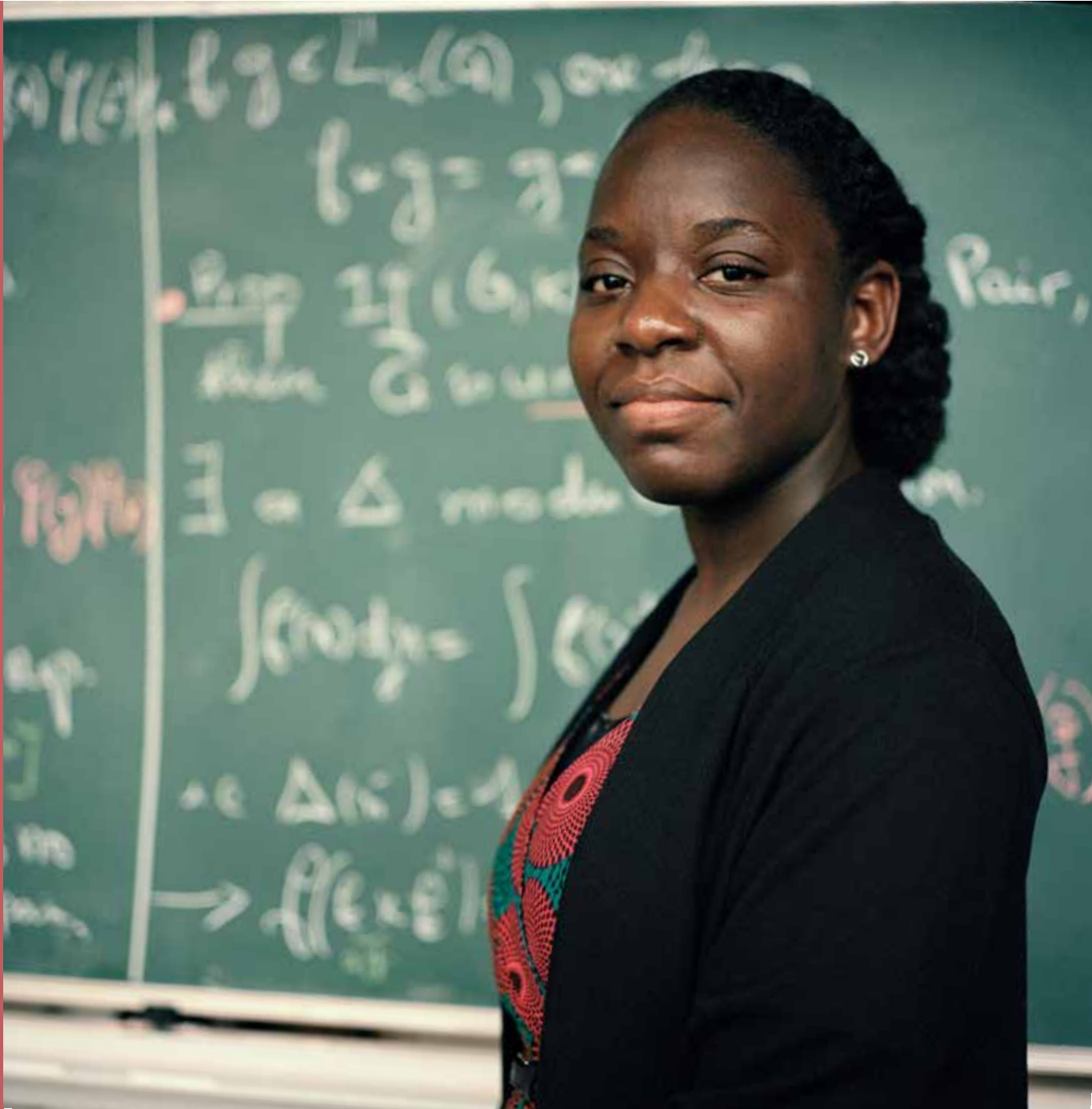


Cornelie Mitcha Malanda

$$\begin{aligned} C^1(L'_k(G)) &= [L'_k(G), C^0(L'_k(G))] \\ &\vdots \\ C^p(L'_k(G)) &= [L'_k(G), C^{p-1}(L'_k(G))] \\ \text{with } C^0(L'_k(G)) &= L'_k(G) \end{aligned}$$

