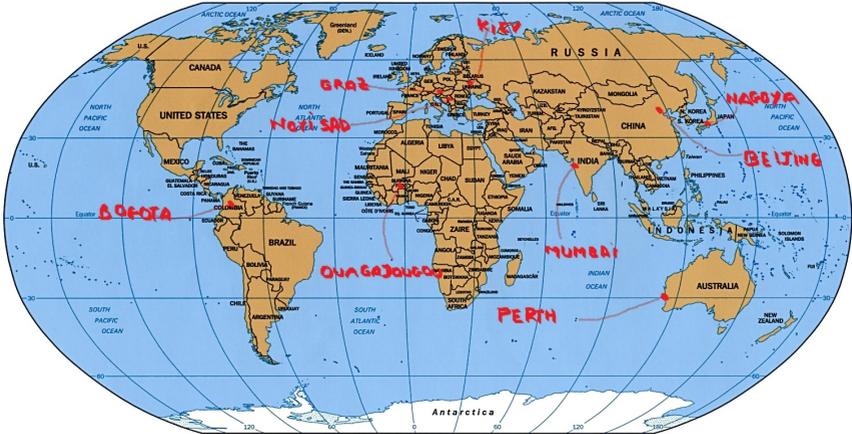


WOMEN MATHEMATICIANS AROUND THE WORLD A GALLERY OF PORTRAITS





Foreword

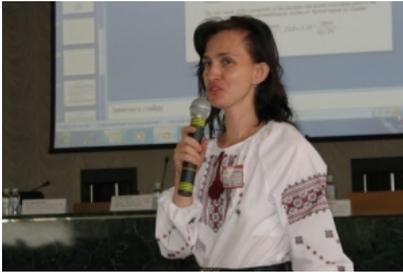
It is often tougher for a woman to become a mathematician than it is for a man, especially in some parts of the world where the few women who make their way up in academia as a mathematician are therefore remarkable women.

I have had the chance to meet various women mathematicians around the world who have impressed me beyond mathematics, as human beings. I would like to report here (with the protagonists' approval and without claiming any objectivity) about the scientific trajectories of some of them and the joys or difficulties they encountered in their careers. One of them is actually a theoretical physicist, and I am very pleased she accepted to join this gallery of portraits. Some of these portraits show the impact of the socio-economic environment and social prejudices on women's careers as mathematicians or physicists but they are also testimonies of the joys experienced by these same women in doing mathematics or physics in spite of the difficulties they might have encountered along the way.

I would like to thank Cheryl, Dušanka, Françoise, Jie, Karin, Luz Myriam, Sasha, Sujatha, Min Ping and Yukari, most warmly for taking the time (that they actually do not have!) to answer my questions and Evgeniya Dyachenko for her valuable help in editing this gallery of portraits.

*Sylvie Paycha, University of Potsdam
December 2013.*

Alexandra Antoniuk



Department of Nonlinear Analysis
Kiev Institute of Mathematics
Tereschenkivska str., 3
01 601, MSP, Kiev - 4, Ukraine
Fax: (044) 235 20 10
e-mail: antoniuk@imath.kiev.ua

Education

- 1990: Kiev State University, Mechanical-Mathematical Faculty. Diploma with honour.
- 1993: PhD in Mathematics and Physics, Kiev Institute of Mathematics, Ukrainian Academy of Science, Department of Functional Analysis.

Professional experience

- 1997–1998: Alexander von Humboldt Research Fellow.
- since 1996: Senior Researcher in the Department of Nonlinear Analysis at the Kiev Institute of Mathematics of the Ukrainian Academy of Science
- 1993–1995: Scientific Worker of the Department of Functional Analysis at the Kiev Institute of Mathematics of the Ukrainian Academy of Science.

Questionnaire

1. *How and when did you come to choose to do mathematics?*

For me there was no question about who I wanted to become. Since I started school and mathematics, I knew that this was what I wanted to do. I have never been good at calculating, thus arithmetics and long harassing calculations are not my piece of cake. However, general logical constructions, drawing conclusions and finding unexpected features of known objects — that I enjoy doing.

2. *Were you then encouraged by your family, friends or by other people around you?*

My mother graduated at the Mathematical-Mechanic faculty of Kiev State University and is presently working as a programmer. I would say she has encouraged me to believe in my capacity.

3. *Did you come across obstacles in pursuing your career as a mathematician?*

It is hard to answer this question. At the beginning of my higher education, I met some prejudice such as the fact that woman are expected not to be as good mathematicians as male students. Perhaps, because it was expected that women should concentrate more on family values and hence could not dedicate sufficient attention to scientific work. However gradually, as I proceeded further in my career I started to feel some informal support and recognition. So now I don't feel any kind of discrimination. One of the important points in my life is the support of my family and my husband who understand me; he helps me in all domestic issues and patiently puts up with my dedication to Mathematics. Another important point in my self-realisation was meeting with you Sylvie and our discussions on this issue. I understood that everything depends on us women. At each step, women tend to expect recognition and approval from the surrounding contrarily to men who are more self-sufficient and do not search for outside support. They simply carry out what they feel is important and appropriate. Thus our natural doubts, diffidence and compliance sometimes act against our self-realisation.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

I do not have any regrets concerning my choice to become a mathematician. I only regret that I am not sufficiently good and I would like to be better in Mathematics than I actually am. I want to get acquainted with other fields and issues which are not known to me for the moment. There are lots of interesting things to do but not always enough time to fulfill these wishes.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

To be mathematician is a good occupation. If you like it, go on and just do it.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

At the beginning of my career I was dedicated to Gibbs measures. This notion comes from statistical mechanics and may be considered as a rigorous mathematical description of an infinite system of $\{x_i\}$ of particles. So the Gibbs measure describes the distribution of all these particles in a given volume. Usually one considers Gibbs measures with a so called quadratic interaction. That is the case when the interaction between the nearest particles is described by a polynomial of order 2, *i.e.* like $(x_k - x_j)^2$. Simultaneously, counter examples were built showing that it is impossible to construct the Gibbs measure if the interaction has the form: $(x_k - x_j)^4$. We have shown that it is actually possible to construct a Gibbs measure for any order n of the polynomial in the interaction function provided we take into account not only the interaction, but also the so called, self-action. It turns out that the relation between the orders of growth of the interaction and self-action it is of utter importance for the existence of such Gibbs measures, however not the absolute value of these polynomials.

