

August 26, 2010



Korean Mathematicians Visible Now **2**



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Kedlaya - A Multifaceted Mathematician

Photo: Rahul V Pisharody

Kiran Sridhara Kedlaya is an Associate Professor of Mathematics at the Massachusetts Institute of Technology, Cambridge USA. He received the A.B. from Harvard (1996), the M.A. from Princeton (1997), and the Ph.D. from MIT (2000). He became a Liftoff fellow of the Clay Mathematics Institute (2000), continued as an NSF postdoctoral fellow and visitor at U.C. Berkeley, MSRI, and the Institute for Advanced Study before joining the MIT mathematics faculty in 2003.

Professor Kedlaya's primary research interests are in number theory and algebraic geometry; more specifically, p -adic analytic methods in arithmetic geometry, and p -adic Hodge theory. He is also interested in computational methods and applications of number theory in computer science; more precisely, in algorithms in arithmetic geometry, and applications in computer science (notably cryptography). In 2006, he received both a Presidential Early Career Award for Scientists & Engineers, and an NSF Career Award. He is also a Sloan fellow.

Professor Kedlaya is multi-faceted; he is a mathematician, juggler, puzzlist, singer, bicyclist, and photographer rolled into one. His directorial activities include the USA Mathematical Olympiad committee, Art of Problem Solving Foundation, Committee on the American Mathematics Competitions advisory board (AMS representative). He received the 2006 Presidential Early Career Award for Scientists and Engineers.

Here, he talks to **Geethanjali Monto**:

Do you have any favorite mathematicians?

There are many mathematicians whom I've looked up to over the years. If I had to pick one, it would probably be Jean-Pierre Serre, who was the youngest Fields Medalist. He introduced many different ideas into many different areas of mathematics – topology, algebraic geometry, complex analytical geometry, number theory...He thought deeply about many different areas of mathematics. He was able to transfer important ideas from one area of mathematics to another. He gave many of the ideas that led to growth in these great the-



Mathematician, Puzzlist, Cyclist, Juggler, Singer - all in one

ories in algebraic geometry. Better yet, I've had the pleasure of meeting him and he's an extremely pleasant individual. He's very gracious, very kind, generous with his ideas and supportive of young people. So if I had to pick somebody, I would pick Serre.

If you consider the mathematicians of the last century and the previous century, do you think the former mathematicians have done deeper work? They've solved many conjectures...

It's difficult to compare. It's hard to compare the mathematicians of our day with somebody like Gauss or Euler...

Maybe it's a culmination of all their efforts?

Certainly everything that comes now builds on work done before. It's not possible without it. But certainly the mathematicians nowadays are solving extremely deep problems that would have been difficult to dream of a century ago. Some of these problems actually do have very explicit connections back to topics that mathematicians were thinking about many years ago. I work in number theory; so, one of my favourite examples is the work of

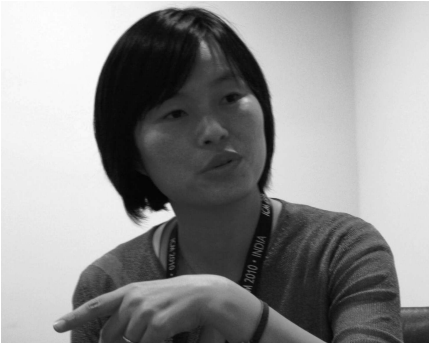
Wiles and his collaborators. Fermat's last theorem is a very very old statement but the resolution of it involved very modern ideas, ideas that were compiled over centuries since Fermat. So there's a lot of collaborative work at some level. Even if mathematicians write individual papers, these papers all fit into one another and the whole is much larger than any of us. This is one major difference perhaps with the mathematicians of yesteryear. In the time of say Gauss, it was possible to make radical contributions individually but now we've progressed further. We've done all the things that were possible to an individual. Nowadays mathematics is really much a collective endeavour. So we are all working together at some level, putting our theorems together, putting our knowledge together.

At any point of time, have you felt the need to motivate yourself mathematically or does it just go on?

I am very strongly motivated by mathematics itself...the discovery, finding new things. Particularly, I find a great deal of aesthetic motivation in mathematics. Mathematics is important and practical in many ways, but it's also very beautiful. For me it's important to find not just a proof of a theorem...