Cornelie Mitcha Malanda grew up and studied in Brazzaville (Republic of Congo). Early in high school she followed a mathematics-oriented path. After high school she did a bachelor degree in general mathematics and a master degree in harmonic analysis. She defended her thesis in 2019 after which she worked as a part time lecturer at the department of Mathematics at the Marien Ngouabi University. From January 2021 to May 2022, she worked as a teaching assistant (tutor) at the African Institute for mathematical sciences in Rwanda. She was awarded a Schlumberger Foundation Faculty for the Future in 2022 to pursue her postdoctoral research at Tokyo University of Science.

- Research topics:**
- Topics-Harmonic Analysis on Gelfand pairs
 - Representation theory of Lie groups



Onna-Okinawa, Japan, 2023



Could you please introduce yourself and tell us when you chose to do mathematics?

My name is Cornelie Mitcha Malanda, and I'm from the Republic of Congo. I'm currently working as a post-doc at the Tokyo University of Science, and as a visiting researcher at the NTT Institute for Fundamental Mathematics. My area of study is abstract harmonic analysis and representation theory. I will say honestly that maths was not my first choice. My childhood dream was to go into medicine. But I was very good at math and physics during all of my school years, and everybody would always tell me, "You need to do mathematics." And I would say to them, "No, I need to be a doctor in medicine!" In my country, you need to pass an exam to enter the faculty of medicine. I took the exam, and I failed. I remember asking my father at the time if I could do both medicine and mathematics, and he said why not? I took both exams, and passed the mathematics one, but failed the medical one. I cried when that happened, because my dream ever since I was a child had been to become a doctor and take care of people. It was a great dream of mine. But I failed, and I ended up entering the faculty of science instead. I showed them my exam scores when I entered, and they said

I should do physics, because my score for physics was very high, higher even than my score in mathematics. We needed to choose as soon as we entered what area we wanted to go into, and I had to choose between mathematics and physics. I couldn't do both. I chose maths because I was more confident about maths, and that's where it all began.

I actually took the entrance exam for the faculty of medicine for the second time, after I was already enrolled in the faculty of science. And I failed again. This time I didn't cry a lot, because my grades in the faculty of science were good, and I felt somewhat comforted by that. It's quite funny actually because I wasn't even really concentrating on my studies in the faculty of science. My heart was set on medicine. My grades in the first year were not good, because I wasn't really focused on my studies, but my grades in the second year were very satisfactory. My studies were going smoothly. When I finished my undergraduate studies, I told myself, "Okay, you need to focus on math and give up medicine." At that point, I had given up physics already.

After I finished my undergraduate studies and before I decided on maths, I actually did take some other exams, like for computer science and statistics. Creating apps, things like

that. But all of the exams I took, I failed. What I wanted was to go into something very concrete, not abstract. But I failed them, and I don't know what happened ... I just know it was not for me. When I failed, I would just think, "It's not for me." I used to say that maths chose me because I was honestly very good at math, good enough to pass. And all of these other areas that I failed, it was a sign that they weren't for me.

Were you encouraged by your family, friends, or other people around you?

I used to say I was really lucky and blessed, because my parents were educated. My father had a PhD in economics, and he really encouraged me to study a lot. Everybody in my family went into fields like finance, economics. I was the first one to do science. I wanted to do something different from everyone else – do something new. That's why I went into science. I remember when I first started at the faculty of science, my father told me that failing my first year was normal, because in my country, everyone knows that the faculty of science is really difficult. And I remember telling him I didn't want to fail. "No, I would like to pass." I worked really hard, and the whole time, my father encouraged me so much. My grandmother passed away very early, but when she was

still alive, she would encourage me to study all the time, because she hadn't been able to study. She was really good at calculation, and she was just fascinated by my path. She told me, "You need to work, you need to go as far as possible in your studies."