It is interesting not only to investigate the question of existence of such measures, but also the properties of the dynamics of such infinite particle systems. In mathematical language, this is described by some operator acting on the function of infinite number of variables and by the semigroups of such operators. The main result obtained in this direction is that the corresponding semigroup has some “good” properties: it is smooth, in the sense that it preserves some spaces of continuously differentiable functions. The difficulty was that for infinite dimensional spaces (of infinite number of variables) we can not use the standard techniques of Sobolev inequalities, because the constant in these inequalities depends on the dimension and grows with the dimension. Moreover, the semigroup in this case is not strongly continuous, and it is impossible to apply the standard semigroup theory to this problem. We have invented some new technique, which permitted us to prove the required results. Furthermore, this technique was carried out for any stochastic system on the Riemannian manifold.

Lately, I have been dealing with the asymptotic expansions for the solutions of so called parabolic partial differential equations in the neighbourhood of “bad” points of the boundary of some region. These “bad” points are called cusps or return points. There are other topics of interest to me

now. In particular this year with one of my colleagues we have proved that porous media equation may be received from the Least Action Principle. With another colleague we have proved some results on Kolmogorov-Sinai entropy. This notion plays an important role to analyse the encephalograms in medicine. But it seems to me, that I have already taken a lot of place and time and I would like to stop at this point.

Karin Baur



(photo: Severin Nowacki, 2011)

Institute for Mathematics
and Scientific Computing,
University of Graz,
Heinrichstrasse 36,
A-8010 Graz, Austria
+43 316 380 5150
e-mail: karin.baur@uni-graz.at

Education

- 1997: Diplom in Mathematics, Philosophy and French Literature, University of Zurich.
- 2002: PhD, University of Basel.

Professional experience

- since 2011: Full Professor at KFU Graz, Austria.
- 2007–2011: Assistant Professor at ETH Zurich (fellowship by SNSF, the Swiss National Science Foundation).
- 2005–2007: Research Associate, Department of Mathematics, University of Leicester, UK.
- 2003–2005: Postdoctoral Researcher, University of California, San Diego, USA.

- 2002–2003: Postdoctoral Assistant, ETH Zurich.
- 2002: Researcher, University of Basel.

Questionnaire

1. *How and when did you come to choose to do mathematics?*

As a child, I loved playing with numbers and solving logical puzzles. Throughout school, I thought I would love “doing mathematics” even though I had no clear idea what that would involve. After school, I spent a gap year working in a hospital (as I was tempted also by studying medicine), studying at the Sorbonne, etc. My goal was to make sure mathematics was what I want to do most. And indeed, these months confirmed my wish to study mathematics.

During my studies, I got more and more interested in research. I was told that there are no university jobs in mathematics. This was discouraging. But in the end, I decided to take it step by step, starting with a PhD and trying my best to keep on track (i.e. go on to do post-doctoral years, obtaining grants during my PhD, afterwards, etc.). It was a long road to go and not easy at all. I am very glad that it all worked out in the end!

2. *Were you then encouraged by your family, friends or by other people around you?*

Yes, my parents were very supportive. (I remember them joking that I would become “Zweistein”.) In high school, I loved math and I was keen to discuss with my math teachers when we were learning new material. During my studies, I had periods of doubt and I remember that my colleagues encouraged me to continue. The first year of studies was very difficult, as the material was so much more involved than what we knew from school. It needed getting used to. Later in my path, during my post-doctoral years, I had other periods of doubt. This is understandable as I know a number of very good mathematician who couldn’t get a permanent job: A career in mathematics (in research mathematics) can involve a very long path of uncertainty, of years spent with applications for jobs or grants to support you for the next few months/years. During my post-doctoral years, my partner, my friends, my parents encouraged me to continue what I was doing.

3. *Did you come across obstacles in pursuing your career as a mathematician?*
Yes.

i) *If so, could you point out to some of them?*

- a) Early on (in school): I got told (by my primary school teachers) that *a girl does not need an education* as she will go on to marry and have kids anyway. Switzerland was (and still is) rather traditional. I think that in the Swiss culture, it is often expected from women to have families and work part-time. This attitude is certainly an obstacle, as working part-time (e.g. 50%) will make a career in research almost impossible. I was once invited as a “role model” to a workshop for female PhD students with children in Switzerland. Many of them thought it was impossible for them to work 80% or more because of their children. This reminded me of myself when — as a young graduate student — I had been interviewed for a grant. I had asked for a grant to let me work on my research 60% (and stay home with my first child 2 days a week). The head of the committee for this grant pointed out to me that at this rate (60%) I would probably not have had enough time for my research. I am very thankful for her remark, it inspired me to go for 80% (and then full time later). I have to admit that I have always enjoyed working on my research a lot, I have never regretted this decision.
- b) Another obstacle at times was my *lack of confidence* in my abilities. At times I worried that I did not know/understand enough to become a mathematician. This probably slowed me down in my progress.
- c) Then the fact that there were (and still are) so *few jobs* around, especially in Switzerland. Having done my PhD in Switzerland meant that I was less familiar with the way the job market works in other countries. It also meant that I was less known in other countries where there are more jobs at an early level in the career. I felt that this was a disadvantage when applying for jobs in countries like the US, the UK, France.
- d) Another potential obstacle might be *prejudices towards female researchers with children*. It is not clear to me whether such prejudices do exist and whether they are affecting the career paths of women with children. It is true, however, that some female mathematicians let me know that they don’t think that having a career as a mathematician and having a family can go together.
- e) More concretely: having children sometimes prevented me from traveling. It meant I had less time to concentrate on a topic, e.g. by participating in a special semester at MSRI (Berkeley): it is not easy to arrange to participate in such a 4 months program if you have children at home. So I had to restrict my travels to shorter research visits (2-3 weeks) and to conferences.

