

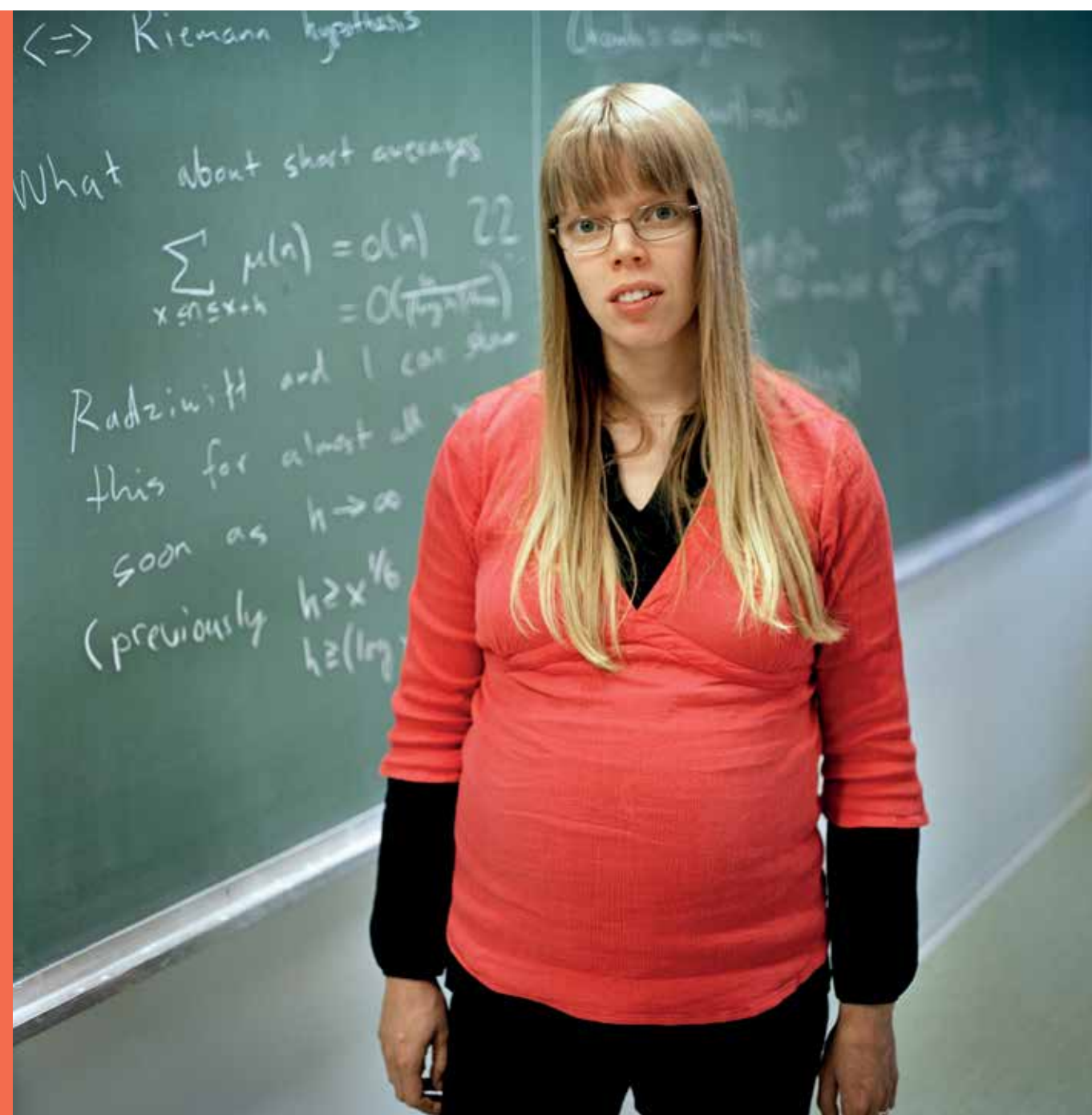
Kaisa Matomäki

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$$

Kaisa Matomäki was born in Nakkila, Finland. She first studied Mathematics at the University of Turku, and then at the University of London Royal Holloway, where she obtained her PhD in Mathematics in 2009 under the supervision of Glyn Harman, with a thesis in analytical number theory. Since then she has worked at the University of Turku, where she was appointed as a tenure track Associate Professor and as an Academy Research Fellow in 2015. She is an invited speaker at the European Congress of Mathematics in Berlin in 2016.

