed to produce scholarship. The purely teaching one is usually for older faculty who have been out of research for awhile. They're not expected to [produce scholarship]. So they can choose that, but all incoming faculty, I know, since I've been here, are expected to have scholarship.

TS: That seems to be pretty much the case across campus that new faculty are told that scholarship is going to be your second area beyond teaching.

NK: Exactly. And I agree with that. We're a university now. Every university to be called a university should have the faculty do some scholarship. Now the degree of scholarship varies among universities, but I think if you call yourself a university, it's implied that the faculty are involved in scholarship, not just teaching.

TS: But you've been amazingly productive in scholarship.

NK: Yes, I think I'm a little unusual in that compared to other faculty, yes. I'm very research driven. It's true.

TS: It only took you two years here to get one of the Foundation Prizes for scholarship.

NK: Yes, I got the Foundation Prize in 2006.

TS: For your college.

NK: Yes. And then I also got my college's Distinguished Scholarship Award in February '06. It was the 2005 award actually, but I received it in '06. This year [2008] I received both the Foundation Prize and the KSU Foundation Distinguished Scholarship Award.

TS: That ought to give you a little money to spend.

NK: Yes, which I need, given our salaries and given my travel needs and so on. . . I just had a meeting with Bill Hill [CETL Director G. William Hill, IV], and he told me, "Do you think you can spend $10,000 for travel and so on?" And I said, "I'm confident I can manage to spend it on travel and supplies and equipment and so on" [laughter].

TS: Well, with all these conferences you're going to.

NK: Exactly.

TS: I guess in the physics that you're in borders don't mean anything.

NK: No, particle physics is very international to begin with. You collaborate with people across the world. In fact some collaborators I haven't even met.

TS: Well, when you were talking about the worldwide web earlier and it's role with physics, it's a whole lot easier to be in contact with the rest of the world today that it was, say, twenty years ago.

NK: That's right. It's much easier and you can do physics basically anywhere. In our field what's amazing is that all the papers get posted on what's called an archive. It's an electronic repository. You don't have to wait for something to get published to see it, and it's free.

TS: That's the e-print archive.

NK: That's right.

TS: I noticed on your website [http://science.kennesaw.edu/~nkidonak/] that you could click on it.

NK: Exactly, and you don't even need a subscription to a journal because everything goes online before it gets published. I mean, if you want a published version, yes, you have to go to the journal, but you don't really need it, and most people don't even bother with journals. You publish in a journal to get the seal of approval, but you don't wait for the journal to publish the article to read it. You read it before.

TS: Journals will still publish an article after it has appeared online?

NK: Yes.

TS: We had a faculty member in the history department that lost the chance to have a journal article published because somebody had posted a draft on his website before the journal published it.

NK: I think there are some journals in other fields which are strict like that, but in physics we lead the way in that sense. We've really led the way in making things available.

TS: That's great.

NK: It is great.

TS: Why don't you talk about the research that you've been doing to win these awards including the KSU Foundation Distinguished Scholarship Award this year?

NK: Well, I mentioned before that my kind of physics is I study what happens in colliders. In particle accelerators we collide particles: protons with anti-protons at the Fermilab Tevatron; protons with protons at the Large Hadron Collider at CERN, the European laboratory for particle physics in Geneva, Switzerland, at even higher speeds, at even higher energies. So I study, basically, all kinds of particles that get created. So I talked about the top quark, also bottom quarks and charm quarks; then there's direct photon production—photons that are particles of light; jet production, jets of particles, you know, the quarks give you jets of particles; then W-bosons, these are carriers of the electroweak forces; then Higgs bosons, you name it, everything that is of relevance to the particle colliders, I produced calculations. My calculations actually are very widely used. My calculations for top quark production are the standard used by the CDF and D0 collaborations at the Tevatron. Whenever they get data they plot their data against my theoretical predictions. Also the Tevatron people have used my calculations for jet production and direct photon production. The HERA electron-proton collider at DESY, which is the German electron-synchrotron facility in Hamburg—they've used my calculations for top and bottom quark production. So I've got a lot of citations. I have something like seventy-six papers so far.

TS: Since coming to Kennesaw?

NK: No, over my career. Since coming to Kennesaw it's twenty two.

TS: That's still like getting about five out a year since you've been here.

NK: Yes, an average of five a year.

TS: And with a teaching load that's pretty impressive.

NK: Exactly, it's a large output. But it's not just the number, as I said, it's the impact, because you can write a lot of things that nobody pays attention to. The impact is shown by citations and people using your data. When I applied for these awards, both for the Foundation Prize and for the Distinguished Scholarship Award, it's not just number but it's quality. It's how many citations. I've got more than two thousand citations on my papers, and they're used widely. Other theorists also use my formalism. They write papers and use my formalism. So it's really the impact in science that matters, not just the number.

TS: So you're getting the name of Kennesaw State out there worldwide.

NK: Well, at least in particle physics, Kennesaw was totally unknown. Yes, I could say I put Kennesaw on the map in particle physics. People now know it. Many times they ask me, "What is this? Where is Kennesaw?" I say, "It's in the Atlanta area." They didn't know, but now they know.

TS: That's great. Talk a little bit more about the intellectual life at Kennesaw State. You've got somebody in your department now that you can talk to about some of these things, but in general, what was your impression when you got here, and what's your impression today of the overall intellectual climate at Kennesaw?

NK: Well, most of my interactions are actually with physicists. I have some interaction with biologists, but not really talking about research or anything like that; it's usually more mundane matters. My interactions are mostly Ted LaRosa, Phil Stephens, and we can have interesting discussions. In general, I noticed a bit of growing pains in the university especially with respect to teaching versus research. I know some of the older faculty don't necessarily like the idea that the university is becoming more research driven. I think I see some resentment from some faculty about people like me publishing so much.

TS: They resent that you publish so much?

NK: That and getting awards, yes, I think there is some resentment. Unfortunately, there is for some people. It's human nature; I understand that. They don't necessarily like that. The new faculty that are coming are more [involved in research], although not as much as they could have been because the selection committees also, you know . . . .

TS: But you picked up on tension between older faculty and newer faculty.

NK: Yes, and not necessarily older and newer because there are some older faculty that are also distinguished in research, so I wouldn't necessarily put it as old versus new. I would say people who are not into research as much and people who are. I know some older faculty who do appreciate very much what I'm doing, but I know some faculty who have never done real scholarship, and I don't think they appreciate it as much.

TS: Ted has been here a fairly lengthy time [since 1994].

NK: Yes, Ted is one of the people in the forefront of research. We have many talks about the [intellectual] climate.

TS: I think that's been part of our history as an institution; we've been evolving ever since we started as a junior college. So new faculty that come in always are, as we've evolved, let's just say they're different from those that were here already, brought different talents to the table than those that were here already.

NK: Although there are some new faculty that are not so much into scholarship either. So, again, I don't really want to totally separate it into old and new—although, of course, there is some preponderance of people just doing teaching among the old faculty, but it's not so clear.

TS: So the difference is how enthused you are about scholarship.

NK: Exactly. And what direction you think the university [should go]. There are some people I know who have actually spoken out that they don't want the university to become more research driven. They think it's actually [a mistake]. I don't agree with them; as I said, a university for me by definition is a place where scholarship is done. It's not a community college anymore. We're not even a four-year college. And actually even some four-year colleges do amazing scholarship. Some of the highest level four-year colleges, you know, the top ten or twenty, they have some pretty nice labs, and they're doing some pretty serious work.

TS: I think part of the issue from those that want to emphasize the teaching aspect is that teaching is going to be sacrificed for scholarship.

NK: Well, I don't really accept that; I don't think it's an either-or situation. For example, I told you about Richard Feynman, the famous Nobel laureate. He liked to teach, and his lectures have become standard [text]books. So I don't believe that if you are into research you cannot be a good teacher. In fact, I think often it goes hand in hand. In fact, I would say the opposite; you can't really be a good teacher if you're not at the top of your game in your science, if you don't know what's going on. And how can you be enthusiastic if you're not enthusiastic about your own science, about research. So I think actually in my letters from the students, the evaluations, many times they say that when I talk especially about modern physics my enthusiasm shows through because I'm really enthusiastic because that's what I work on. I do know there are some people who are doing research and are not good in teaching. I guess that's the kind of people that maybe Kennesaw couldn't have. A very research driven institution could afford to have [such] people because not everybody maybe teaches as much. I guess the difference that we are also into teaching as well is that we cannot afford a person who would only do research and not be good at teaching. But I don't accept that you cannot be good at both. In fact, if you just teach and don't do research, I don't think you can be the best.

TS: Well, I think maybe the key is hold their feet to the fire in both teaching and scholarship, but give them a teaching load that's reasonable so that they've got time to do scholarship.

NK: Exactly, because you cannot have expectations [in scholarship] when you overload people with teaching.

TS: And I think you've pointed the way—go out and get a grant that pays to reduce your teaching load because there's only so much money from the state. So everybody can't have a small teaching load.

NK: Exactly. So it certainly helps to apply and people should. That's another thing, that people don't apply as much as I would like them to. Some people just can't be bothered. I've noticed that, even for awards. I remember in department meetings actually urging my fellow faculty to apply for incentive grants, for example. The university itself pays for those, they are not even external grants. You can apply for incentive grants. I always encourage people to apply for incentive grants, apply for external grants, apply for awards; awards also pay. If you get a Foundation prize, you know, you get money. Now the university is also better at start-up grants for new faculty. I think some time ago there were no start-up grants. When I came in there was a very modest one. I think it was about $6,000. Now, I know our new faculty get substantially more, I think on the order of $20,000 or something like that. So that helps people start up, especially experimentalists.

TS: Start-up a research grant?

NK: Exactly. But even for theorists, computing equipment. I use my money for computers. I know the new theory faculty use their money for very fancy, many computers, and so on. Another thing I think that's important to help people is that I don't think it's good to hire people who've just finished with a Ph.D. I think having a post-doc experience is useful to get you started. One thing that helped me also was that I had a lot of post-doc experience. I had eight years. So I had a program going. I didn't need to start from scratch here. So that's one reason I was able to keep publishing a lot because I was a very experienced researcher already.

TS: You had done a lot of the research before you ever got here.

NK: Exactly. Although I started as an assistant professor here, and I just became an associate this August . . . .

TS: You put in the minimum time to get promoted.

NK: Exactly. I became tenured, so I actually started as a tenured associate professor last month in August. But although I came as an assistant professor four years [ago], my experience was probably higher than some associate professors in terms of research because of this eight years of, basically, being a scientist. And I think we actually say that in our job advertisements in our department that post-doctoral experience is preferred. It's not an absolute requirement, but it's better that you have started something because it's hard enough to start teaching and . . . .

TS: Well, it's the same as asking for experience in teaching to ask for some experience in scholarship.