ii) *Do you think some of the possible difficulties are related to*

a) *the socio-economic situation in your country?*

Yes, this might well be: Switzerland is very rich. This makes it possible that one salary is enough to support a family/a couple. And this in turn may lead to the idea that women should be housewives and mothers instead of having a good job.

b) *the fact that you are a woman?*

See the above items i a) and ii a). Maybe the difficulties are also related to the education/culture — girls seem to be less keen to prove excellence. Which leads to the fact that they are not perceived as being excellent; after all, they don't always show their achievements. My idea was always to do good mathematics, to find new results, to continue finding new directions in my work and new problems to work on. It might be more useful, to go for new contributions or solutions to well-known open problems instead.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

Yes, I am very happy to have chosen mathematics. It is what I love doing! I enjoy finding new problems in my research, finding solutions, new results, discussing research with collaborators, coming up with new approaches. In my work, there is little routine and a lot of flexibility. And there is always the opportunity to learn new things. Hardships: It can be frustrating doing research in mathematics. Progress is often very slow and sometimes almost not visible.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

If she knows that she wants to start a career in mathematics, then I would recommend that she sticks to her decisions. I would warn her that it is a difficult path with lots of uncertainties along the way. She should always try to keep on track. Should she have doubts, I would recommend that she discusses them with a few close friends. Or that she thinks about “plan B” and that she gives herself enough time to try out “plan A” before giving up. I remember a more senior colleague telling me to aim for steady progress, to try to have x (where x is a rather small number, but not too small as not to be reasonable for the field) papers per year ready, in order to be in a good position.

Also, I would recommend that she keeps her eyes open for opportunities. That she participates in conferences, workshop, to interact with other re-

searchers in her field. This will enable her to know what is going on in the field. And will most likely lead to interesting discussions or collaborations.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My research lies in algebra, more precisely, in representation theory of algebras, of algebraic groups, in cluster categories, in cluster algebras, etc.

In cluster categories, we work with certain triangulated categories which arise as orbit categories in bounded derived categories. This might be as complicated as it sounds. To get there, one needs a lot of algebra, homological algebra, Auslander-Reiten theory, etc. There are, however, approaches to this field, that are less involved. These approaches have to do with links to combinatorial geometry. The philosophy we use is that the categories we want to understand are determined by their building blocks: indecomposable objects (up to isomorphism) and certain maps between them. These objects can be explained using triangulations of polygons and more general oriented surfaces. The maps then correspond to moves between the diagonals in the polygons (surfaces).

It is not easy to say what my favourite personnel achievement is in mathematics. One of the recent results I like a lot concerns a new approach to cluster categories. Is in joint work with A. King (Bath) and R. Marsh (Leeds). We prove that cluster categories can be obtained as the stable category of a Frobenius category which we obtain from Postnikov diagrams or from dimer models with boundary. The latter (dimer models with boundary) are new to this field. They have been discovered independently in similar and in different contexts, and we have already seen that they link to many other areas in mathematics. This is one of the exciting products of your work. I also like it a lot as we had to combine several very different approaches to get to this result.

One of my first achievement is based on work in my PhD and shortly afterwards. It is the characterization of pure tensors in the Cartan component of a tensor products of irreducible representations (of algebraic groups). I was able to show exactly when these pure tensors in the Cartan component are given as the orbit closure of the minimal orbit. Some of the discussions I had with other PhD students and post-docs during this time led to work on secant varieties in representation spaces, it resulted in several joint projects with J. Draisma (Eindhoven).

Luz Myriam Echeverry



Universidad Sergio Arboleda,
Escuela de Matemáticas
Calle 74 # 14-14
Bogotá, Colombia
(57) 3257500 Ex 2158
e-mail: lechever@uniandes.edu.co

Education

- 1971: Mathematics, University of los Andes, Bogotá, Colombia.
- 1974: Masters in Numerical Analysis, University of Dijon, France
- 1978: PhD, University Paris VI, France

Professional experience

- since 2008: Professor-researcher, University Sergio Arboleda, Bogotá, Colombia.
- 1976–2006: Associate Professor, University Los Andes, Bogotá, Colombia.

Questionnaire

1. *How and when did you come to choose to do mathematics?*
I chose mathematics in my last year of high school in 1967. I liked mathematics and physics very much, these were my favorite subjects.

2. *Were you then encouraged by your family, friends or by other people around you?*

I was encouraged by my father and my professors, in particular by Professor Puyana.

3. *Did you come across obstacles in pursuing your career as a mathematician?*

No, we were several women studying Mathematics at university. For the Colombians it was well looked upon for a woman to be a teacher and that she should study before getting married. After my PhD in Paris I started working at the university of Los Andes. In my generation in Colombia few women got jobs at university and the colleagues were very kind to us, maybe because we were so few and did not represent a threat.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

Yes, I am happy to have chosen mathematics. I always loved solving problems and for me it was delightful teaching to young people and to see how they turned out to be successful in their lives. The hardships in mathematics for me were to pursue your work even when not getting the results you are expecting.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?* I would recommend the same for a man or a woman: to love mathematics and to enjoy it.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My interest is in solving numerically differential equations. I presently have two projects:

- i) Celestial mechanics; we are studying how to move from one satellite orbit around the earth to another using mathematical optimization technics. This is a work related to the project “Libertad II”; it is a project in order to send a second Colombian satellite to space.
- ii) Epidemiology, we try to study the spread of malaria investigating the migration of people.