Research topics:

- Number theory
- Multiplicative number theory
- Prime numbers
- Additive combinatorics





How and when did you choose to do mathematics?

During the last year of elementary school I had an excellent teacher who would give me extra maths tasks. As well as maths, as a child, I enjoyed writing and reading, but mostly I liked mathematics. Then, at the age of sixteen, I went to a special mathematically-oriented school in Valkeakoski, some 100 km away from my home town. I'd heard about someone who had been to that school and so I wanted to try it out. I took the entrance exam and was accepted among some 20 pupils out of the 80 applicants. Nokia funded our board and lodging and we worked part time for them. I spent two years at that school before the matriculation exam (which corresponds to A-Levels). During those two years, we attended extra university courses delivered by advanced university students, both in computer sciences and mathematics. While at that school, I first considered the idea of becoming an engineer but later changed my mind, opting for mathematics, which I then studied at Turku University. I chose Turku, a middle size town, rather than Helsinki. Also, Turku was known for its number theory group, and I was already interested in number theory.

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

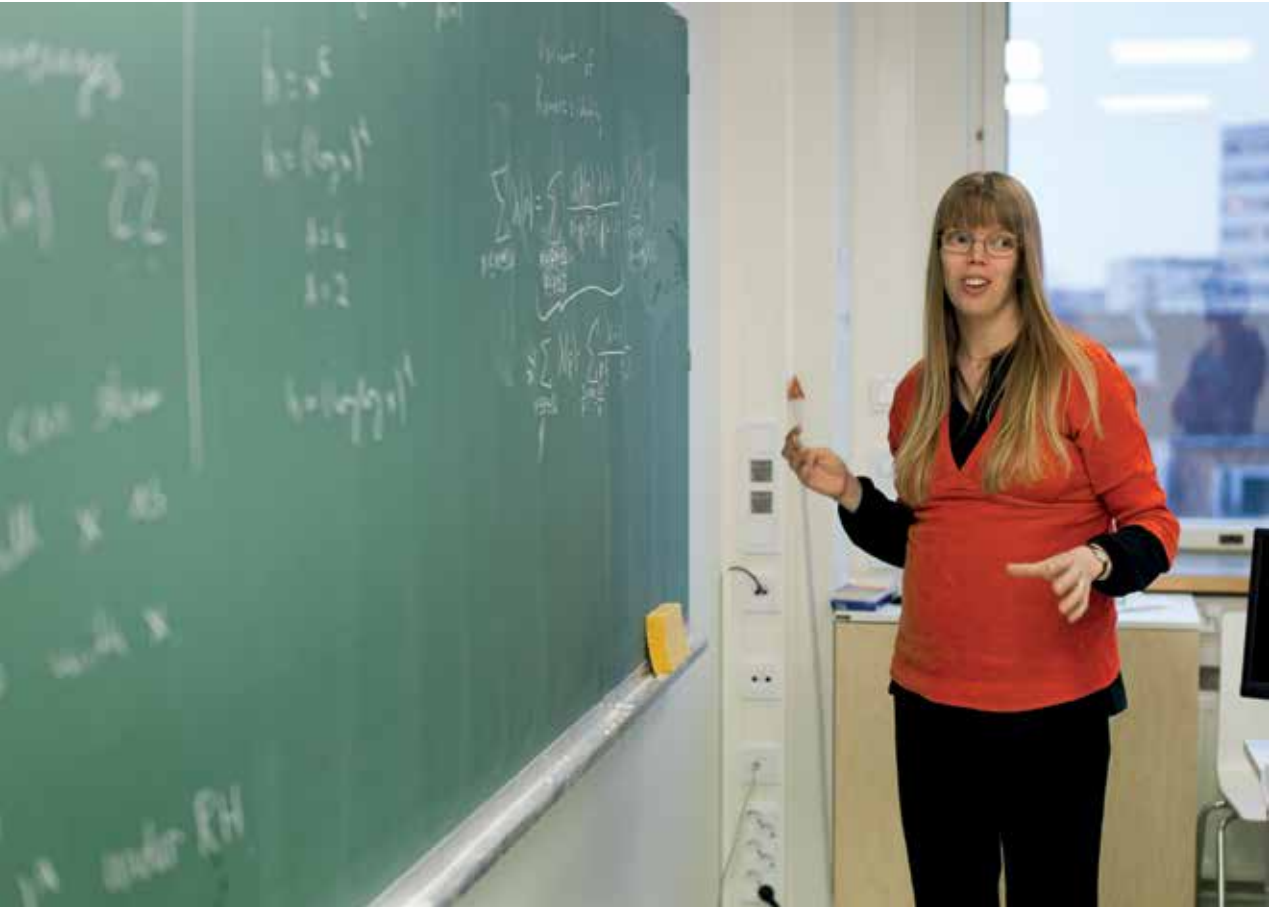
As a child, I learned a lot from my brother who was 4 years older than me, and who would tell me about what he was learning at school. He's now a statistician working at the Turku University hospital, where he takes care of the statistics for the medical researchers.