NK: Exactly. We also seek the person who has taught before. We want somebody who has both done some teaching and done some research—some experience so they don't get totally overwhelmed here because then it's really hard I think for someone.

TS: Yes. I remember years and years ago wondering when I was at the very beginning of my career—everybody wants experience, but how do you get experience unless somebody gives you a job? But post-docs are a way to move from one level to another.

NK: Especially in the sciences. I don't know about history; I don't know how things work in the humanities.

TS: Well, we do have post-docs. One of our faculty members in fact is doing a post-doc this year on a leave of absence, but not like in the sciences I don't think.

NK: Yes. The sciences now, especially in particle physics, I know, two or three post-docs is normal. You are expected to do five or six years or more. Some people do much more even. I know people who did fifteen years and then eventually they became faculty.

TS: Do the post-docs pay a decent salary?

NK: It's decent, but it's not much. Things have changed; I think the pay has improved. When I was in the UK I was paid in pounds, so it's hard to compare, but I remember at Florida State it was around $35,000 to $37,000. That was ten years ago. I think now it's probably better. I've seen numbers like $40,000 to $50,000.

TS: So similar to an assistant professor.

NK: Sort of; a little below. Although I know there are some places that pay spectacularly well and some places that pay spectacularly badly. So it ranges from twenty something thousand to eighty thousand. But I would say the average is probably in the $40,000s now.

TS: What do you see as the future for Kennesaw State?

NK: Kennesaw is growing. It's changing. In terms of numbers, we'll get larger and larger. In terms of reputation we'll get better and better. I think teaching will be the main focus still, but research will be more and more required. In fact, I think now with the new tenure and promotion guidelines, all faculty are supposed to do scholarship.

TS: Some scholarship.

NK: Yes, even if it's scholarship of teaching or service. It doesn't necessarily have to be [basic] research. But I do think that as the university grows and gets more and more reputable that the expectations will keep increasing, and I think that's a good thing because you cannot build a reputation without doing . . .

TS: We're going to do stuff off-campus to build the reputation.

NK: Yes, and I think you need more national recognition to make it as a full professor now. It also depends on the finances of the state and how much they let us grow. For example, it's very indicative what Dr. [Daniel S.] Papp, our president, said. We had actually a reception at Jolley Lodge last year for people who had applied for grants and who had received grants. I went to that reception and Dr. Papp, I think, said it very well that, "We're not a research university, but we want people to do research and to apply for grants." Even the term of research university is not very well defined. I think every university in a way is a research university—that people do research. But, maybe, what he meant by research is the extent of the research, the extent of the funding, the extent of the expectations. What he meant was very extensive, really driven as opposed to Kennesaw, which is sort of half and half.

TS: Well, the Carnegie Foundation used to have these categories of Research I, and everybody wanted to be Research I. So they've gone away from those terms to a wide variety of descriptive categories that have more to do with your size and what types of graduate and undergraduate degrees you offer.

NK: Dr. Papp said, “We’re a robust sector of comprehensive universities.” So again, these are names, but we’re getting graduate programs; we’re getting doctorates and Ph.D. programs now. So we are a doctoral institution now.

TS: Yes, that’s got to change our culture.

NK: Yes, but as new faculty come in and as scholarship is expected and people do research, things will change somewhat.

TS: So you see Kennesaw as a place that you’d like to stay for a long time?

NK: Yes, if it goes along that track of improvement, yes. It’s definitely a place where I can prosper, obviously. I can do my research, and I can do my teaching. It would be better if we had increased presence of physics programs. It depends on how these things will progress.

TS: I guess what they’re saying now is that they don’t want to duplicate traditional majors that everybody else has got, but if you can do something that’s a new wrinkle, so maybe if you have a program in theoretical particle physics at Kennesaw.

NK: Yes, I don’t know if that would fly. [laughter] I don’t think the market is big enough for that. Of course, I would love that. But, yes, if we can meet some needs. The campus is so much focused on teachers. That’s one thing that [we can do.] We even have some physics education faculty who are into that. But we want a more traditional physics major. And eventually maybe even graduate programs. Who knows? We definitely have the expertise and the quality for that. It’s just a matter of numbers and politics and things like that and support from administration, Board of Regents, and so on.

TS: Well, what should we have talked about that we haven’t?

NK: I don’t know. I think I’ve covered pretty much my whole academic history. We talked about family, so I don’t know.

TS: Well, I think I’ve just about run out of questions.

NK: Okay, I think we pretty much covered everything.

TS: Our tape is just about to run out anyway.

NK: Well, that’s a good time to stop then.

TS: I’ve certainly enjoyed talking to you.

NK: I enjoyed that too. Thank you.

TS: I hope you stay at Kennesaw for a long, long time.

Kennesaw State University Oral History Project
KSU Oral History Series, No. 78
Interview with Nikolaos Kidonakis
Conducted, edited, and indexed by Thomas A. Scott
Friday, 22 August 2014 – Part II
Location: KSU Archives, Kennesaw State University

TS: Today's interview is with Nikolaos Kidonakis who won the Distinguished Research and Creative Activity Award in 2014. He also won the award in 2008. This is a follow-up to the 2008 interview. Nick, you've won the Distinguished Research Award for the second time now, and I was looking at your NSF grants, and you were working on your first one, I guess, when we did the interview in 2008. Now you've had three in a row, each of them a three-year grant, so you've been consecutively funded by the National Science Foundation for eight years and still have a year to go through 2015 on your current one. All these are significant grants that have given you released time and money to travel and such as that. Why don't we begin by you talking about what you've done to receive these grants?

NK: Yes, so what I do is I do research, and I publish papers and conference proceedings and so on, and then I give many talks, many of them invited, in international conferences. I also do review papers and book chapters and things like that. My first NSF grant was back in 2006, and then that ran through 2009. In my last interview six years ago that's the one I had. Then in 2009 I got my second one, which ran through 2012, and then my third one is from 2012 to 2015.

TS: Are these basically continuing the grant you already had or are they for different kinds of research?

NK: They all have different titles, but, of course, I have a theme of research that's common throughout. I work on the top quark, high order calculations, resummation, the Higgs boson. So there is a common theme, although they are all independent grants, and they have different titles from each other. Every time I apply I have to make a brand new application.

TS: So it's not just a continuation of the grant?

NK: It's not just another minor continuation, no. Even for renewals you still have to reapply from scratch, so even though you're continuing, it's still a new grant with a new title and new grant number and so on. It's not just a rolling grant.

TS: Sure. So it's quite an achievement to get it three times.

NK: Yes. It's an independent review every time. Of course, for the subsequent grants, what they look at is how productive you've been, you know, if they are spending their money wisely on you.

TS: Sure. They're not going to give it to you if you didn't do anything on the first one.

NK: That's right, yes.

TS: Well, when we did the first interview you were doing a lot of work with CERN in Switzerland and also the place up in Illinois, I believe it was.

NK: Yes. What has changed since then is that the Tevatron Collider, at Fermilab up in [Batavia] Illinois, actually shut down. It was still running back in 2008, but then it shut down, while on the other hand the LHC has started running. Back in 2008 it still hadn't started collisions. What is different now is that the Tevatron is no longer operational while the LHC at CERN has been taking data. The LHC is the Large Hadron Collider.

TS: Okay. Why did it shut down in the United States?

NK: Well, partly because the LHC started running in Switzerland, and the LHC is much more powerful. I guess Congress didn't want to spend the few million that it would have cost to operate the Tevatron for a couple more years. There was a request, but in the end it was deemed that they would just shut it down and just support the LHC.

TS: Who actually pays for the Large Hadron Collider?

NK: It's mostly the Europeans. CERN is an international organization, but it's mostly European. There are observer states like the U.S. and other associated states, but the member states are mostly European countries. It's basically the European taxpayer, I guess, who pays most of it, but the U.S. gives a big contribution, hundreds of millions of dollars.

TS: So your efforts are really going into LHC now almost entirely?

NK: Yes. Well, I'm a theorist, so my calculations are more general, but I do produce numerical calculations that are relevant for the LHC. To be honest, it doesn't matter that much if it's the Tevatron or the LHC because the calculations are what they are. When I do the computer programming, then I specifically study the energies that are at the LHC to produce the numerical results, but all the theory calculations are the same.

TS: They're not telling you, "We need this done"; and you're doing it [in response to a specific request]?

NK: Not directly. I know what things people are interested in, I know what I'm interested in, and there's a big overlap, so my results are very widely used by the LHC. I mean, they were used in the past decades at the Tevatron, and now in the last several years they have been used very, very widely by the experimental collaborations at the LHC. My calculations are the standard results both for top quark pair production and also single top quark production. The top quark can be produced in two different ways; one way is you produce a top quark and an anti-top quark together. The anti-top is the anti-matter particle. Another way is to produce just a single top in association with either a W boson or with other particles and so on.

TS: Right. I think you have on your website 115 significant papers. I think we were at 75 when we did the interview six years ago, so you're producing seven or eight papers a year it sounds like.

NK: Something like that, yes.

TS: It's mind boggling. But also I think you have 5,000 citations or something like that. People are obviously using what you're doing. Could you talk about that a little bit?

NK: Yes. Right now it is something like 5,500 citations, so basically every time the experimental collaborations of the Tevatron or the LHC write a paper about the top quark or about supersymmetric searches or even the Higgs searches, they cite my work because they use my work in either studying the properties of the top quark or looking for the Higgs boson, which was actually discovered in 2012, or looking for signs of supersymmetry in physics.

TS: In 2012?

NK: Yes, the discovery of the Higgs boson was actually announced on July 4, 2012.

TS: So when we did the previous interview it hadn't been discovered?

NK: No, it hadn't been discovered, and that was the main discovery of the last . . .

TS: I think I do remember hearing that on the news.

NK: Yes, it was big news. So every time they write a paper, they cite my works, so I get thousands of citations from that. Also theorists have used my theoretical calculations, my theoretical formalism for resummation. For many, many years I got thousands of citations from theorists, so there are thousands of papers out there that cite me, and that's why I have this enormous number of citations. In fact, several of my papers have been listed among the top 100 papers for many years now, since 2005, every year. They are listed among the top 100 papers cited by other physicists, and that's among more than one million papers in the literature, so for me that's the biggest accomplishment.

TS: So practically every paper that you write is in the top 100?

NK: Well, not every, but many of them are.

TS: Pretty close it sounds like.

NK: Many of them are, yes.

TS: This probably oversimplifies, but the way I understood what we were talking about several years ago was you come up with these mathematical formulas, you theorize that this is the way that things are supposed to work, and then other people are actually doing lab experiments, and they're comparing their results to your theory, and whenever there's a match the theory has a high probability of being correct.