My favorite achievement is to have taken part in building up a good Mathematical department at the university of Los Andes. I believe that the new generation of mathematicians now working at our department will be successful in their work thanks to the seeds of our initial input. Also I was the first professor with a PhD in Numerical Analysis in Colombia and my work arose the interest of many students for this area of research.

Yukari Ito



Graduate School of Mathematics,
Nagoya University,
Chikusa-ku, Nagoya 464-8602, Japan
TEL +81-(0) 52-789-2429
FAX +81-(0) 52-789-2829
e-mail: y-ito@math.nagoya-u.ac.jp

Education

- 1992: BS at School of mathematics, Nagoya University.
- 1994: MS at University of Tokyo.
- 1996: PhD at University of Tokyo.

Professional experience

- since 2007: Associate professor at Nagoya University
- 2003–2007: Lecturer at Nagoya University
- 1996–2003: Assistant Professor at Tokyo Metropolitan University

Questionnaire

1. *How and when did you come to choose to do mathematics?*

When I was 18 years old, I went to a preparatory school, a special school to prepare an entrance exam to university. Half of the mathematics teachers were real mathematicians and talked about their research. I became very interested in modern mathematics and wanted to study more mathematics.

2. *Were you then encouraged by your family, friends or by other people around you?*

Yes. My parents wanted me to do what I wanted to do. My friends at high school also did what they wanted to do. So there was no problem in doing mathematics.

3. *Did you come across obstacles in pursuing your career as a mathematician?*
No.

ii) *Do you think some of the possible difficulties are related to*

b) *the fact that you are a woman?*

If a female PhD student marries, nobody thinks she needs a job. But if a male PhD student marries, everybody thinks he does need a job soon.

Having a baby makes it difficult to find enough time to study.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

I am happy to have chosen mathematics because I like both studying and teaching mathematics.

The joy of mathematics is that I can think anytime, anywhere very freely. The hard thing in studying mathematics now is to find enough time to think about mathematical problems without any duties at university and home. But when I discuss mathematical problems with other mathematicians and students, I am very happy.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

You should study mathematics as hard as possible when you are young, and find good friends who encourage you to do mathematics.

You should also write papers and give many talks, then you will be able to get a job soon. And then you can do anything! (where anything encompasses mathematics and private life). Moreover, you had better visit and stay in other countries as a PostDoc when you are young.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My major in mathematics is Algebraic Geometry. In particular, I am studying singularities and their resolution. A singularity is a strange point in a space and I am working on how to remove it. It is called a resolution of singularities. Moreover, I am interested in the correspondence between algebraic properties and geometric properties of the resolution. I studied the 3-dimensional cases and the results were related with superstring theory in physics.

Marie Françoise Ouedraogo



Département
de Mathématiques et Informatique,
Université de Ouagadougou
03 B.P. 7021 Ouagadougou 03
Tel: +226 50-30-70-64/65
Fax: +226 50-30-72-42
e-mail: omfrancoise@yahoo.fr

Education

- 1994: “D.E.A. de Mathématiques”, University of Ouagadougou.
- 1999: “Doctorat de Troisième Cycle”, University of Ouagadougou.
- 2009: PhD, University Blaise Pascal, Clermont-Ferrand.

Professional experience

- since 2013: Maitre de conférences, University of Ouagadougou.
- 2003–2013: Assistant Professor, University of Ouagadougou.
- 1994–2003: Stand-in teacher at Mathematics Department, University of Ouagadougou.

Questionnaire

1. *How and when did you come to choose to do mathematics?*

I had already decided to do mathematics when I was in high school. Indeed, I preferred logic and computations to other subjects so that I naturally went on along that path.

J'ai choisi de faire les mathématiques depuis le lycée. En effet, je préférais la logique et les calculs aux autres matières enseignées et j'ai naturellement continué dans cette voie.

2. *Were you then encouraged by your family, friends or by other people around you?*

I have been very much encouraged by my mathematics teachers who felt I had aptitudes for that subject. My family and friends also encouraged me.

J'ai été vraiment encouragée par mes professeurs de mathématiques qui voyaient des capacités en moi. Ma famille et mes amis m'encourageaient aussi dans cette voie.

3. *Did you come across obstacles in pursuing your career as a mathematician?*

I came across several difficulties:

- socio-cultural obstacles: girls and women are encouraged to take up short studies that enable them to get married, raise children and take care of their family.
- The intolerance of some of my peers who could not cope with the fact that a girl could compete in a field they consider is theirs.
- The scepticism on behalf of some professors or colleagues which forces you to work harder in order to prove that you deserve the right to be where you are as much as any other person does.
- The drastic lack of role models of African women mathematicians to which one can refer to encourage oneself to go on.
- In order to make up for these difficulties, I have had to work harder than my peers and I believe I still do so.

J'ai du faire face à plusieurs difficultés:

- Les pesanteurs socio-culturels: les filles et les femmes sont conseillées ou orientées vers les études plus courtes qui leur permettraient de se marier, d'avoir des enfants et de s'occuper de leur famille.