I have four sisters, and five brothers, so there are then of us, which is a normal African family! But no one in my family did mathematics other than me, and I was the first one to do science. My mother didn't work, what with there being so many children. I'm the fifth oldest, four from the top. All my siblings studied. I have one sister who is in France, but most of my siblings are in Congo. Our eldest sister did something finance-related, and has a BTS (technical Bachelor's degree). The second and third eldest sister have masters' degrees. My eldest brother went to his first year of university, then got a job. My second brother got a baccalaureate, and left as well. After that it's me, and I did a PhD. The brother after me is now studying medicine, the sister after that has a bachelor's degree, and the brother who follows her is finishing his undergraduate studies. At university, there was a professor who is now the dean of the science faculty, who was really nice to me. I forgot to mention this, but I was always

the youngest in my classes during my studies. People were shocked by my age when I was at university, but all my professors would encourage me to do more, learn more. As I said, my grades were not very good in the first year of my undergraduate studies, because I was still so set on medicine. It was just at the lower limit. So some people felt like the only reason I had passed was because I was a woman, that it was some sort of favor to me. But in my second year, people saw that it wasn't a favor, that I really could do it. And everybody encouraged me. If I needed a recommendation or even just assistance for anything, I could do go to my professors, and they would assist me and give me their recommendation. I didn't really experience any barriers in that sense.

This was actually also how I came to do the math I'm doing. In Congo, we were doing differential geometry. But in 2015, a professor visited from Cote d'Ivoire to do a course on Lie Algebras for two weeks. When we went into the course, he said that the best student on that course would be able to do their masters with him. And I was among the best students – one female, and one male. So I started my masters with him, and he was surprised because I was very quick in my studies. During my Masters' defense, he

gave me the topic for my PhD which decided me for a PhD, because I was very fascinated by the topic. It was as if I didn't have a choice. I was just so fascinated. I needed to do it, I needed to learn again.

My supervisor, my professor, my parents, everybody really, really encouraged me. The problem is that Congo is such a small country with only six million people. When I was studying, there was just one woman at the Mathematics Department. She was our professor in algebra. That's why they encouraged women in university so much, and I was among those who were encouraged in this way by my professors.

I had a scholarship for my undergraduate and masters' studies, but when I was in my PhD program, the economy was really bad, and the government could not pay for our scholarships. So I started my PhD without funding. It was very hard, because it was a complicated task even to get Internet connection. I started my PhD in 2016, and in 2018, they opened the application for the Collège Doctoral (PhD program) « Mathématiques, Informatique, Biosciences et Géosciences de l'environnement » run by the Agence Universitaire de la Francophonie (AUF). I applied for that funding, and got it in 2018, after which I started traveling in 2019. That same year



in 2019, I also received a grant from the EMS Simons grants for Africa, for three months.

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

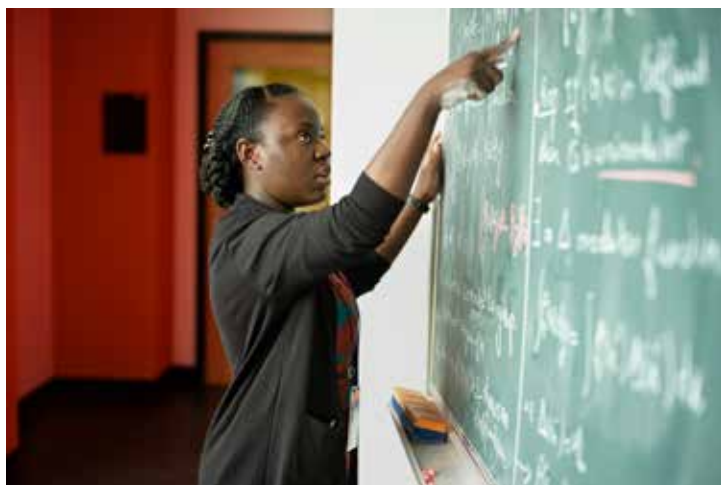
Honestly, I will say no. I'm currently 29, and I am the youngest doctor in my country in mathematics, amongst both men and women. I defended my PhD when I was 25. I think just based on that, people are always fascinated to learn what I've studied, what I've done. And most people will really encourage me.