NK: Yes. The theory is the Standard Model, so this is a two-fold approach. The Standard Model is pretty well established now, but still the top quark because it's the heaviest particle that has ever been discovered—it's actually even heavier than the Higgs . . .

TS: The top quark is the heaviest particle ever discovered?

NK: Yes, the heaviest elementary particle. It's very important because its properties have implications for understanding the Higgs mechanism, for understanding electroweak physics, QCD, and also for new physics. Because it's so exceptional in its properties, it's a very hot topic to study, the top quark. The experimenters try to understand the cross section, to measure the cross section, you know, how many quarks are produced, the differential distributions, how many top quarks are produced with a given momentum, and so on. By studying that they understand the properties of the top quark. Then also they need to know how many top quarks are produced because the top quark is a background to possible new physics, to possible production of other particles. If you're looking for new particles, how do you discover them? First of all, you have to understand how many top quarks are produced, how many bottom quarks are produced, and so on, so that you can find the signal for the new physics. To find new physics you have to understand the older physics in order to be able to find new signals. So it is a two-fold utility both in its own sake to understand the top quark but also to understand the backgrounds for new physics that may be discovered.

TS: When you're talking about new physics . . .

NK: Like particles that have never been discovered such as supersymmetric particles or dark matter candidates, other exotic particles. There are many theories beyond the Standard Model that people have been trying to discover evidence of, and it's been a long time.

TS: Just like forty-five years ago nobody had ever heard of a quark, so we're maybe on the edge of some brand new discoveries that are unimaginable now?

NK: Yes, in fact, the quark model was first proposed, I think it was 1964, so it was actually fifty years ago, so this year is actually a pretty important anniversary of several ideas. Also, the Higgs, it was at that time, in 1964, that it was proposed, so this year is actually the half-century of many interesting proposals.

TS: What were they calling [the Higgs boson], the God particle or something like that?

NK: Yes, that was a name that was given in a [1993] book written by a Nobel Prize winner [Leon M. Lederman], and I guess the editors wanted to call it a God particle I guess to boost sales.

TS: But the concept was the most basic thing you can possibly find?

NK: Well, it's not really more basic than other elementary particles, so in that way maybe it's a little overhyped, but it is responsible in a certain way for giving masses to the other fundamental particles. The question is, how do elementary particles acquire mass? And the answer is that you have this electroweak theory, and the theory has a big symmetry at very high energies. But then at the time of the Big Bang there was a symmetry group, and then when the temperature cooled, this symmetry was broken spontaneously through this Higgs mechanism. This Higgs particle is basically the particle that corresponds to the quantum field that is responsible for this symmetry breaking, which in the end gives masses to the fundamental particles. That's it in a very short matter of explanation of how it works. Actually, the mechanism is more important; the particle itself is just a remnant of that field; but it was the last missing piece of the Standard Model. That's why it was so important to find it because it was the only piece of the Standard Model—our most successful theory—that was still missing. By discovering it in 2012 that basically closes a chapter in modern physics because now we have all the ingredients of the Standard Model, which works amazingly well.

TS: You've been making talks all over the world, what did you say, five continents, I've forgotten what it was?

NK: Yes, it was more than twenty countries and five continents—many international conferences, many invitations in universities and national and international labs.

TS: Some of them sounded really neat. You've been everywhere, Russia, Sweden, Australia, and of course all over the United States as well.

NK: Yes, most of the conferences were actually in Europe, then most of the rest were in the U.S., and then there were some in Australia, Chile, Japan, Israel…

TS: I recall that Israel was eight or nine years ago it seems like [Particles and Nuclei International Conference, Eilat, Israel, November 2008].

NK: Yes. But most of them have been in Central Europe or Western Europe and then Russia as well.

TS: There was one place in Germany that you were the scholar of the week or something of that sort.

NK: Yes, theorist of the week [DESY, Hamburg, July 2012]. I just noticed they've changed it and now they call it theorist of the month; they changed the title!

TS: DESY?

NK: Yes, DESY [Deutsches Elektronen-Synchrotron] is the German laboratory for high energy physics and the synchrotron there.

TS: That was in July of 2012 that you were there.

NK: Yes. That was a big year for travel. I was in Australia actually when the discovery of the Higgs was announced, and then I went to Germany for a week and gave a talk. DESY has also in the past used my results when they were looking for flavor changing neutral currents and they're also interested because there are many people that work at the LHC, so they were interested in my results for the top.

TS: Right. I think Ken Harmon was making a joke on the title of your paper that you won the Foundation prize for this year. What did he say? "You've all read that I'm sure."

NK: I'm sure everybody's read that, yes, exactly!

TS: It's a tongue twister of a title but it sounds like there was a joke in there to me—"Next-to-Next-to-Leading-Order Collinear and Soft Gluon Corrections for t- Channel Single Top Quark Production."

NK: It's a technical title. As I told you, single top quark production is one method of producing, and then there's actually three different ways of having single top production, and one of them is called the t-channel. It's a technical term. What I calculate is corrections to the production. The leading-order is the most basic way of producing this top quark. Then you have corrections that in addition to the simplest way you can have an extra gluon being emitted. So next-to-next-to-leading-order means that it's two levels higher than the simplest way of doing it. It gets extremely complicated the higher you go. Leading-order is very basic; next-to-leading-order takes a while; next-to-next-to-leading-order is much, much harder. The complication increases exponentially with order.

TS: So it's not a joke then.

NK: No.

TS: I thought you were making a joke for your fellow physicists.

NK: No, no. It's a very technical term actually.

TS: Great! So what basically did you do with this paper? Is it a mathematical formula or is it a theory?

NK: I have developed a theory for resummation for how to calculate these soft gluon corrections. There's a general framework that I developed, but then it takes work to actually calculate for specific processes. I did the calculations that produced the mathematical formulas, and then in addition I coded this computer program, and then I produced numerical results for single top quark production at the Tevatron and the LHC. This was one of my most cited papers ever, I think, because there are more than 300 citations now. My paper is used by every paper you see on the single top quark production, and even for other processes also because again this process can be used as background for other physics. It's been extremely widely cited.

TS: And it's come out in the last year and already has 300 citations.

NK: No, I think it wasn't last year; it was [16 May] 2011 that it was published. But yes, to have so many citations in only three years—I think when I applied for [the Foundation Prize] I mentioned that it's like one in 1,000 papers only have that high a rate of citations, something like that.

TS: Who published it?

NK: *Physical Review D* [Volume 83, Issue 9]. It was published as a rapid communication, which is a special class within *Physical Review D* for papers that deserve accelerated publication.

TS: I think you said something in the earlier interview about a lot of these things are almost immediately put online nowadays.

NK: That's right. I posted this on the archive of the electronic repository immediately, and then at the same time I submitted it to the *Physical Review*, and then of course there's a lag of a few months before it gets published. It has to go through the refereeing process and then, you know.

TS: Oh, I see. You put it up before it's gone through the peer review.

NK: That's right. There is still a sort of review in that not anybody can just post anything. There are people who check that it's a legitimate scientist who posted things, so there is actually a system that prevents anybody from posting, but it's not refereed in a sense that a journal sends it to a referee and then . . .

TS: They're just looking at your credentials?

NK: Exactly, and that the paper is not a crackpot paper.

TS: It could be a crackpot paper, but at least you've got the credentials.

NK: Well, actually, if it's obviously crackpot, they will not allow it to be posted. But the real refereeing process is through the journal.

TS: I guess maybe a follow up to this is how we've been able to keep you at Kennesaw.

NK: Well, being given all the prizes certainly helps!

TS: Well, we do have very well-funded prizes on our campus.

NK: Yes, I think Kennesaw has the largest amount of money that it gives to its faculty for prizes in the University System of Georgia. That's what I've heard.

TS: Thanks to Tommy Holder particularly and the Foundation for putting all that money into prizes.

NK: Yes, the Foundation is really helping out. That is certainly one thing that helps recognize people who are actively researching.

TS: You've been here ten years. You've won the Foundation Prize, which is for best research paper in your College of Science and Mathematics for four out of those ten years. You've won the Distinguished Research and Creative Activity Award twice in ten years. There is a little bit of money that comes with these awards.

NK: That's right, and that certainly helps.

TS: Good. We were talking in the previous interview that because your work is theoretical, you don't have to have the lab facilities that we obviously hadn't had in the past at Kennesaw.

NK: That's exactly correct. I don't need lab facilities. I just need some computers, which I have. I have several of them actually right now. Then pen and paper, and that's really what I need. Although to be fair, we have a new Science [Laboratory] Building. It doesn't directly affect me, but it's good for other scientists wanting facilities.

TS: I wanted to ask you about that. That opened [on 25 October 2012]. I noticed that we have two post-doctoral people over there. Is either one of them in physics?

NK: I think there is one, but it's also computational, so as far as I know no one from physics is using the new facilities; it's all biology and chemistry. All the labs in the new Science [Laboratory] Building are for biology and chemistry.

TS: Is that always going to be that way or do you think we're going to have physics labs over there?

NK: It's not clear to me yet. I don't know. The other thing is now with the consolidation I know at Southern Poly they have a couple of labs, but I think they're very specific for one type of physics. I actually think that for physics it would make more sense to concentrate on our strengths. Since we are strong in theoretical and computational physics, this is an area where we can excel. In my specific field of theoretical particle physics I know I have the only NSF grant in the State of Georgia. In fact, in the whole of the Southeast there are only a few active NSF grants and even DOE grants, Department of Energy, so it's an area where we can really stand out. We already stand out because

I'm the only one in the State of Georgia. So it's an area where we could really build up, and we can compete with anybody in the state because we have already the publications and grants and so on.

TS: Right. I was checking the website for the Biology and Physics department this morning, and six years ago we were talking about there wasn't a physics major. It doesn't look like there's a physics major yet.

NK: We're getting one through the consolidation.

TS: Oh, we are? Because . . .

NK: Southern Poly has a physics major, so we are getting a physics major now, and we're getting a physics department.

TS: Oh, you're going to separate from biology?

NK: That's right. In fact, my current department is splitting three ways. Even biology is splitting into two biology departments and then physics is separate as well.

TS: I've been doing some interviews over at Southern Poly in the last year with the consolidation. What they tout is that they've created majors in the sciences, but with more of a technological focus than Kennesaw. I can't take it any further than that because I don't know exactly what that means in physics, but once you have your new department will it have more of a technological focus than the standard physics department? Is it going to be experimental or is it going to be theoretical or what will it be?

NK: I don't know frankly. It's not clear. It partly depends on the interest of the students, what they want to do. As an undergraduate, you really don't specialize much anyway, so there's no specific focus that they have to choose, there's no real focus we have to choose. I think already at Southern Poly they have some tracks within physics for those who want to also have a concentration in mechanical engineering or electrical engineering and so on. I assume that will stay, but we may also create new tracks to give students more possibilities. The idea is, I guess, to have a broad major so that people with different interests can choose a track that they like. There's no need to concentrate on one thing. We should be broad so we can attract the widest [number of students].