- L'intolérance de certains promotionnaires, garçons, qui ne supportaient pas qu'une fille vienne se mesurer à ce qu'ils considèrent comme leur domaine réservé.
- Le scepticisme de certaines personnes (professeurs, collègues) qui t'obligent à travailler plus durement pour prouver que tu mérites autant que quiconque le droit d'être là où tu es.
- Le manque crucial de modèles féminins africains en mathématiques auxquels se référer pour s'encourager à continuer.
- Pour applanir ces difficultés, j'ai du travailler plus que mes camarades et je pense que c'est ce que je fais toujours.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

In retrospect, I am glad I persevered. Joys in maths are

- to be able to solve a problem or to answer a question you have been asked
 - to discuss mathematical issues with colleagues
 - to take part in scientific meetings in order to share ideas or to learn new things.
- parvenir à résoudre un problème ou répondre à une question qu'on se posait ou qu'on vous a posée.
 - discuter avec des collègues sur des questions mathématiques.
 - participer à des rencontres scientifiques mathématiques pour partager des idées ou apprendre de nouvelles choses.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

I would recommend that she keeps going and does not lose faith. It's a long path but as long as you believe it's possible, you can make it. If I can, we all can!

Je lui conseillerais de bien s'accrocher et de s'armer de courage.
Le chemin est long mais quand on y croit, on peut y arriver. La preuve, je l'ai fait!

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My personal achievement is to have been able to do a PhD thesis on pseudodifferential operators. Indeed, my initial research topic was algebra. So I changed topics to do a PhD thesis while going on teaching. I now work on pseudodifferential operators which generalise the differential operators and enable to solve elliptic equations. I am also interested in the even more general Fourier integral operators; those are used for hyperbolic

Ma réussite personnelle et ma fierté est d'avoir pu faire une thèse sur les opérateurs pseudodifférentiels. En effet, mon domaine de recherche initialement était l'algèbre. J'ai donc changé de thématique tout apprendre de cette théorie pour faire une thèse tout en continuant mon métier d'enseignement. Je travaille actuellement sur les opérateurs pseudodifférentiels qui généralisent les opérateurs différentiels et permettent de résoudre des équations elliptiques. Je m'intéresse aussi à des opérateurs encore plus généraux, les opérateurs Fourier intégraux qui eux s'utilisent pour résoudre des équations hyperboliques.

Dušanka Perišić



Faculty of Sciences and Mathematics
University of Novi Sad
Trg D. Obradovica 4,
21000 Novi Sad, Serbia
e-mail: dusanka.perisic@dmi.uns.ac.rs

Education

- 1986: BS in Mathematics, Faculty of Sciences, Novi Sad;
- 1989–1990: summer semester postgraduate studies at the Institute of Mathematics and Geometry, University of Innsbruck (Austria)
- 1991: MS in Mathematics, Faculty of Sciences, Novi Sad
- 1992: PhD in Mathematics, Faculty of Sciences, Novi Sad

Professional experience

- 2006–2012: Vice dean of Faculty of Natural Sciences and Mathematics, University of Novi Sad (in charge of organization and finance)
- since 2003: Full professor of mathematics, Faculty of Natural Sciences and Mathematics, University of Novi Sad.
- 1997–2003: Associate professor of mathematics, Faculty of Natural Sciences and Mathematics, University of Novi Sad.
- 1993–1997: Assistant Professor, Faculty of Natural Sciences and Mathematics, University of Novi Sad.
- 1987–1997: Teaching Assistant, Faculty of Sciences, University of Novi Sad.
- 1986–1987: Computer programmer, oil company “Naftagas” in Novi Sad.

Questionnaire

1. *How and when did you come to choose to do mathematics?*

I was good in mathematics but also in many other different subjects in school. I have “chosen” mathematics by an elimination process. I knew what I did not want to become, but not exactly what I would like to become. I come from a family of lawyers, and wanted to do something else. My perception of mathematics when I finished high school was wrong, and I was pleasantly surprised when I realized this after the first few lectures at university. It took me only a few weeks to realize that I had chosen the right thing.

2. *Were you then encouraged by your family, friends or by other people around you?*

Yes. My father was very proud of me, and mother was always there for me.

3. *Did you come across obstacles in pursuing your career as a mathematician?*

At the beginning of the nineties, when many of my colleagues decided to leave Serbia, hoping for a better life, I decided to stay, to go abroad to study, but to return back and establish my career in Serbia. I am aware that the easiest way is not always the best choice.

- ii) *If so, could you point out to some of them? Do you think some of the possible difficulties are related to*

- a) *the socio-economic situation in your country?*

I have experienced the so called scientific sanctions against Serbia (My Fulbright scholarship for doctoral studies in USA was approved but then suspended. I still have a letter from the editor of a mathematical journal saying that my paper was refused because of the sanctions.), economic sanctions against Serbia, hyperinflation comparable with the one in Germany before the second world war, and then 72 days of bombing of my home town.

Now in retrospect the obstacles look insuperable, but at that time I believed that with a lot of energy, everything is possible.

- b) *the fact that you are a woman?*

Yes. But... Again the obstacles just looked insurmountable for a while. I vividly remember a conversation with my mother, who told me once “If you start to think that some job is not for a woman, you will end up with the conclusion that there is no job suitable for a woman.”

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

I have no regrets. The world of mathematics is universal, without visas, borders. . . A sanctuary, but it can also be a lonely place.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

To make a network of colleagues, friends.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

I work with a group of physicists who are trying to produce a model of climate changing.