My parents, who have now retired – my mother was an elementary school teacher, my father a farmer – were very supportive. On the one hand they were proud that I could attend a special school for gifted children, on the other hand, they missed me, lamenting that the school was so far from our home town. But I was happier at this school than I had been at my previous school, where I had suffered from being different from my school mates. I enjoyed the atmosphere at that special school, and have kept friends from that time, some of whom studied in Helsinki, where they are now working. Among the 20 pupils in the class, only 4 were women; the proportion has probably increased since them.

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

No, I didn't experience any obstacles. I was recently appointed to an associate professorship at the mathematics department of Turku, which I will hold after the 5 year long research position I won simultaneously. On the national level, we were three to get such a research position, amongst whom two were women. I obtained this position the second time I applied, after one failed attempt.

I expect to have a second baby in February 2016 and will probably be on maternity leave for about a year; the period of well-paid leave is 10 months. During my maternity leave, I will also have my 3-year-old son at home, since I don't want him to be in day care while I am at home. I had a lot of time to think about mathematics when I was on maternity leave for my first child, even though I didn't have much time devoted solely to work. I'm not sure how it will work out this time with two children. However, as I have a quite secure position and an official maternity leave, I am not really worried even if I do not get much mathematics done for a year, but can happily devote time for the family.



In retrospect, are you happy to have chosen mathematics or do you have some regrets? For you, what are the joys of mathematics? What are the hardships

I have no regrets, since mathematics is what I enjoy doing. I like doing research, having new ideas, but do not like getting stuck on a problem, which is a source of frustration. To have a new idea is exhilarating, I get excited and can hardly sleep. I am eager to go on thinking about it, and sometimes go on doing so at night.

When I get stuck, I try to leave the problem aside for a while and to think about something else. I have many collaborators who can help me overcome the problem. Ideas go back and forth between me and my collaborators, some of whom may well find a solution to a problem I couldn't solve.



What would you recommend to a young woman in your country wanting to start a career in mathematics?
I would tell her to just try it out, and not to care too much about other people's comments. I would encourage her if she showed some enthusiasm and her credentials were good. As a matter of fact, I would tell a man or a woman the same thing.

Could you write a few lines describing your topics of research in a manner understandable to non-experts?
Among other things, I am interested in the distribution of prime numbers; the larger the numbers, the scarcer the prime numbers. However, one still expects that there are infinitely many twin prime numbers, namely pairs of prime numbers of the form $(p, p+2)$, such as $(5, 7)$ and $(17, 19)$. This is a major unsolved conjecture in number theory, but for instance one does know that there are infinitely many primes p such that $p+2$ is either a prime or a product of two primes. Another famous unsolved problem in the area is the Goldbach conjecture, stating that each even integer at least 4 is the sum of two primes (e.g. $10 = 3+7$ and $16 = 5+11 = 3+13$). It is known that every odd integer at least 7 is a sum of three primes.



Some of my recent research concerns the combination of these two approximations of the famous conjectures – my collaborator Fernando Xuancheng Shao and I showed that each large enough odd integer is a sum of three primes $p_1 + p_2 + p_3$, where each prime p_i is such that $p_i + 2$ has at most two prime factors. These are relatively easy questions to formulate, easy problems to state. I do not know of any practical applications, but there might be some in cryptography for some related problems.

Could you describe your favourite personal achievement in mathematics?
I am proud of work I recently did with Maksym Radziwiłł. He came up to me after a talk I gave in Oberwolfach, on Fourier coefficients of modular forms. Together we managed to improve my results and started to investigate some generalisations. Our first achievements in view of a generalisation were pretty unsatisfactory results on sign switches of multiplicative functions, but eventually we ended up proving a very nice

result on general multiplicative functions. It turned out that the method we developed could give rise to interesting results concerning other problems. Other people, including Terence Tao, have since used our approach to establish some of their recent results.