TS: Where's the department going to be housed?

NK: I have no idea actually. For now I assume that the office will remain at Southern Poly, but I don't know about the future. I believe we will advertise for a permanent department chair. There will be an interim chair, which is the current chair of the physics department down at Southern Poly, but I believe within a year we will advertise for a permanent chair, and then whether the offices will be housed there or here I don't know. The idea is that the faculty can still be on both campuses because we have to teach physics on both campuses, so faculty will probably be present in both. I don't foresee any movement, but for the actual department office I don't know.

TS: But you're going to stay here.

NK: Yes, I intend to stay here, absolutely.

TS: I was counting the number of faculty members in physics, and it didn't look like we have any more [in 2014] than we did in 2008. I think I counted five full time tenure track and one temporary full time and a couple of part time.

NK: Well, actually there should be seven overall.

TS: You think seven full time tenure tracks?

NK: Yes, and then we have some temps as well. Of course, the number of temps fluctuates; there's usually three or something like that.

TS: There may have been some new faculty that hadn't made the website yet.

NK: Possibly.

TS: How many do they have at Southern Poly?

NK: They also have around seven so . . .

TS: Oh so it'll be a big department then.

NK: Yes, so about double—we'll be about fourteen or fifteen people.

TS: The consolidation is going to be good for you it sounds like.

NK: In a way, yes. Of course, we still have to work through the details; we have to work now through the P&T [promotion and tenure] guidelines and bylaws and so on. But, yes, there's obviously a chance to grow.

TS: When we did the interview before you talked a little bit about tension on campus between people who do a lot of research and those who don't.

NK: That still exists. If anything I think there's been even more stress, and the consolidation has also added more stress to the atmosphere. I'm sure at Southern Poly there is even more stress because I was reading the news and, yes, they've been very vocal about their feelings. Let's put it that way.

TS: Yes, a lot of people left from down there.

NK: A lot of people, including a lot of the senior administration.

TS: Those are the ones that I've been interviewing before they all got away. Some others too but particularly I've been trying to get folks before they got away. I haven't interviewed anybody from physics yet, and so what you're saying is very interesting, I think. I guess the sense I get is that now that we're a comprehensive university that means we're supposed to be doing more research than the rest of the state colleges and universities. But Southern Poly has been in the category with the rest of the state colleges and universities, so I think I've detected at least a little bit of concern about tenure and promotion for those that haven't done a whole lot of research.

NK: That's right, exactly, because I know that most of their faculty are mainly teaching; they're not doing research. So there is a lot of concern on their side. We had more of a transition period, and even though it was only last year we were denoted as a comprehensive university and we have to do research, the fact is that actually when I came here in 2004 in my memorandum of understanding it was included that I was expected to publish papers and I was expected to apply for grants. Of course, I did all that; that wasn't a problem for me; but what I'm trying to say is that already from ten years ago we had already turned the page, and we were expected to research and even apply for grants. The standards have only increased since then, so we're definitely adding new faculty that to be tenured or promoted will have to do a substantial amount of research. For full professor they have to be nationally recognized.

TS: That's my impression too that we were acting like a comprehensive university before the regents actually recognized that work.

NK: Exactly.

TS: But basically you don't see any change in the intellectual climate over the last six years on campus.

NK: Well, I know that we have more research and more facilities. We have some new faculty that have brought in more money, so the amount of money has changed. If you remember from President [Daniel S.] Papp's [2014 Opening of the University speech, 14 August 2014] it went from $2.3 million [for external research and service funding in fiscal year 2002] to $10.7 million [in fiscal year 2013]. So there's been a large increase and a lot of that has been driven by my college of Science and Mathematics.

TS: Yes. It was also sobering when he compared that ten million to the $91 million in fiscal year 2012 at Georgia State [for basic and applied research and developmental expenditures] and $351 at the University of Georgia and $689 at Georgia Tech.

NK: Yes, there's still a lot of room for improvement!

TS: Yes, to make the point, we're not in the ballpark with the research universities.

NK: No.

TS: But I think too, and you've mentioned this before that Dan Papp certainly is supporting people that are doing the research, or maybe that's a biased question for me to ask. What's your sense? Do you think there has been support from the top for what you've been doing?

NK: Well, there's certainly support in the sense that in addition to these prizes the teaching load has decreased very, very significantly.

TS: Okay, you were doing nine hours when we did the interview before.

NK: Now I'm down to three actually. Things have progressed even more. In fact now for the last couple of years I'm teaching one semester and not teaching the other. Last year I taught fall of 2013, and I didn't teach in the spring of 2014.

TS: So what did you do, six hours one semester and nothing the other one?

NK: That's right. That's exactly what I did.

TS: Well, that's good, I mean, if you're going to get your work done it helps to not have classes to run off to.

NK: Exactly. For people like me who are extremely active, it is almost like being in a research university because the publications I do, the grants I have, and the teaching load is the same as I would have in a research university. I guess what distinguishes us as a comprehensive university is that we can have different faculty roles who can do different things. Not everybody is expected to do what I do, but those of us who are very active do get recognition in the sense of release time from teaching and then grants and so on. But then we have also teaching models where people do eighteen hours of teaching, and then they're not expected to do any research, so there's room for both.

TS: I know when we did the interview in 2008 I didn't say so but I thought at the time that your nine hours sounded extremely heavy for all the work that you were doing in scholarship.

NK: Yes, in fact, I started with even more than that, and then it went down to nine hours when I got my first grant, and then it went down to six and now three. So it has been going down.

TS: I was doing six for years and years and years it seemed like each semester. But that's great. Personally I like that model to be a place where we can honor those that are doing the teaching and honor those that are doing the scholarship, and hopefully everybody is doing a little bit of both.

NK: That's what we did in our T& P guidelines. We wrote down explicitly five models, so two of them are mainly teaching, one is balanced teaching and research, another is intense research, and then there's administrative, so we have all these different models for different interests.

TS: Basically you're saying that even if you went to a research university you wouldn't be making any more money than you are with all these awards you're getting.

NK: Well, the salary would be higher probably. You know, Kennesaw doesn't pay so well, but, yes, I wouldn't be getting all these awards because they don't usually have awards like that in a research place.

TS: And you wouldn't be teaching any less at a research university than you're doing here.

NK: Probably not. It would probably be about the same. At this time, yes.

TS: I know there are some senior faculty that maybe teach one class a year at research universities, but you're about as low as you can get.

NK: Well, I teach also one class that has a lab as well. That's why it's six hours, so the lab also counts.

TS: Oh I see, so one class . . .

NK: But it gets both the lecture session and the lab. That's why it's bigger than just three hours. It's six hours because of the lab as well.

TS: Okay.

NK: So we'll see how that continues; I don't know.

TS: When you were doing nine hours it was one class but two labs?

NK: Yes.

TS: A big class?

NK: It was forty-eight students broken up into twenty-four student labs. Now I have a twenty-four student class and also one lab of twenty-four students, the same twenty-four students.

TS: Right. You were also doing directed studies?

NK: Yes, I did that as well. I have been trying to get students to do research with me even though we don't have a physics major until now, but I was able to direct some students from math or even some from computer science and chemistry but mostly from math. I was actually quite successful at getting something like sixteen directed studies over the last ten years, which given the fact that we don't have physics majors, I think is not bad. Actually, one of them was extremely successful. Even though he transferred to Georgia Tech, he stayed on with me in doing direct studies, and I was actually able to fund him through my NSF grant. This student's name is Elwin Martin. He actually came to my office when he was still in high school. He was very advanced already, and he wanted to do research already. He saw my name in the faculty and saw that I was active, and he came to talk to me even before he started at KSU. We started directed studies. I got him up to speed, and then he started even doing some basic research in the beginning. Then after a year he transferred to Georgia Tech, but he continued working with me because there's nobody at Georgia Tech that he could work with on this theoretical particle physics. After a while I started paying him through my NSF grant. Right now he's at UCLA. He's just started his graduate studies at UCLA. He moved this summer. We wrote a paper together, and now we're working on a second one. That has been very successful.

TS: What's your impression of students in general that you get in physics classes?

NK: Well, most of them have to take physics as a requirement, so they're not really that interested, but you do get once in a while good students, some even exceptional students. Those are the ones that usually want to do directed studies. Many of my directed studies students were students who were in my class, and then they wanted to continue to learn more things about physics, and then they did directed studies.

TS: What do you see for your future? You're forty-five years old now, I guess, and you ought to have some teenage sons by now, I guess.

NK: Yes, I'm forty-five and yes, I do. I have twin boys, and we discussed them in the previous interview. They're now thirteen; they will be fourteen in a couple of months; and they're in eighth grade. They're very, very good; their classes are all accelerated classes, so they're actually getting high school credit right now even though they are in eighth grade, the last year of middle school, and they're already thinking about college. They're very interested in science and math.

TS: What do you see for your future? Is this work with CERN going to continue for the foreseeable future?

NK: Yes, for the foreseeable future I will keep working on top quark physics and Higgs physics and other collider physics relevant to the Large Hadron Collider. That will be for the foreseeable future. Of course, I cannot speak what will happen in ten years, but for the next five to ten years that's what I intend to do.

TS: Is there still going to be a place for a collider in ten years, do you think?

NK: I expect CERN to be still running even in twenty years. The CERN collider will be working for at least ten more years if not twenty, and then there are many proposals already for the next collider. By that time I'll probably be in my sixties, so I'm not worrying about that too much!

TS: You're just getting started. Okay. Well, great! I think I'm probably through all the questions that I had unless you can think of something we ought to put in the interview that I haven't asked you about.

NK: No, I think that's sufficient. Given what we discussed six years ago, I think that basically takes us up to date.

TS: All right. Thank you very much.

NK: Thank you.

Interview with Nikolaos Kidonakis
Conducted, edited, and indexed by Thomas A. Scott
Thursday, 5 May 2022 – Part III
Location: Department of Museums, Archives and Rare Books, KSU Center, Kennesaw State University

TS: This is the third interview that we've done with Nick for the KSU Oral History Project, but the first to be filmed. I think it would be helpful to start with a quick review of what you told us in 2008 and 2014. You were born in Greece in 1969, came to the U.S. at age 17 to go to school at California Institute of Technology, graduated from there with honor in Physics in 1990, studied a year at the University of Cambridge, then received a PhD from State University of New York, Stony Brook in 1996. Why don't we begin by you telling us briefly what you concluded in your dissertation, which was entitled "QCD [quantum chromodynamics] Resummation and Heavy Quark Cross Sections."