Cheryl Elisabeth Praeger



School of Mathematics and Statistics,
The University of Western Australia (M019),
35 Stirling Highway.
CRAWLEY WA 6009, Australia
Phone: 6488 3344
Fax: 6488 1028
e-mail: cheryl.praeger@uwa.edu.au

Education

- 1970: BSc with 1st class honours and University Medal in Mathematics, University of Queensland
- 1972: MSc, University of Queensland
- 1972: MSc, St Anne's College Oxford
- 1973: PhD, St Anne's College Oxford
- 1989: DSc, University of Western Australia

Professional experience (The University of Western Australia)

- 2010-2012: Director, Centre for Mathematics of Symmetry and Computation
- 2003-2007: Deputy Dean, Faculty of Engineering, Computing and Mathematics

- 2007–2012: Australian Research Council Federation Fellow
- 2007 (Mar–Nov): Australian Research Council Professorial Fellow
- 1996–1998: Inaugural Dean of Postgraduate Research Studies
- 1992–1994: Head of Department of Mathematics
- since 1983: Professor, now Winthrop Professor
- 1983: Senior Lecturer
- 1976–1982: Lecturer

Professional experience (Other)

- 2012–2014: Distinguished Adjunct Professor, King Abdulaziz University
- 1997–2003: Research Affiliate, Australian National University
- since 1988: Director, Data Analysis Australia
- 1973–1975: Research Fellow, Australian National University

Honours and prizes

In 2003 Cheryl Praeger received the Centenary Medal of the Australian Government. She was awarded an honorary DSc by the Prince of Songkla University in 1993 and by the Université Libre de Bruxelles in 2005. She was named WA Scientist of the Year in 2009.

Questionnaire

1. *How and when did you come to choose to do mathematics? Were you then encouraged by your family, friends or by other people around you?*

I was the first in my family to attend university and felt no sense of entitlement to a tertiary education, let alone an academic career. Rather I feel deeply grateful for the sometimes amazing opportunities I have had.

2. *Did you come across obstacles in pursuing your career as a mathematician?*
 - i) *If so, could you point out to some of them?*
 - ii) *Do you think some of the possible difficulties are related to*
 - a) *the socio-economic situation in your country?*

b) *the fact that you are a woman?*

I was only the second woman professor of Mathematics appointed at an Australian university, and at the time of my appointment there was only one other woman professor at UWA: Sandra Bowdler appointed professor of archaeology six months earlier. There was considerable media interest, and most articles appeared in the “women’s pages” of local and national newspapers.

Being a young female professor was sometimes rather strange. It was not uncommon to receive a telephone call from someone wishing to speak with Professor Praeger. After identifying myself, the caller would repeat their request, sometimes more than once. They could not believe that I was not “my secretary” – I wished that I had one! In the same vein, I remember one occasion at Perth airport, as I was returning from a government meeting in the Eastern States: I was looking for my ride home, and the Commonwealth Car drivers were completely uninterested in me. When I eventually attracted their attention, my somewhat embarrassed Com Car driver mumbled: “I was looking for an elderly gent”.

I am often asked if I, as a woman, experienced any discrimination. And unfortunately I have to reply yes, I did. The most upsetting occasion was when I was trying to get tenure at UWA in 1977. The university, having advertised a tenured job for which I applied, decided to offer me a 3 year position. This offer matched the length of a position I had just been offered at another Go8 university. I wanted to leave; my husband John wanted to stay; and we both realised that what was happening was not right. After a sleepless night we made a decision: we told the Department Head Professor Larry Blakers that we would both stay at UWA if I were offered the tenured job I had applied for, and otherwise we would both leave UWA, even though John had not thought of applying for a job elsewhere at that stage. Two days later I received an offer of a tenurable lectureship at UWA. The explanation we were given was that the senior staff did not realise that I “really wanted” a tenured position, since my husband John did not have one; whereas our view was that one tenured job was much better than none.

c) *other reasons? Please describe the type of difficulty you encountered (and maybe still encounter) and comment on how you overcame these difficulties, if any.*

3. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

4. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

For someone passionate about mathematics I would be completely supportive. I would say: follow your dreams; gain as much skills and preparation as you can; seize every opportunity — whether it is to go to a conference, work with a new collaborator or in a new area. Seek out a mentor, and "enjoy the ride".

For someone who does not know they love or enjoy mathematics, I would say to think very carefully before choosing this path. Mathematics is hard work; maths problems are not always easy to solve and require persistence and focus. The rewards in finding solutions are great, but the life-style may not suit everyone!

5. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

I am an algebraist with a strong interest in group actions. My major research area has been in the theory of permutation groups and their applications, especially to automorphism groups of graphs and designs. I pioneered the theory of quasiprimitive permutation groups and its applications in graph theory. Many of my results exploit the classification of the finite simple groups (which has changed the face of group theory and all mathematical areas which exploit the symmetry of structures).

Minping Qian



The School of Mathematics,
Peking University,
100871 Beijing, PR China
(86) 010-62752525
e-mail: qianmp@math.pku.edu.cn

Education

- 1962: Peking University. Dissertation Title: Prediction Theory on Homogeneous random fields.

Professional experience

- since 2004: Emeritus Professor
- 1987–2004: Professor
- 1983–1987: Associate Prof.
- 1979–1983: Lecturer
- 1962–1979: Teacher Assistant

(All at Peking University)

Questionnaire

1. *How and when did you come to choose to do mathematics?*

When I was at high school, I felt that I enjoyed mathematics and was good at it. Then I applied for an undergraduate student at the department of the mathematics and mechanics at Peking University, which was considered the top one in China that time. I was accepted, and spent 6 years there for my undergraduate study after which I was a faculty member until 2003, when I retired.

2. *Were you then encouraged by your family, friends or by other people around you?*

Yes, my father is a scientist, and he conveyed to me the impression that doing scientific research is interesting, noble, and worth devoting one's whole life to. My mother appreciated and was proud of my father's work. She strongly supported his work all her life. I remember that when I was very young, I would often wake up in the night and see my parents coming back home together from my father's lab with boxes in which my mother had brought midnight snack to the lab for my father. Besides, my mother did not believe that girls should always become housewives and that scientific research is only reserved for men. She always claimed that girls could also do science. On the other hand, my elder brother who is 12 years older than me, is a very good mathematician who gave me guidance all the way through my career.