First Korean Woman Invited Speaker at ICM

Photo: Rahul V Pisharody



Prof. Hee Oh

Hee Oh is the first woman mathematician from South Korea to give an Invited Talk at the ICM. She is married to Seong-June Kim, a computer programmer and holds a permanent residency of USA. She pursued her B.Sc. from Seoul National University, Korea and PhD from Yale University. Her thesis was on 'Discrete subgroups generated by lattices in opposite horospherical subgroups' under Gregory A. Margulis. She is currently at Brown University, USA. She has had stints at California Institute of Technology, Princeton University, Hebrew University and Oklahoma State University.

About her Prof. Raghunathan says, "She has done very good work in mathematics...I know

that well!"

She talks to **Richa Malhotra** and **B.Sury** about education in Korea and US.

You are the first woman mathematician from South Korea to give an Invited Talk at the ICM. How does it feel?

I don't put too much emphasis that I am the first Korean woman speaker. But this is only the second time that Korea has had invited speakers at the ICM, and this was more important. But of course I am happy to represent Korean women.

Did you face any problems being a woman mathematician?

Yes, when I was younger. After graduation when I was doing post-doc, I felt that people don't take me as seriously as my male counterparts. It took me some time to establish myself. But maybe because I was a student of Prof. Margulis, who is a Fields Medalist, I had some advantage because of his name.

When I went to conferences other mathematicians would talk a lot to other young men and I had to make a special effort to belong to their group. Now that I am senior, it's different but it was like that in the beginning.

Could you throw some light on school and college mathematics education in South

Korea?

It is very different now from what it was when I was in Korea. Now, I think the students in Korea study too much. I feel that children should have more time to play. You learn calculus when you are in college; you don't have to know this when you are in middle school. But now everybody wants to learn as quickly as possible. This is too much a pressure for little kids. On the other hand, there are some positive effects, on the average may be the math ability went up and is better in Korean kids when compared to what was maybe 10 or 20 years ago but there are also negative effects, as I said.

Could you compare the education in the US and Korea, as you have been in both?

In the US, the kids play too much (laughs!); I think people put too much emphasis to make their children happy. But in Korea the problem is that the kids are judged by how good they are in their grades but in US, they don't want their children to have any stress. But in order to learn or understand something new, of course there has to be some pain.

Do you have a mathematician in your family?

No, I am the first one. I am the first one in academia, in fact.

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Korean Mathematicians More Visible Now

Professor Jongil Park is one of the two invited speakers from Korea in ICM 2010. He did his Ph.D. at the Michigan State University in 1996. Here, he talks to **B.Sury**.

Congratulations on being invited to give a talk at the ICM. How does it feel? What does it mean for the Korean mathematical community?

Thank you, I feel very honoured. In the previous ICM at Madrid 2006, there were three invited speakers. So, the strength of the Korean mathematical community is getting more visible now. I am sure this will help in enhancing the level of mathematics in Korea.

You went to the US for your Ph.D. Where did you study before that? How was your experience in the U.S.? Would you suggest that young talented people in Korea work in Korea itself or go to the US but re-

turn?

I got my Master's degree in Korea and went in 1989 for my Ph.D. to the U.S. Now, I am in Seoul National University. I feel that Korean mathematics is much stronger now but still it is not as strong as the U.S. Nowadays we have quite many internationally acknowledged mathematicians and we also have an excellent Ph.D. programme in Korea. So, it is a matter of choice whether some people can go to the U.S. or some can work in Korea. In any case, it would be good for Korean mathematical community.

You are a topologist. As it happens, I have met two other Korean mathematicians who also work in topology. Is topology a very popular subject?

(Laughs). Not really. There are many applied mathematicians and pure mathematics is getting slowly popular nowadays among the young bright students.

How does school education compare in the U.S. And in Korea? I heard that already in middle school in Korea, people start learning calculus. Is that true?

The society is very competitive in Korea because of which students do learn many things even before high school.

Who inspired you to take up mathematics as a career – particularly, in 4-dimensional topology?

The most influential person in my mathematical career is my Ph.D. advisor, Prof. Ronald Fintushel. He inspired me in many aspects as well as mathematics. I also had a teacher, Hyun-gu Lee, in my Master's programme who encouraged me a lot; he is now the Principal of Sangsan high school in Korea. He was also a great influence on me.

How does it feel to have the next ICM in Korea? Are you a

part of the organizing committee for the next ICM? What are your plans?

I feel very proud. It is very good for Korea. It is a bit too early to set up the organizing committees but I expect that eventually, I would be involved in the work. One main thing is to contact mathematicians from other countries and set up satellite conferences. This takes time.

Did you visit any places in the town?

I have been to Golconda Fort. I also went down town. Ok, thank you very much for talking to us!

Photo: Rahul V Pisharody



Jongil Park invited from Korea

Kiran Kedlaya Speaks on....