NK: Yes, my field of research is theoretical particle physics, so I'm interested in the most elementary particles that make up the world and the forces with which they interact. The heaviest elementary particle that we know of is the top quark, and that's what I've been studying for a long time, in addition to other things. We try to do calculations that can make predictions for what happens when protons collide with protons, or protons collide with antiprotons, and create new particles like top quarks. The experimentalists measure these things, for example, at the Tevatron in the past, and at the LHC [Large Hadron Collider] now. They measure what's called the cross section, which, roughly speaking is a measure of how many particles you produce, how many top quarks you produce in these collisions. People like me, theorists, calculate using quantum field theory and, in particular, perturbation theory.

Quantum chromodynamics is the quantum field theory of the strong nuclear force with which the protons are bound, because the protons are made out of quarks and gluons, and they're bound together. We use this theory to calculate these things. And so, my calculation was basically theoretical calculation that made predictions for the production of top quarks and other heavy quarks. The resummation means that in perturbation theory you can calculate a series of terms where the leading term is the easiest one to calculate. Then the next leading order one is harder and so on, but there are certain parts of those terms that you can calculate at very high orders. And these terms come from soft gluon emissions. Gluons are the particles responsible for the strong nuclear force. When these gluons have low energy, they're called soft gluons, and they dominate the cross section numerically. So, my calculation was basically to do the resummation to all orders of these soft gluon effects and produce theoretical results that then can be compared against the experiment. So, that's what it is very briefly.

TS: How did you get into the theoretical side of things as opposed to the experimental side?

NK: Well, I have a theoretical bent, I guess. Since I was a young boy, I was always interested in physics and later, more particularly in particle physics. I guess the theoretical part attracts me more because it addresses fundamental questions using mathematics. That attracts me more than doing experiments in a lab.

TS: This is really, really advanced mathematics applied to a problem in physics?

NK: Yes, that's right. We use advanced mathematics, and sometimes we create our own mathematics, or sometimes we recreate it. We didn't know that they were invented before, so, yes.

TS: In the previous interviews we talked about how your work is applied at CERN, which is over in Geneva, Switzerland, and the Large Hadron Collider. They're basically creating large collisions of protons and neutrons and all that are colliding with each other and producing these particles. And you're doing mathematical formulas that predict what they're going to find?

NK: Yes.

TS: And they test it there to see whether it works.

NK: That's right. At the Large Hadron Collider, they are colliding protons with protons at very high energies. Before that at the Tevatron Collider in Fermilab, outside Chicago, they were colliding protons with antiprotons, the antiparticles corresponding to protons, what's called antimatter. At the beginning of my career, when I was a graduate student and then post-doc and so on, and even as a young faculty member, it was the Tevatron Collider that was producing results, and my calculations were relevant to that. But the Tevatron has shut down [in 2011], and so now my results are used by the Large Hadron Collider.

TS: Did Tevatron shutdown because it's not needed anymore?

NK: Well, it wasn't funded to continue, and part of the reason was because of the LHC having much higher energies. So, they thought, okay, now, since we're doing collisions with much higher energies at LHC, maybe it's time to shut down the Tevatron.

TS: Which, I guess, is to say that there's an international scientific community; so, it really doesn't matter whether it's done in Batavia, Illinois or Geneva, Switzerland.

NK: That's true, yes. But, of course, it does make a difference to have your own collider in your country because it attracts people to physics. There are other colliders, smaller ones that have other uses, like at Brookhaven they're building a new one, an electron ion collider.

TS: Where is that?

NK: That's at Brookhaven in Long Island actually; so close to Stony Brook. They got another collider recently [beginning operation in the year 2000]—RHIC, Relativistic Heavy Ion

Collider. And now they're building a new one, but the physics down there is more towards what's called hadronic physics and towards nuclear. So, it's not as much on the topics that I work. The topics I work are more relevant to what they're doing right now at the LHC.

TS: In your earlier interviews, I was surprised to learn that Stony Brook is so important to the field of physics and the kinds of physics that you're studying. I mean, everybody knows about Harvard and other famous research institutions, But for a State University of New York public institution …

NK: Because they were running Brookhaven [National Laboratory]. I'm not sure exactly how it works. I don't know what the situation is right now. But just like Caltech runs JPL, the Jet Propulsion Laboratory, in Pasadena, Stony Brook basically was overseeing Brookhaven National Laboratory. So, yes, it's a big deal.

TS: Okay. So, you wrote your dissertation, and then you started doing postdocs, first at the University of Edinburgh, and then you went from Scotland to Florida.

NK: Yes, Florida State University.

TS: And then you taught for a while at Southern Methodist University.

NK: Yes.

TS: And then you did another postdoc at the Cavendish Laboratory in Cambridge. You went back to Cambridge and had a Marie Curie fellowship.

NK: Yes. It was basically my own grant. I brought in my own money, so it was paying for my salary.

TS: Oh, fantastic.

NK: So, I was independent in that sense.

TS: Well, I mean, anything associated with Marie Curie sounds very impressive.

NK: Yes, these are prestigious European fellowships.

TS: By the way, one of the things that I really liked about the earlier interviews is that you talked about tracing your genealogy, but the genealogy you traced was from your professor at Stony Brook to his major professor and back.

NK: Yes, Peter Higgs, and then back then I could trace it down to James Clerk Maxwell. But then I actually managed to trace it way, way beyond that, back to Isaac Newton and even before back to Byzantine times and so on. It's amazing how much you can trace now that there are tools available. There's also a math genealogy. And because theoretical physics and mathematics are so intertwined, you can use also the mathematics genealogy project to trace your roots. I think I went back to 1200, maybe earlier. It's really amazing. It really was a lot of fun.

TS: Well, that sounds like a really important type of genealogy: who are your intellectual mentors and who were theirs?

NK: Exactly. It's a lot of fun.

TS: You have the history of physics there, I would think.

NK: That's right, yes.

TS: Well, my question, I guess, that I'm leading to is that you came to Kennesaw State University in 2004 after being a nomad for all these years. You now had a family, of course. But you were jumping around from one place to another every few years, but you've settled here. You've been here eighteen years now. So, my question is something we talked about in the earlier interviews, but I think it's worth doing again now that we are filming: How did all of this work prepare you for your career at Kennesaw State, and why was Kennesaw a good fit for someone who was doing as much publishing and presenting at international conferences as you were doing?

NK: Well, the post-doctoral appointments were a very useful experience. In fact, right now they're almost required in my field. They're basically required. If you want a faculty position, you're expected to hold several post-doctoral positions. And you basically grow as an independent scientist. You grow because you have time to do research without having the burdens of teaching and of service and so on that you have as a faculty member. So, it takes you from being a graduate student who's just coming into his own, to basically allow you to mature as a scientist. Then you're ready to start a faculty position where you have other obligations: teaching, service and so on. So, they were very useful. And even my little teaching visiting position that I had helped me when I came to Kennesaw to start my teaching. When I interviewed here, they told me that Kennesaw was growing very fast, which is true. And it's still growing very fast.

TS: What was our enrollment in 2004?

NK: I think it was 17,000 [17,961 in fall 2004]. Now, we're in the 40 thousands [42,983 in fall 2021]. So, it has more than doubled. Then, in addition to the large growth, the accompanied growth in stature of the university and also the focus on research. So, when I came here, they told me they were beginning to require research. The focus was going more into research. It wasn't just encouraged. It was expected. I think I had to sign a memorandum of understanding that I would publish papers and apply for grants. So, it was clear, at least in my department. I'm not saying that it was the same everywhere in all departments or colleges of the university, because I know there has been some variation, but it was very, very clear that you had to publish, and you had to do research.

I actually liked that because I wanted to continue being an active scientist. So, I liked that. I thought, okay, this place is somewhere where I can succeed and flourish and do my work. Of course, I know we didn't have the [laboratory] facilities. We have many more facilities than back then, but being a theorist, I don't need that. If I was an experimentalist, that would be a different matter, but being a theorist, I can work anywhere as long as I have basic things like a computer and an office. It didn't matter much. What mattered was that research was encouraged, acknowledged, and supported, and the fact that they expected you to apply for grants. I've been on grants ever since I came here, basically. I applied in 2005 and my first grant started in 2006, and now I'm on my sixth NSF [National Science Foundation] grant. So, the fact that they would allow you to get grants and give you release time from teaching and so on, some of that was...

TS: Wow, that's interesting. I know we didn't have memos of understanding in the history department.

NK: As I said, it varies. It varies.

TS: You were in the department of Biology and Physics.

NK: At the beginning, yes. Then it became department of Physics. It was a very large department initially.

TS: So, they were actually looking for a researcher when they hired you.

NK: Oh, absolutely. Absolutely. That was the main thing.

TS: You talked in earlier interviews about how there was some tension between [older] faculty who thought we should be almost exclusively a teaching institution—which we were in our early days—and those who wanted us to be a research university, which we weren't yet by definition in 2004. Maybe this would be a question that gets into the last eight years, as well as the previous. How has that evolved over the eighteen years that you've been here? You talked earlier about tension between those who were doing a lot of research and those who weren't.

NK: There is still tension. Of course, there's still tension; even within people who do research some are more active, are more successful. There are also human elements, obviously. There could be resentment, there can be tension, there could be many different things. But I think overall we've turned the page. I think everybody understands and accepts that faculty who come here must do research. I mean, even when I came back in 2004, it was expected. The expectations have only increased since then. So, I don't think there's any debate anymore that incoming faculty—at least tenure track faculty [will be expected to do research].

Now, of course, we have the whole other chapter of getting a lot of lecturers now. We're much more dependent on lecturers now than we used to be in my department. They are taking the heavy side of teaching. The faculty who come as tenure track faculty get a lower teaching load, but then they have the expectation. No free lunch. You teach less, but you should do research. That's now accepted. Of course, as you said, we used to be an undergraduate institution a long time ago, decades ago, then we started graduate programs and under Dr. Papp doctoral programs. Then we became an R3 [Research 3] and an R2 [Research 2—High Research Activity]. So, the university has evolved a lot, but it's been a gradual evolution. I don't think it's been dramatic: "Oh, now we're an R2!"

As I said, even back then in 2004, I was expected to publish and get grants. So, I think it's only a slow evolution in terms of quantitatively, maybe sometimes qualitatively, but I don't think it has been a big jump—suddenly, we became an R2, and suddenly everything changed. Actually, I think it took the Carnegie Classifications maybe too long to recognize that we were actually changing.

TS: The Carnegie Classifications were behind reality?

NK: Yes.

TS: I think I agree with that.

NK: Because it takes some time to find out what's going on. So, I think we were already at least an R3 before we were officially recognized.

TS: Although a lot of the Carnegie Classification depends on how many doctorates you turn out each year.

NK: Yes. So, it's not everything. For example, they don't use number of publications or citations. I think it's money [research expenditures]. And then how many doctorates you give and things like that. So, it's not a complete picture, but I guess it's good enough.