3. *Did you come across obstacles in pursuing your career as a mathematician?*
Yes.

- i) *If so, could you point out to some of them?*

I really only came back to the mathematical work around 1977. But even when we could do maths, we found it extremely difficult to figure out what was going on in the western scientific world, since at that time China was pretty isolated from the world academic community. It would often take us several weeks or even months to get hold of an article or a book related to our work.

- ii) *Do you think some of the possible difficulties are related to*

- a) *the socio-economic situation in your country?*

Yes. Indeed, for historical reasons, almost all mathematicians in mainland China in my generation could not do much mathematics for some 10 years. Even after 1976, we were encouraged to do math, but everyday life was kind of difficult and we needed to spend quite a lot time to get food and deal with the necessities of life, washing and cleaning by hand, etc.

b) *the fact that you are a woman?*

Not much, in my case. But in China now, being a good woman mathematician can cause difficulties since

- A. it makes it hard to find a husband, because many boys want a housewife or at least a “basic housewife” who might have a job, but in no way do they want a companion on an equal footing,
- B. it makes it harder to find academic jobs in comparison with men.
- C. Women generally take on more chores at home than men, related to family and children.
- D. The family usually does not encourage girls to doing mathematics.

c) *other reasons? Please describe the type of difficulty you encountered (and maybe still encounter) and comment on how you overcame these difficulties, if any.*

In my case, I fortunately found a good husband, who has been my mate all along. We met as colleagues and work together. When we had a child, he really helped a lot. My strategy is to have a simple life. I do not to go for fad and focus on what I really care about.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

I am very happy to have chosen mathematics and devoted my whole life to it and its applications, so much so that now I am still working with students as a volunteer, just for fun.

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

Try to understand it and not get trapped in its logic. Try to gain more independent thinking and more self confidence. Be persistent as long as you feel you enjoy doing mathematics, otherwise it will not be a career suited for you.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

I have worked on stochastic processes and its application, especially to molecular biology and medicine.

- i) I cooperate with others to find the essential conditions of a system, which could represent a living process or phenomenon, such as cells,

a living body, and etc. We gave the mathematical definition of entropy production to describe how far the system is from reversibility. We found that time irreversibility, non-equilibrium, positive entropy production, existence of positive circulation along a loop circuit, are all equivalent for a system represented by a Markov chain, with either discrete or continuous time. For stochastic dynamics/Markov chains with multi-attractors/multi-recurrent classes.

- ii) We found a multi-scale hierarchical structure between attractors/recurrent classes for stochastic dynamical systems/exponentially perturbed by exponential “noise”. This result is closely related to multi-scale calculation for complex interacting particle systems.

Ramdorai Sujatha



School of Mathematics,
Tata Institute of Fundamental Research,
Homi Bhabha Road, Colaba,
400 005 Mumbai India,
Phone: +91-22-22782283,
e-mail: sujatha@math.tifr.res.in

Education

- 1982: BS, St. Joseph's college, Bangalore.
- 1985: MS, Annamalai University.
- 1992: PhD, TIFR/Bombay University.

Professional experience

- current: Professor, School of Maths, TIFR (associated with the University of British Columbia, Canada).
- since 2010: Canada Research Chair in University of British Columbia.
- since 2009: Member, Prime Minister's Scientific Advisory Council, Government of India.
- 2007–2011: Visiting Professor, Chennai Mathematical Institute.
- 2007–2009: Member of the National Knowledge Commission.

- 2001–2004: Principal Investigator for the Indo-French Centre for Promotion of Advanced. Research (IFCPAR) Project 2501-1 on Algebraic groups in Arithmetic and Geometry.
- 1997–1998: Alexander von Humboldt Fellow.
- 1994–1997: Associate Professor, the Indian Academy of Sciences.
- 1993–1994: Assistant Professor, Ohio State University.
- 1991–1992: Research Assistant, Regensburg University.

Honours and prizes

Ramdorai Sujatha is the first and only Indian to win the prestigious ICTP Ramanujan Prize in 2006 and also a winner of the Shanti Swarup Bhatnagar Award in 2004.

Questionnaire

1. *How and when did you come to choose to do mathematics?*

My love for mathematics started early on in my primary school, when I realised that one could do well in this subject by just understanding it! Among my happy memories of the summer vacations are those that I spent in the city library reading and also of the times when we got the text books for the next year. I would quickly try to understand and work through the early math chapters before school started. The other subject we would run through much faster and more easily was English.

2. *Were you then encouraged by your family, friends or by other people around you?*

There was no academician in my immediate family but I was fortunate to be born in a family which revered education and knowledge. My attitude to academics was shaped by my grandmother, who all through her life lamented the fact that she was not fortunate enough to have had a full education. Her thirst for learning and knowledge however stayed with her all her life and she instilled it in me and my brother. I grew up being hardly conscious of a life beyond one that encompassed the mind.

3. *Did you come across obstacles in pursuing your career as a mathematician?*
Yes.

i) *If so, could you point out to some of them?*

In the late 1970's, there was no career counselling and information was not as freely available or accessible as it now is. Engineering was not the rage that it is now. However, it was clear that a successful degree in a good engineering college, preferably in computer science, meant that one's career was comfortably made! There were not many women doing engineering and I was torn between pursuing a degree in the pure sciences and an engineering degree! When I was discussing this with one of my seniors in my pre-university years, he asked me if I liked abstract thinking. I said I loved it and then his immediate response was that I should then continue to do mathematics rather than engineering! This helped me make up my mind and I did not even apply to any of the engineering or medical colleges after my pre-university results were out.

ii) *Do you think some of the possible difficulties are related to*

a) *the socio-economic situation in your country?*

b) *the fact that you are a woman?*

c) *other reasons? Please describe the type of difficulty you encountered (and maybe still encounter) and comment on how you overcame these difficulties, if any.*

I am very conscious that in India, women have multiple contextual roles to play, and am also constantly struck by the fact that women do it with dexterity and ease, across sections of society!