I have not come across obstacles as an African, because the only country that I've visited apart from Africa was France, where people were really nice to me. I contacted a at the University of Orléans at the beginning of my PhD. He told me he didn't have funding for me to work with him, so when I got my funding for research visit, I contacted him again and asked him if I could work with him. He agreed, so I went there to work with him which was really nice. I didn't face any obstacles as an African or as a woman, but I think my story is quite particular. I've been really blessed. My father never told me I needed to get married or to have children. He always told me I needed to work, to do this and that. He reminded me all the time that I needed to



be really strong in life. Even if other members of my family or others would ask me why I was doing maths, that at my age, I needed to have children, my father would tell me to ignore what they said and to keep doing what I was doing then. He was so supportive of me, it was really nice. My mother also encouraged me to work. Sometimes though, people outside of my family would say, "Why are you doing that? You need to get married!" But I never cared. I never listened to those people. I remember my professor one day told me he didn't understand why people say women cannot do mathematics. He said, "Mathematics isn't a sport. It's not physical activity. It's just using your brain. And men and women have the same brain. We can think in the same way. Why is it that people say women cannot do mathematics?" So it goes to show you what people were like. I was really blessed.

One difficulty, however, was that I had a scholarship for my undergraduate and master's studies, but when I was in my PhD program, the economy was really bad, and the government could not pay for our scholarships. So I started my PhD without funding. It was very hard, because it was a complicated task even to get Internet connection. I started my PhD in 2016, and in 2018, they opened



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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?

Of course. I would never regret it. I almost wonder why I didn't decide to study it earlier. I'm so happy to do mathematics. What's nice about math is that there's a logic to it when you're working on it. It's not easy, sure. Sometimes you fail, sometimes you find yourself struggling, sometimes you're down, emotional, because you can't find a way out of a problem. But at the end of the day, you understand something, however small, and that's your achievement of the day, and you feel fine. I will say that if you want to do mathematics, you have to be ready to learn all the time. Be ready to learn everything, as much as possible. Learn, try to do things.



The joy of math for me is that it feels like you've discovered something new when you understand something, even if it's not new in the literature out in the world. But it's new for you, and it feels exciting, like you're back to being a child again. "Oh, wow!" I'm so fascinated every time, like when I was a young child and saw chocolate for the first time, and I screamed in joy, like that. I think when I'm working to try to understand something, I'm just excited. Sometimes I don't want it to stop. I think to myself, if I stop here, I won't be able to learn anymore today. I have time left, I can still go on. It's kind of like an addiction. I got here today, but maybe if I push myself a bit harder, do it again, I'll learn more.

There are difficulties too. I remember I would sometimes cry when I was doing my PhD. I had two supervisors for my PhD, and one of them told me, "If you're crying over your PhD, if you feel down about it, that means you're doing it right, if you don't cry or feel down, something is wrong with you". I think the difficult part is spending so much time on something, and not getting any results. I would sometimes cry in my room, like, "Maybe I'm not good enough. Maybe I can't do it. Maybe something's wrong." It's hard. But keep trying, keep going, and it will be fine.