TS: I meant to check before the interview to see how much grant money we're bringing in at Kennesaw each year. [According to data on the Office of Research website, 113 external rewards were received by KSU in 2020, totaling $9.9 million, and Research and Development expenditures came to $17.9 million, up significantly from earlier years].

NK: I don't know the number overall. I've brought about a million dollars through my six grants since I got here.

TS: Well, maybe it would be a good time to start talking about these grants. You had one in Europe, a European grant, before you ever came to Kennesaw.

NK: Yes, that was the Marie Currie.

TS: You were saying a few minutes ago, your first grant here came two years after you arrived officially, in 2006. And I guess these are all three-year grants?

NK: Three-year grants.

TS: So, every three years you've gotten a new grant.

NK: That's right

TS: You've been as regular as clockwork, 2006, 2009, 2012, 2015, 2018, and 2021. How much have the grants brought in?

NK: The last one is $300,000. It's about a million dollars overall. They were not the same amount. It kept increasing. Each grant kept getting bigger.

TS: In the previous interview you alluded to the fact that you had to almost apply from scratch each time, but what you had done in the previous grant helped a lot getting the next one. So, why don't you talk about just exactly what these grants enabled you to do, and what kind of research came out of them?

NK: Yes. The theme of it all is in theoretical particle physics. I was doing theoretical calculations that are relevant for various processes. As I said, I've been working ever since my graduate student days on the top quark, but I've also worked on many other things: on the Higgs Boson, on what I call the electroweak vector bosons, like the W Boson and the Z Boson. These are all the many particles.

TS: We talked about the Higgs Boson last time.

NK: Yes, that was discovered finally, experimentally, in 2012.

TS: Yes, it was right before we did the 2014 interview, even though people had theorized about it since the 1960s.

NK: That's right. Higgs [did so] in 1964 and other people, [Francois] Englert and [Robert] Brout and others also theorized it. Also, I'm doing calculations for processes that involve both the top quark and other particles. For example, top quark and Higgs together, or a top quark and a photon or a top and a W or a top and a Z. So, all kinds of different processes I've been working on all these years. As we were saying, there are six NSF grants. Each of them is independent. So, you go through the review again. Even though there's a continuous flow of my research topics, they're still independent grants. You have to apply from scratch every time. It's not like they just say, "Okay, you have it, and you keep automatically renewing." It doesn't work like that.

TS: Do you ask for money to give you course releases and pay for travel?

NK: Actually, course releases were during the beginning. Now, they don't do it anymore because now that we're a research university, they expect the university to give course releases. We get that sort of automatically. The NSF changed this position at some point. I don't remember which grant was it—the third or the fourth—where it said, "No more ‘official’ course release money, because now you are at an active research university.”

TS: If your university doesn’t support you, better go somewhere else?

NK: Exactly. Exactly. So, they stopped that, but summer salary, that’s the most important thing—summer salary and money to support students, so you can pay students some salaries as researchers, [also] computer equipment, and travel. These are the main things. I should also mention that the first five grants that I got, I was the single PI [Principal Investigator]. Then, my most recent one, I’m still the PI, but I have a co-PI, Marco Guzzi, who came here in 2017. So, this is a joint grant. I’m the PI; he’s a co-PI.

TS: Oh, he’s been here since 2017? Five years is a long time! So, you have had somebody who can talk to you.

NK: That’s right. That’s right.

TS: Maybe it is a good time to ask this question: prior to 2015, we didn’t have a physics major. What kind of students were you able to recruit to pay on these grants?

NK: I was able to get people from math, and then I’ve supervised or mentored or whatever you want to call it about fifty undergraduate and graduate students—fifty over my career here, including mostly undergraduate, but also some graduate students. But most of them until recently were not in physics. There would be people from math, from chemistry, and from computer science, who were just interested. They would take my classes, and then I would advertise, “If you’re interested in modern physics, come and talk to me.” So, they would come. Some of them did directed studies or directed methods. And then some of them were interested enough and good enough to go on my grant and then publish papers and so on.

TS: I think this would be natural for somebody in mathematics who is looking for some practical application of what they’re doing.

NK: Yes, that’s correct. And I also get some students from Georgia Tech. Some of them wrote to me even from high school, others directly from Georgia Tech. Others went from Kennesaw State to Georgia Tech, but they kept working with me. So, I get students like that. Once we had the physics program, I could also have students from the physics major. One of them was very successful, Matthew Forslund. We wrote three papers together and also some proceedings papers together. He’s now a graduate student of Stony Brook. And even when he went to Stony Brook, for a while I would still support him from my grant.

TS: How does that work if they’re going to Georgia Tech or Stony Brook? It has to be some kind of mutual relationship between the universities, doesn't it?

NK: Any student in any University System of Georgia university can take classes in any other. So, Georgia Tech students can take classes here officially. They can do directed studies, for example, or they could even take another course if they wanted to. It's easy to do that. For the NSF to pay them, it's not as straightforward, because you cannot pay them as undergraduate students. You have to pay them as something else, like research associates from somewhere else. So, it was a little complicated, but I managed to do it. And then I guess another thing I would like to say is that I've also recently had post-docs as well. I had my first post-doc.

TS: I wanted to ask you about that today. That's got to be the first for Kennesaw State, doesn't it?

NK: I'm not sure if it's the first for Kennesaw State, but certainly the first in my field. Nodoka Yamanaka is his name. He was here for a year, and he was paid from my previous grant. He's a faculty member now in Nagoya University in Japan. So, he was successful. He came here for a post-doc, and then he got a faculty position back in Japan. We're still working together. Then, we just hired another post-doc, Alberto Tonero, who's going to come in August. He will be my second post-doc.

TS: All this points out just how international the field is, doesn't it?

NK: That's right. I'm very happy that finally we can have post-docs. I should mention that the first post-doc, Nodoka, was paid half from my grant and half through a post-doctoral sponsored associate award from the Office of Research here at KSU. The university is supporting post-docs as well, at least partly, or they expect you to eventually get a grant. I already had a grant, so I asked them to chip in for a year. Then, the new one will be here for at least a couple of years.

TS: Wow. So, you use the grant money to pay students; you use the money to get credit for teaching what you would get if you were teaching a class, equivalent to whether you were teaching in the summer. Did you use some of it to travel to those international conferences where you were invited to go?

NK: Yes, I've traveled to many throughout these years. I don't know. I've given a hundred talks or so in conferences. So, I've traveled widely, of course, not the last couple of years because of COVID. Since 2020, I'm still attending conferences, but they're all virtual. In fact, just yesterday, I gave two online talks at a conference.

TS: That's a lot cheaper.

NK: That's a lot cheaper, yes. But I had a lot of travel money that I couldn't spend. The truth is that's how I managed to hire my first post-doc, because I hadn't spent all this travel money. Then, I could pay at least half of the year for the post-doc and the other half from the office.

TS: National Science Foundation doesn't object?

NK: No, no. In fact, I asked them, and they said, "What a great idea! You're helping somebody, a particle physicist."

TS: I think maybe one of the things the pandemic has done, with Zoom and what have you, is made us realize, "Why are people spending so much money traveling to an international conference when you can all meet virtually?"

NK: Yes. Of course, there's something to be said about in-person interactions. It [the virtual conference] doesn't exactly replace [in-person meetings], but it is way more accessible to people.

TS: All that you're doing with these grants would sound very impressive if we were an R1, but for an R2…obviously, every professor can't do this kind of work.

NK: It's not typical.

TS: But I think it's very impressive that it's happening at Kennesaw now. I guess the one thing we haven't talked about is, what have you contributed to the field as a result of having this grant money to do all this research and having students to help?

NK: Increasingly, precise calculations for the variety of processes, creating new theoretical formalisms and generalizing them more and making—as I was telling you earlier about using perturbation theory in calculating things at higher and higher orders—what are called higher loops. There are these diagrams that you calculate and what are called loop diagrams. When I started decades ago, the state of the art maybe was one loop calculations or next to leading order. And then I pushed the envelope to two loops and more recently, to three loops or next to next to leading order and approximate next to next to next to leading order and so on.

So, I've been pushing the envelope, and I've been also covering many more processes, more complicated processes. So instead of being two to two, now two to three, so you start with collisions of two particles, and you get three particles out and more and so on. These more precise calculations are needed in order to test our models and see if we can find new physics. LHC, for example, uses my calculations to validate the existing theories, but also as a background to look for new signals of new particles, new directions and so on. So, that's the contribution.

TS: It keeps getting more sophisticated.

NK: More sophisticated, yes.

TS: In the previous interview, you said you thought the Large Hadron Collider, LHC, would be in CERN at least into 2030. What do you think now?

NK: Yes, yes. In fact, this summer, it's just starting again. We had a long shutdown and now Run 3 of the LHC will start for several years. Then, there will be another shutdown.

And then there will be the High Luminosity LHC, which will go on for more years. So, it will go definitely into the 2030s. And then, after that, we don't know. There may be a higher energy LHC. Then they're talking about maybe near the end of the century to build what's called the FCC, the Future Circular Collider with a much higher energy. But, of course, that's maybe in 2070. I will long be gone by then, but I don't think I'll be active if I'm alive at that time.

TS: Oh, well, it'd be wonderful if you were.

NK: I would be over 100 if I am alive.

TS: You might still be doing research then. But let's talk about the most recent grant of 2021, the $300,000. That's the biggest one so far?

NK: That's the biggest one. As I said, it is with Marco Guzzi. So, it's a joint one.

TS: I guess I should ask; did you have to lobby hard to bring him on to the faculty here?

NK: Yes. I had my fights. Let's put it that way. Also, we should mention, we have a third particle theorist now on the faculty: Andreas Papaefstathiou. It's a Greek name. He's from Cyprus, Greek ethnicity from Cyprus. He came last year. So, we now have a group of three, and we may even get more. We are waiting for our dean to decide if we have what we call now, RIGs, Research Interest Groups. The hiring goes through the RIGs now. So, we may be hiring even a fourth person this year or in the future. We'll see how it goes. So, we are expanding. We have a solid group now.

TS: I'm going to read this. I think it came straight from you, so, don't necessarily assume that I understand anything I'm reading. But the grant is to improve theoretical predictions for various particle processes in high energy collisions of protons.

NK: Yes, basically what I was saying before. In other words, collisions of protons at the LHC produce particles like top quarks, like Higgs, and so on. So, our research is basically to have improved theoretical predictions for what happens in these collisions and how you produce these particles.

TS: So, you're funded at least through 2024 now.

NK: Yes. That means in 2023 we have to reapply.

TS: It must be exciting to have colleagues now that are doing the same kind of work that you're doing.