As for myself, I got married before I graduated and then continued to do my Master's degree in mathematics, by correspondence. I was still unaware that a research career in mathematics was possible, the level of information dissemination was quite abysmal then even in cities! We moved to Bombay and here a few people vaguely mentioned "Tata Institute of fundamental Research", however knowing little beyond the name! It was a sheer stroke of luck that I chanced upon the advertisement of TIFR calling for admissions to the PhD degree... I did my PhD there under the supervision of Professor Parimala Raman and have continued to work there after my PhD.

4. *In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?*

The intellectual freedom that academics have is something very valuable. Of course, with it comes the responsibility, frustrations etc, but the challenge,

should we seek it, is there, beckoning us constantly. Patience, discipline and rigour, especially in mathematics, are essential in a scientific career. Often, one can spend frustrating days and weeks not seeing the path to solve a problem. When one finally sees it, that joy and the eventual beauty of all parts of the intellectual puzzle fitting together so intrinsically, makes one feel that it was worth all the periods of frustration! Another invaluable facet of an academic career is the collaborative component. It is deeply rewarding to be able to share ideas with other researchers from around the world and work together. Both at a professional level and at a personal level, such experiences enrich our lives and bring people together in a manner that is becoming more and more rare in other areas in today's strife-torn world!

5. *What would you recommend a young woman in your country wanting to start a career in mathematics?*

For women, a scientific career perhaps offers more flexibility in combining a career with a family life. Scientific policies could be shaped towards making them sensitive to the problems of women. I truly feel that there is a whole new world in science waiting to be discovered and claimed by women.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My thesis subject was the algebraic theory of quadratic forms over fields; an area with connections to various other fields in pure mathematics. But in the last decade, I have been working in the area of arithmetic geometry, especially that of elliptic curves. Elliptic curves are very special, with an enormously rich structure, multi-layered, with connections to complex geometry, topology and number theory. From the number theoretic point of view, they are greatly fascinating, being the mysterious arena in which there is so much intrinsic structure, yet with many deep conjectures and open problems! Of course, these days elliptic curves are rather fashionable because of their applications to cryptography, but their study goes back to a few centuries!

I would say studying for my master's degree through the distance mode, on my own, since we had moved to Bombay and I had a little daughter. This gave me the confidence to pursue research and helps me navigate newer areas within mathematics. One other thing I would like to mention is my recent involvement in education and policy related issues, which gives me a different perspective beyond research. I see myself as a researcher and an educator.

Jie Yang



School of Mathematical Sciences,
Capital normal University,
100048 Beijing, PR China
e-mail: yangjie@mail.cnu.edu.cn

Education

- 2000: BS in physics. University of Science and Technology of China (USTC).
- 2003: MS in physics. University of Science and Technology of China (USTC).
- 2008: PhD in physics. California Institute of Technology (Caltech).

Professional experience

- since 2011: Assistant professor. School of Mathematical Sciences, Capital normal University
- 2008–2010: Postdoctoral fellowship. Scuola Internazionale Superiore di Studi Avanzati/International School for Advanced Studies (SISSA)

Questionnaire

1. *How and when did you come to choose to do physics ?*

I have been fascinated by the beauty of physics since I was at junior high school. In particular, I was inspired by a book called “Mr. Thompkins in wonderland” by Georgy Gamov.

2. *Were you then encouraged by your family, friends or by other people around you?*

I was encouraged by my father who liked to buy me books in this field and who wanted me to become a scientist. Many of my teachers also encouraged me.

3. *Did you come across obstacles in pursuing your career as a mathematician?*
Yes.

- i) *If so, could you point out to some of them?*

As I was finishing my postdoc job, I started looking for a new job in China. I came across many obstacles, some because I didn't have connections in China, some because my research area is barely studied in China.

- ii) *Do you think some of the possible difficulties are related to*

- a) *the socio-economic situation in your country?*

- b) *the fact that you are a woman?*

As a woman especially a Chinese woman, I wasn't so confident in pursuing physics for my career and I wasn't very open to discussions and reluctant to asking questions. When I went to the US for my graduate study, I tried to adjust myself to the US culture and I pushed myself into talking to people and opening my mind. The second reason and maybe the most important one, is that I became a Christian, so I have gained a lot of confidence from God.

- c) *other reasons? Please describe the type of difficulty you encountered (and maybe still encounter) and comment on how you overcame these difficulties, if any.*

The environment in China isn't so satisfying. Firstly we have a different culture, it's only during the past 50 years we started developing science and technology. Secondly we are too eager to aim for applications rather than building up a solid background for science and technology.

4. *In retrospect, are you happy to have chosen physics or do you have some regrets? What are for you the joys of physics? What are for you the hardships of physics?*

I am happy to have chosen physics and my regret is that I didn't start with an open mind early enough. The joys are to use physics to explain nature and to explore the mysteries of our universe. On the way to finding the truth we discover many laws of mathematics.

5. *What would you recommend a young woman in your country wanting to start a career in physics ?*

Try to be open minded and not be shy in order to discuss and discuss one's work with other people. Support and encourage each other, after all we women physicists, are a minority.

6. *Could you write a few lines in an understandable manner to non-experts, describing your topics of research and your favorite personal achievement in mathematics?*

My research is called string theory more precisely topological string theory. String theory is an attempt to unify all the four forces that we know in our universe. Topological strings is a branch of research in string theory. It focuses on some topological features of the whole theory which makes it easier and mathematically feasible.

My favourite personal achievement is that I have become an expert in topological string theory and recently I have started a new project which I think is very promising.

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