...is the one that gives you the most insight and tells you how to go beyond the theorem and go to the next theorem and to the next one after that.

You have a wide variety of interests. Did you, at any point of time, have to give up something because of your mathematics career?

Not *per se*. I definitely have thought about other areas. I studied some physics and computer science. Ultimately I decided that the aspects of those which are most interesting for me are things that I can continue to think about as a mathematician. Even though my department says I'm a professor of pure mathematics, nothing prevents me from thinking about a problem in theoretical computer science. For example, I had a very interesting collaboration with a theoretical computer scientist at Caltech on a basic problem that was of interest to both of us on factoring polynomials. We had certainly different backgrounds because he went through more of a computer science background and I came from a math background. But that was good. We had complementary ideas and we did some very interesting work. So I find that I get to inspect and dabble in some areas nearby mathematics even while being a mathematician. So I have no regrets about my choice.

But what about your other skills in juggling and music and...? How do you manage everything?

It's all play to me, even mathematics. It's been said by various people at various times that the best thing about your job is if it doesn't feel like a job. For me, of course, all these other things are recreation but even my work feels like recreation. I play around with a theorem and maybe I actually manage to put together a generalization or discover why it can't be correct, but it doesn't feel like work.

Do you think in terms of music or math or...?

Probably I think more in terms of mathematics than anything else. I do have parts of my brain that are perhaps musical, perhaps there's a part of my brain that likes to put words in patterns, but most of my brain seems to like doing mathematics. So I spend most of my time doing that.

In India, there's a phobia about learning mathematics in school. Children don't seem to understand math. Do you have any suggestions for improvement?

There are some concerns about how it's instructed, because it's taught very much as a finished product. Of course, at some level, five times six is not going to change. But mathematics might be a lot more relevant...it might be a lot more interesting if it was presented not simply as the finished product but also the process that led to mathematicians thinking in a certain way.

This is a complicated question. We struggle with this in the States also. How to still teach the basic mathematical skills that are important but also provide students with the opportunity to think more like mathematicians, to experience the process of organizing the mathematical concepts and understand why it makes sense to do it. So this is a tough question. But many people are thinking about it. I don't know if I have a special idea.

Regarding Mathematical Olympiads and high school math competitions, would you

say that a person who wins in these competitions is more likely to become a good researcher in mathematics?

That's a certainly a likelihood. Many of the prominent mathematicians like Ngô Bảo Châu, Stanislav Smirnov, Terence Tao and Grigory Perelman were winners at Mathematical Olympiads. Many people find that the Mathematical Olympiads involve not a simple question and answer format; they require proofs; they require actual explanation and justification and some creative thought and some reflection and also expression. You have to write answers in complete sentences. It involves a great many things and the students who thrive on that often, but certainly not always, find success in mathematics. There are many other skills that are important in mathematics. Even with the Math Olympiads, the problem is given and you have to solve it, whereas in mathematics, the problem is not necessarily given or it's not given in a well-specified way. Often you have to create the problem or figure out what the problem is supposed to be before you can solve it. Sometimes the challenge is even to give the correct definition. So it's a different process than the Olympiad or other competitions. But there certainly is a strong affinity between them and many successful mathematicians.

Do you think that professional rivalry helps in the development of a subject or is it generally detrimental?

It can be helpful to a point. If it becomes too personal, then it can be counterproductive. Often the rivalry in mathematics involves not just simply multiple personalities but actually multiple points of view and multiple ideas. It's very often productive to have multiple points of view to approach a single question. Even if one approach succeeds in proving a theorem, it's very often not considered redundant to have a second proof that comes from a different idea. It's actually complementary. It provides more insight and sometimes if you want to go to the next theorem (we are always thinking about the next theorem, not just the theorem we just proved; we are always thinking about how to go further), having multiple proofs of the same theorem is often important. You need to pick out the right ideas and sometimes, you will bring multiple ar...

An Evening of Music

Photo : Midhun Raj



Ustad Rashid Khan sings at ICM 2010

'You never know how your interest will change'

...continued from page 2

You have been in various universities, Caltech, Brown, Yale etc. Could you compare mathematics education in these different universities?

Yale University is very relaxed. When I went to Princeton University as an Assistant Professor, I saw how hard the Princeton graduates were working; I was so shocked and felt as if I wasted my time at Yale because I was too relaxed. But I must mention that Yale has a very friendly department and everybody is quite relaxed and interacts with other professors. Professors knew about students of other professors; even in the graduate school other professors knew about me, but in Princeton you know your student, not necessarily know students of other professors. At Princeton, graduate students are much more competitive and they worked much harder, but we were probably too relaxed, that's how I felt about my education. Maybe now it's different.