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

I think getting my PhD at the age that I did was really helpful for my community in Congo. At the time, people perhaps didn't believe that women could do mathematics, but now they see me, and they say, "If she can do it, you can do it." I'm now a role model for them, because I've shown them that it's possible. That it's not impossible for women to be in mathematics. If the young lady came into my office, I would encourage them to go out and just do it. If they are studying at that level, that means they have the capacity to do more. I would say, just trust yourself. Be convinced. Be more confident. You will face challenges, you will be down sometimes, you will cry, that's true. But don't give up. You might feel down, you might want to cry, but you will stand up again. Continue on your way. The peace that you will feel from trying is so much better than living with regret all your life. You have the capacity to do everything you want in your life. You need to pay the price, sure, but you can do it. Be confident. It's like ... I remember when I was at the African Institute for Mathematical Science (AIMS), people were always coming to me with questions. Most of

them, I didn't solve the question for them. I would sit down with the laptop or textbook or whatever it was, and I would ask them questions. Why is it like this here? Why does it do this? And after these questions, they'll have solved the problem themselves. And I'd say, "You did it, not me." And they would leave feeling confident and comfortable. I would just discuss, interact with them, and they would derive their own solutions to their problems.

Could you describe your favorite personal achievement in mathematics?

My personal achievement in mathematics ... is perhaps that I did all my studies in Congo. Everything, in Congo, and now I'm in Japan to do this post-doc. People sometimes think that if I'm from the Congo, I cannot travel far from Congo. I need to be in Congo, do everything there. But my personal achievement in mathematics is when I see people younger than me who say, "I need to do mathematics." Another achievement is perhaps finishing my PhD.

Could you describe your field of mathematics in simple words?

I used to say that I'm doing is like a pot-pourri. It's all a mix, a stew. You'll find everything inside, and you'll enjoy it. A mix of different mathematics. If I want to explain it to people in high school, I'll ask them



if they know what a matrix is. I'll then ask if they know what vectors are. Then I'd say, "Well, you multiply the matrix and the vectors." And they would say, "That's it?" And it is. That's representation theory. Roughly speaking, representation theory studies abstract algebraic structures by representing their elements as structures in linear algebras, such as vectors spaces and linear transformations between them. It is a beautiful mathematical subject which has many applications. If I were to explain

it to people who are doing engineering or computer science, I'll say to them, "When you simulate your code, the mathematics behind it is what I'm doing." The mathematics being used in their computations is what I'm doing. That's abstract harmonic analysis.

Is there a question missing you would like to answer? I'm very grateful to the Faculty for the Future Fellowship program run by the Schlumberger Foundation, for the grant I received. I really appreciate the philosophy of that group. They

give people grants for PhDs, post-docs. They encourage people to leave their country, go outside and learn, and after that, give back to your country. It was so nice for me to get this grant because I honestly feel I need to give back to my country. It's not common to see countries giving people scholarships for undergraduate and master's studies, even if things aren't going as smoothly right now. I was the first Congolese to receive the Faculty for the Future grant. And I want to give back, to encourage people. Because I



think there are a lack of role models. People, when they want to work towards a career, they need to have a role model, they need to feel like there are people who have done it before then. Sometimes, if you don't have that mirror, you can feel like it's impossible to achieve. I remember when I received the catalogue of the exhibition "Women of Mathematics" with portraits of female mathematicians and their stories. I still have it. I remember when I finished my PhD, I went to look through it again, and there was a woman in it who was doing harmonic analysis. Everybody's story is just totally different. You can see how different people have gone through their careers, what they have done, and it can inspire you to work harder, to try to be better at your job. I think I can serve as a role model in Congo, and I feel that it is my one of my duties. When I was growing up, there was no mathematics competition. I think it's called the Olympiad. But now we have the Mathematical Olympiad, and we have what's called "Miss Mathematics," which I think is to encourage women. You can see the change in the new generation, with people going in and trying their best. I think I do need to be a role model for them. And one final thing, I am sincerely thankful for everything.