NK: Yes, it's nice to be able to talk to people and collaborate. We wrote a paper with Marco. Now the three of us, Marco, Andreas, and I, our thinking of doing something together. So, it is good. Yes.

TS: Can you say something about Marco and about your collaboration together?

NK: Yes. We wrote a paper on *tZ'* production [Marco Guzzi and Nikolaos Kidonakis, "*tZ'* production at hadron colliders," Eur. Phys. J. C 80, 467 (2020)]—the associated production of a top quark with the *Z'* boson [pronounced Z prime boson]. *Z'* prime is a hypothetical particle. We're doing work not just for particles that we already know exist, but even for some particles that are hypothesized to exist and that people are looking for. So, we wrote a paper together on that. Now, we're thinking on writing a new paper, again, something about the top quark. Of course, he has his own research in different aspects of the field, but we have overlapping interests as well.

TS: You've already talked about your theoretical high-energy physics group that you're working to bring about. That's going to include your three or more faculty members and all the students that are working with you.

NK: And a post-doc.

TS: So, you should have quite a concentration.

NK: Yes.

TS: Let me just ask you in the way of a question, how unique is this in Georgia to have a concentration of people who are doing theoretical particle physics?

NK: It's quite unique. For many years, I was the only theoretical particle physicist in the State of Georgia—certainly the only one funded by the NSF, but I don't think there was anybody else. So, my research program was unique for many years. I had the only NSF grants in the field for decades. And now, we have Marco. I think there may be some other people now who are being hired in Georgia, but I think we're the only group. That's why I get people from Georgia Tech coming to work with me. Georgia Tech is obviously much bigger research wise, but they don't have somebody doing theoretical particle physics. And that's why I've had several students over the years coming to work with me here. That's not the typical way you would think about it. You would think it would be the other way around.

TS: Do experimental particle physicists have to be at a place like CERN to do their work, or can they do experimental work at Georgia Tech or...

NK: I think they have Astro-particle physics, if I'm not mistaken. I mean, big research universities have facilities. They can build parts of detectors and things like that. So, they can do some work. Of course, there is no university that can have its own collider. That's for sure. There can only be one or two in the world. But universities that have a lot of money can still have facilities where they can build parts of detectors. And so, they can have experimentalists doing work at the university and not having to do everything at CERN. But we don't have facilities for that here.

TS: Sure.

NK: And that's why you have a much larger ratio of theorists to experimentalists here than that in other universities, for that reason.

TS: But Kennesaw has become the hotspot.

NK: Exactly, yes.

TS: Well, you started winning prizes as soon as you got here. Do we still have Foundation Prizes?

NK: No, but, I got a total of four Foundation Prizes and I think maybe the last year was the last time I got it. I believe I got it in 2006, 2008, 2012 and 2014. And I don't think they gave anymore after that, or soon after that.

TS: The purpose of the Foundation Prizes was to fund your research?

NK: Well, it was basically recognition. It's like the distinguished awards, basically. It's a recognition of a single paper that was impactful. You had to prove that it was impactful, and then you got the award.

TS: When Ken Harmon was either provost or acting president, he read the title of one of your papers [in an Opening of School Year faculty meeting] and joked, "I'm sure everybody has read this."

NK: Yes, yes. That was one of the times. The Foundation Prize is similar in a way to Distinguished Scholarship and Research awards that I also got. I got three of those, although the names slightly changed [KSU Distinguished Scholarship Award in 2008, Distinguished Research and Creative Activity in 2014, and then Outstanding Research and Creative Activity in 2016].

TS: I didn't quite understand why we went from "distinguished" to "outstanding."

NK: I think they slightly changed the rules and the number.

TS: I guess we used to give a number of the Foundation Prizes, at least each college could have one or something like that. But we had only one Distinguished Research award.

NK: Exactly, exactly.

TS: And I guess going from "scholarship" to "research" was an implication that we were becoming more R2 or R3 or whatever.

NK: Yes, possibly. I don't know how they were decided.

TS: I guess really the Foundation Prizes maybe got replaced with each college being eligible to have an outstanding research award.

NK: Yes. I think instead of having Foundation Prizes, they are giving now more than one outstanding [research] award. When I got my first two, there was only one [campuswide] distinguished scholarship or research award [each year], but more recently they can give more than one. I think now they give two outstanding research awards. For a while, I think they gave more actually, but then they went back to two. So, there has been some evolution in these prizes. They keep changing. But I think in a way maybe they replaced the Foundation Prizes with having multiple outstanding research awards rather than the single one that I used to get in the past.

TS: Right. It was a lot easier to interview the recipients when there was just one a year.

NK: That's right, yes.

TS: But you got the big one in 2020, the KSU Foundation Distinguished Professor award. Why don't you talk about what these awards have meant to you?

NK: They meant a lot because it's recognition, and it's also a good chunk of money. But it's recognition that the work I do is valued. So, it has meant a lot to me. I guess the university Distinguished Professor award is the culmination of that because that's the highest faculty honor. I've been getting them for two decades, but now I don't think I'm eligible because now they say if you get it once you're ineligible [to receive it twice]. So, I guess I have to stop.

TS: Well, you can still be getting grant money, I guess.

NK: Exactly.

TS: But it really is amazing that our foundation has been so supportive, I think, with money as well as recognition.

NK: Yes, I think so. I think partly it is to make up for the salaries because our salaries, of course, are not those of Georgia Tech. So, that in a way was supposed to encourage people to work and "here's some remuneration to help you along with your research."

TS: You can go teach in the business college, if you want more money.

NK: That's true. That's true. There is a disparity between different colleges. Computer scientists also, I think, make more.

TS: You could do computer science, but you're doing what you're passionate about.

NK: My passion. Yes, exactly.

TS: Which I think is what we all do.

NK: That's right.

TS: There's another thing I think is very definitely worth talking about—international recognition. It's nice to have all this recognition on campus. You were talking in an earlier interview about how that's one of the things that keeps you here—the fact that you have been appreciated. But you have also been appreciated internationally. I don't quite understand how they do the rankings, but maybe you can tell us how they measure your top ranking in fundamental physics worldwide in 2018 and it was updated in 2021. How was that measured?

NK: First of all, that was, I think, the biggest honor or distinction that I've received. There were a couple of physicists at CERN, and they made this study of citations, how many citations people get. But it's not just pure number of citations because citations by themselves can be very misleading. If you write a paper, for example, in big experimental collaborations where we have hundreds of thousands of people, citations of a paper mean nothing because they're divided.

TS: If you have multiple authors?

NK: Exactly, if you have multiple authors, how do you split them? They did a very sophisticated study where they accounted for number of coauthors in papers. They didn't just use just pure number of citations, but they normalized that number by number of coauthors. So, basically, they divided by the number of coauthors. And then they accounted for other things like what is the normal citation rate in each subfield of physics. Historically, people didn't get as many citations as now. So, they used very sophisticated tools to account for all these variables, and they came up with a thing called individual citations. So, normalized by all this, I was ranked number one in the world in fundamental physics since 2010 in terms of individual citations.

TS: But papers often have the lead researcher listed first and then other authors.

NK: That's also true. But in my case, most of my papers are single authored. So, there was no question about that. And not only I was ranked number one in my subfield, but all over fundamental physics, even astrophysics and other fields. And not only was I number one, but there was a big gap between me and the second person. Then they also used three other measures. They called it author rank, which is their default, the most important one, and paper rank and then citation coins. Author rank basically accounts for the importance of your papers via the connectivity to other papers—not only how many people cited you, but how important were the people that cited you and how important were the papers that cited you. So, it's a very complicated analysis. That's the most important thing, author rank. And again, I was ranked number one, and then they did a similar thing with the papers who cited you—how important those papers were, and so on. Then they had another thing called paper rank. So, again, number one in that, and finally citation coin to basically exclude self-citations and what they call citation cartels—people being in groups citing each other and so on. So, under all these four metrics, I was ranked number one. So that was a huge distinction for me.

TS: In the field of history, somebody may cite you just to say that you got it all wrong.

NK: Yes, that's also true, but that's a very, very minimal thing in physics. I mean, you don't get cited if you did things wrong. That's not how it works.

TS: So, that's quite an honor.

NK: Yes, and that was updated. It was published in 2019 and then updated again in 2021—again, still the same.

TS: Wow. So, I don't even need to ask you what it would mean to you.

NK: It meant the world. I mean, it was huge, and it was surprising.

TS: And I guess that's one reason post-docs want to come here then.

NK: Well, that helps, definitely. I knew I had a high ranking before, because many of my papers were among the top one hundred papers in physics year after year, since 2005. And that has happened about, I don't know, fifty times or so. So, I knew I was ranked very high, but to be ranked number one and under all measures and with such a gap with respect to the others—that was a surprise that I didn't expect.

TS: How many papers have you published now?

NK: I just realized recently that overall, I have published about 150 papers, but I have published exactly 100 papers since I came to KSU.

TS: Is that right?

NK: I had 55 papers when I came here in August 2004, and now I have 155, so exactly 100 papers. So, that's a very round number.

TS: And how many citations?

NK: Overall? I have now over 14,000, according to Google Scholar. I think it was in the thousands when I came, but barely. I don't remember if it was a thousand or two or something like that. It has exponentially increased.

TS: That's amazing.

NK: So, I keep working. I keep working.

TS: When we did the interview in 2014, we were still in the process of consolidating with Southern Polytechnic State University. They had a major in physics, and the Kennesaw campus didn't. You got a physics major out of the consolidation and a Physics Department as well. You're no longer in with biology. When we did the interview in 2014, you weren't clear where all this was going. I don't even think you had a department chair chosen yet at that time.

NK: No, we got our department chair in 2016. Back then, I wasn't even sure where the offices would be. The administration, the office of the chair, is in Marietta. But we're split half and half. Half are in Marietta. Half are in Kennesaw because we teach on both campuses. We have to be on both.

TS: So, you don't necessarily have to be running from campus to campus.

NK: No, I have only to run there when I teach majors classes because they all are taught there. The introductory courses are taught on both campuses, but the majors' classes, because the policy of the university is that you should be able to complete a major without having to travel between campuses. So, I do go there when I teach an advanced course, but my office is on the Kennesaw campus.

TS: It's a nice campus down there.

NK: Kennesaw is better, I think. I like where I am.

TS: But you can ride the Big Owl Bus down there if you want to.

NK: I drive.

TS: Well, let me ask you from your perspective, how has the consolidation worked out?

NK: We've definitely increased. We've doubled our size, more than doubled by now, tripled. We have many faculty now, about half tenure track, about half lecturers. We have on the order of twenty plus faculty. So, definitely a much bigger number.

TS: Twenty in physics?