At Caltech the undergraduates work very hard but somehow I also feel they are kind of continuing their high-school education in the sense of not what they learn but they work, work and work, and do not try to enjoy their lives; they try to become elder. I don't like to work like that hard (laughs!). But in Brown they are more like a free spirit; Brown has open curriculum, students don't

have any mandatory curriculum to major in and take their classes only those days when they want to learn. I somehow like the spirit in Brown.

What is your approach in doing mathematics; do you pick a problem and work on it or you get interested in understanding something, leading to a problem and perhaps its solution?

I usually start with a concrete problem and then I go to understand how to approach the problem. I think this is also influenced by my adviser; he is also a problem-solver.

Your work involves a combination of subjects like Lie theory and number theory. Is it necessary to master more than one subject to do work of the highest order even in one subject?

Well, you never know actually how your interest will change. That is why you have to be open-minded. For instance, I think from a broader perspective I worked in the same field but then amongst the peak fields, I changed my interests quite frequently. My thesis was on structure of the discrete subgroups of Lie groups but now I work on homogenous dynamics and number theory but I also did

some work on unitary representation and harmonic analysis. Broadly, they are all related, but you have to be open-minded, because you will never know how your interest will change. Then you turn to some other problem, and never know what the right approach is. I wouldn't say you have to master all these different subjects but you have to view your field in an open-minded way, and somehow expand your field. You have to think of these possibilities

"I felt that people don't take me as seriously as my male counterparts. It took me sometime to establish myself"

and maybe something is not necessarily needed right now but later. So just be open-minded and try to learn new things. I don't like doing the same things

for 10 years or 20 years. It is boring.

What other interests apart from mathematics do you have? Do you sacrifice your interests because of several commitments?

It was very hard in the beginning. When I had my first baby, for a while I could not concentrate on thinking as much as I used to. Then my time was really limited, I had only 9 to 5 pm for maths and then after I picked up my child I didn't do any mathematics.

Before I had my baby I used to

read newspapers, had chat with my friends over coffee, etc. I used my time very effectively when my child was born, and I gave up reading newspapers. This did work. After two or three years I realised I can still go on. I know several women mathematicians who disappear.

You have to focus; your family is very important and your work is also important. But eventually having family and children helps me because I get motivated when I see my kids. When you think of some problem, you need to divert your mind, and children are perfect for this. When I see my children smiling, all my stress goes away. So, in that sense they help me do mathematics.

Do you have plans to move to Korea?

It is too early to decide. I am in KIAS which requires me to go to Korea for one month per year. I just completed the three-year project of KIAS scholar and now I made a re-contract for three more years. Last year, I was there for one year.

How was your experience at ICM, here in India?

I am very happy to be in India. This time I am a bit more relaxed. I got to know about the Indian culture this time, though I have been twice in Bombay before.

Mathematics a Universal Language

Richa Malhotra

"Communicating mathematics to society at large" was the theme of the panel discussion held today at the International Congress of Mathematicians. The Chair of the discussion G. M. Zeigler found the terms "communication", "mathematics" and "society at large" huge to talk about. He highlighted some of the initiatives of the German Mathematical Society for increasing the outreach of mathematics to the young. C. Rosseau, who is a teacher and researcher, opined that scientists should carry a message of science, how science develops, and its limits to the society at large. She pointed out that public must know the role of mathematics in everyday life such as in Google Search Engine. Ivars Peterson, who has been a science journalist for a long time said that mathematics is a universal language while for the outsiders the subject is intimidating.

R. Ramachandran presented a scenario of mathematics communication in India from a journalist's point of view. He emphasized on the need of cultivating media, which can be done by encouraging scientists to interact with the media. He criticised the absence of a media officer in Indian institutions. Science Express is highly successful and Ramachandran suggested that the coach of mathematics might as well be added to the Science Express. There are science museums in India but the lack of exhibits is a setback for the communication of science. Marianne Freiberger talked about the freely accessible Plus magazine, and some of the most visible articles available on the website.

This and That

Photo: Sidharth Varma



Announcement

Round Table

Use of Metric In Evaluating Research

18:00 - 20:00, Hall 4

Newsletter Team

R. Ramachandran
B. Sury
Geethanjali Monto
Richa Malhotra
Midhun Raj U.R
Mohammed Anvar T
Rahul V Pisharody
Sidharth Varma
Nikhil MG