NK: Yes. twenty plus. I don't remember the exact number. It depends also how you count, if you include some temporary people [Editor's note: At the start of Fall 2022 the website for the Physics Department listed twenty-one full-time faculty members, including eleven who were tenured or tenure-track, eight lecturers, and two limited term assistant professors].

TS: That's about three times as large as before, isn't it?

NK: Yes, something like that. We have a major, we have students, and so, we've grown a lot.

TS: How have the students on the Kennesaw and Marietta campuses blended together? Even in 2015, was there any difference in types of students on the two different campuses?

NK: I wouldn't say there's a huge difference. I didn't see a major change teaching introductory courses between those people who are based in Kennesaw and those who are based in Marietta. I think, overall, academically, in terms of students, our consolidation was one of the most successful in the State of Georgia in the sense of the level of the students, if you compare their SATs ...

TS: They were good in math on that campus when we consolidated.

NK: To be honest, I don't know if there's a big difference for physics. Obviously, again, we didn't have our own [physics] undergrads before.

TS: Right. Do any of the engineering programs require physics?

NK: Oh, yes.

TS: To what degree are you servicing the Southern Polytechnic College of Engineering and Engineering Technology?

NK: To a large degree. Before the consolidation, we didn't have engineering, obviously [on the Kennesaw campus]. So, it was mostly [servicing] biology and chemistry and then maybe some math and some other topics. But now it's a big representation of engineering in addition to chemistry and others.

TS: It oversimplifies things, but Southern Poly's engineering programs were noted for their practical, lab-oriented application, as opposed to theoretical. Is that changing, and to what degree did that affect the kinds of students that you got in your physics major?

NK: Again, the major was there to begin with. So, we didn't have a change in major as such. Now the students, of course, have more opportunities. They can work with people like me. So, they have more opportunities research-wise. Before the consolidation, Southern Poly wasn't very much into research. So, that was the other big difference. Now, they have a lot more opportunity to do research. There are faculty with grants, so, there's a lot more opportunity for the students now.

TS: Several faculty members from the Marietta campus have won distinguished professor awards in recent years. So, they must be doing some research down there.

NK: Well, now the expectations are the same for everyone. It has now been eight years since the consolidation started, right? So, there's...

TS: Fewer and fewer people who remember what it was before, I guess.

NK: Exactly. So, I think the expectations now are pretty uniform throughout.

TS: Well, when we did the last interview, I think we were called a comprehensive university, which was a University System of Georgia terminology to put us with Georgia Southern and Valdosta and West Georgia in kind of a secondary category below the four research universities, but above the other state colleges and universities. But research wasn't in our nomenclature so much. And as you mentioned, we became an R3 [in 2015], and there's no such thing as an R3 anymore.

NK: Yes, it's a different designation still.

TS: I remember when our administrators [in late 2018] were discovering that we fit the R2 [Carnegie] definition, and then we had to persuade everybody else we were an R2.

NK: Well, I don't think it's a conflict between the comprehensive title and the R2. Comprehensive is what the State of Georgia considers us.

TS: They still use that terminology?

NK: I think so. I'm not sure, but I think so. You could equally well say comprehensive as R2, and then R1 is the top research universities. So, there's not necessarily a conflict between the two.

TS: Okay. But there certainly has been an evolution. You've talked about this already—how it has impacted you and all that you're doing. Even in 2014, I think you were down to teaching every other semester. What's your teaching load now?

NK: Oh, it's very similar. I teach one introductory course in the fall [PHYS 2212—Principles of Physics II in fall 2022]. Now, I teach a special topics course in the spring. This semester I was teaching the quantum field theory course, Relativistic Quantum Fields and Particles [PHYS 4490]. So, I have a light teaching load because of my research.

TS: Basically, your grants buy you some free time, and it sounds as though, from what you said earlier, does the university increasingly support research by giving released time?

NK: Yes. In fact, our incoming faculty, the new tenure track faculty, have a very low teaching load because they're expected to do research and get grants, frankly. I think we're maybe slowly getting to the point where even though officially it's not an absolute expectation to get a grant, it's almost an expectation. I think we're moving that way.

TS: Well, I think for history majors, if they have to take a science course, physics was probably the last one that they were going to take, at least when I had more contact with history majors than I do nowadays. Is that still the case that you basically get people from the sciences that take the introductory physics course?

NK: Yes, I think so, because I think there's a generic science course [SCI 1101 and 1102 (Science, Society, and the Environment)] that people who are not in science take. So, people in history and so on would take this science course. Of course, if they want, they can take physics. But specific physics is only required for some engineering majors, chemistry, biology, and so on.

TS: Is that calculus based?

NK: Calculus-based [physics, PHYS 2211 and PHYS 2212] is required for engineering and for chemistry. And then biology, I think they can have the trig based. Although they can take the calculus based if they want.

TS: It doesn't hurt them to take the calculus based I wouldn't think.

NK: Exactly. Some of them do, but not a majority, I think.

TS: So, teaching has adjusted to the kinds of research that the individual is doing. And, I guess, in physics, you were saying earlier you had lecturers.

NK: We do have many lecturers. It's about half the department.

TS: That would be a non-tenure track position, but full-time teaching without expectation of research, I guess.

NK: That's exactly right.

TS: So, they're taking the bulk of the introductory sections, but you're also teaching introductory courses.

NK: Yes, but they have a lot more. They have basically three times the teaching load that I have, or roughly that. So, it's a different number of courses that we teach. I teach an introductory course, but that's it and just the lectures now, no labs.

TS: We've said a little bit about your work with students and post-docs and so on, but I wonder if you want to talk a bit more about some of the students that have worked with you and what kinds of work are they able to do, particularly if they're undergraduate?

NK: Yes. It varies a lot depending on the interests and abilities of the student. Some would be a directed study. They will learn some things, and maybe at the end do some very easy calculations. But the best ones could work either on analytical projects, mathematical projects or coding or running computer codes. And then many of them went ahead and gave talks at meetings of the Southeastern Section of the American Physical Society. I had several students go and give talks. Typically, undergraduates are welcome in these meetings. The better ones, the more advanced ones, wrote papers with me and gave talks. Like Matthew Forslund gave talks at national and international meetings. So, it varies a lot. There is a wide spectrum of ability and of interest and of how long they will stay with me and how much they will do.

TS: It seems to me that there's a major focus at Kennesaw to have faculty work with undergraduate students on research. And there's a big conference each year on campus [Symposium of Student Scholars].

NK: Yes. Yes. We hosted the national undergraduate conference [National Conference on Undergraduate Research in 2019], so I refereed some abstracts for that. We do try to support undergraduate research and help them present and so on. I've definitely done that with my students.

TS: You spoke a little bit about COVID affecting your international travel and doing things on Zoom and so on. How did it affect working person to person with students over the last couple of years?

NK: Everything had to be done online via Zoom or via Teams or whatever. As I said, conference talks, working with other people, students, talking to students—it all had to be done by Teams or Skype and conferences via Zoom and so on. It didn't affect my productivity in terms of writing papers. It didn't affect that at all because, again, I don't need to go to a lab or do anything like that. I could equally well work at home. I have my computers at home. So, my productivity in the sense of writing papers and doing research wasn't affected at all. What was affected was my ability to travel. But then, especially 2020, because the physics community hadn't caught up yet, and they hadn't started these online conferences, for a while, for example, we had a conference that was canceled, and that was it. They didn't have the preparation to do it virtually, but then the year after they did it virtually.

So, 2020 was more of a dead year in terms of conferences. But then 2021 was fine because everything was done virtually. So, I was able to give many talks. Although now it's going back to in person conferences. So, it was okay. The main thing for me was that I couldn't travel in the summer to go to Greece or things like that in 2020. I did manage to go last year, 2021. I'm hoping to go this year. But that was about it.

TS: Say something about Dorian and Dimitrios.

NK: My sons, yes.

TS: I think they were born in 2000 if I remember correctly.

NK: That's right, yes.

TS: So, they're in their early twenties now.

NK: They're 21.

TS: I know you've been mighty proud of them, and they were doing some pretty advanced stuff at a very early age it seemed. Talk about them and what they're up to.

NK: Yes. They are both mathematics majors at Georgia Tech, although they've taken also several physics classes and one of them is doing a minor in physics.

TS: I was going to ask why they didn't follow in your footsteps.

NK: Well, they were interested at the beginning. They were interested in everything. For a while they thought they may go into physics or astrophysics or particle physics or things like that. But then they got involved in math competitions when they were in high school. They took all these very advanced math courses, calculus and so on. So, they decided to go into pure math. But they took quantum mechanics at Georgia Tech. So, they've taken several physics courses, and they enjoy that as well. When they were already in high school, they took many AP classes, advanced placement, and they even took remote classes from Georgia Tech. Georgia Tech had a program where the professor would speak, and they would watch him online. So, by the time they were admitted to Georgia Tech, they basically had the standing of sophomores or juniors almost.

They could have already graduated, but because they're interested in doing professional work and going to graduate school and eventually being math professors, they want to have as much background as possible before they go to grad school and also to have the strongest application possible. So, they're already doing research with professors. They're already taking graduate classes. In fact, from their first year there as freshmen, they were taking graduate classes. So, they're staying a fourth year just to beef up their resumes, so to speak, and take more graduate classes, do more research, maybe publish papers. I guess this fall, they will be applying to graduate school. And I guess they will officially graduate from Georgia Tech in spring of next year.

TS: Where are they looking for graduate school?

NK: Well, all the top departments, the Ivies [Ivy League Schools], MIT, Caltech, Stanford, all the usual places, but there are other places as well. They probably will apply to Georgia Tech also. They haven't made the list, but roughly...

TS: Are they going to go to the same school together?

NK: Oh, I don't know. It depends if they get accepted to the same place.

TS: It sounds like they're pretty close to each other.

NK: They're pretty close. I hope they end up in the same place. We'll see.

TS: Well, I don't know whether I'll be around in eight years from now to do another interview with you. So, why don't I conclude by asking you what you see as your future? You're what? Early fifties now, I guess.

NK: Yes, I'm 53.

TS: You've got another decade or two at Kennesaw, a generation, if you want to stay. What are your plans?

NK: Well, my plans are, first of all, keep working, keep doing good work, keep my research active, try to grow the particle physics footprint here, the group, and keep getting grants, hiring post-docs, attracting students. What I'm interested in professionally is working on theoretical particle physics. My hope is that the LHC will keep producing data, and maybe we'll have some unexpected discovery. So, in a way it's more of the same, but it's basically enlarge the particle physics presence here and keep hiring good people. If we hire more faculty, keep hiring the best people we can find, and the same thing with post-docs and so on, these would be my goals for at least the medium term.

TS: Well, is there anything that you'd like to put in the interview that we haven't talked about?

NK: Nothing comes to mind. No, I think we've covered pretty much everything.

TS: Well, thank you very much.

NK: Thank you. Thank you, Tom.

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