



2021 Ruth Lyttle Satter Prize

Kaisa Matomäki was awarded the 2021 Ruth Lyttle Satter Prize at the Annual Meeting of the AMS, held virtually January 6–9, 2021.



Kaisa Matomäki

Citation

The 2021 Ruth Lyttle Satter Prize is awarded to Kaisa Matomäki for her work (much of it joint with Maksym Radziwiłł) opening up the field of multiplicative functions in short intervals in a completely unexpected and very fruitful way, and in particular in their breakthrough paper, “Multiplicative Functions in Short Intervals” (*Annals of Mathematics* 183 2016, 1015–1056).

The Möbius function μ is a function from positive integers to $0, \pm 1$ which sends n to $(-1)^k$, where k is the number of prime factors of n if n is square free, and to 0 otherwise. It is a basic example of a multiplicative function, i.e., a function f on the positive integers satisfying $f(ab) = f(a)f(b)$ whenever a and b are coprime. The Möbius function is intimately connected to the Riemann zeta function and to the distribution of prime numbers. For example, the prime number theorem (giving the asymptotic distribution of prime numbers) is equivalent to the nonvanishing of the Riemann zeta function on the line $\text{Re}(s) = 1$, which in turn is equivalent to the fact that the Möbius function asymptotically has mean zero on intervals of the form $[x, 2x]$. It is important to understand whether this mean zero behavior remains true on shorter intervals $[x, x + h(x)]$, even for “most x ”. In their 2016 *Annals* paper, described as a “stunning surprise” going well beyond what was commonly thought to be currently possible, Matomäki and Radziwiłł showed that for most x this was true as long as $h(x)$ grew with x , however slowly. (Moreover, they proved a general result that holds for any real-valued bounded multiplicative function, not only for the Möbius function.) Previously, even assuming the Riemann hypothesis, such a result

was only known for h growing like a power of $\log x$. Their result has had a transformative effect on analytic number theory, opening up new lines of research and leading, for instance, to important progress on the Chowla conjecture and to Tao’s resolution of the Erdős discrepancy problem.

Biographical Sketch

Kaisa Matomäki was born in Nakkila, Finland, in 1985. She received her master’s degree at the University of Turku, Finland, in 2005 and her PhD at Royal Holloway, University of London, in 2009. Since 2008 she has worked at the University of Turku in different positions. Currently she is an Academy Research Fellow there. Matomäki received an EMS Prize in 2020, and together with her collaborator Maksym Radziwiłł she received the SASTRA Ramanujan Prize in 2016 and the New Horizons Prize in Mathematics in 2019. Matomäki and Radziwiłł were jointly invited speakers at ICM in 2018.

Response from Kaisa Matomäki

I am very honored and delighted to receive the Ruth Lyttle Satter Prize. It would not have been possible without my mentors and collaborators, to whom I am extremely grateful. In early years my teachers Harri Ketamo and Merikki and Esa Lappi, as well as math contest trainers, made me excited about mathematics. My PhD supervisor Glyn Harman helped me to get a good start in my research career. Andrew Granville has helped and advised me in various ways. I want to thank all my collaborators—together one can do much more than alone. Special thanks go to Maksym Radziwiłł, with whom we have had several successful projects. Finally, I would like to thank my family, in particular my husband Pekka for all the love and support, and my children Touko, Lotta, and Ilmari for all the joy they bring to my life.

About the Prize

The Satter Prize is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous six years. Established in 1990 with funds donated by Joan S. Birman, the prize honors the memory of Birman's sister, Ruth Lyttle Satter. Satter earned a bachelor's degree in mathematics and then joined the research staff at AT&T Bell Laboratories during World War II. After raising a family, she received a PhD in botany at the age of forty-three from the University of Connecticut at Storrs, where she later became a faculty member. Her research on the biological clocks in plants earned her recognition in the United States and abroad. Birman requested that the prize be established to honor her sister's commitment to research and to encourage women in science. The prize carries a cash award of US\$5,000.

The Satter Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2021 prize, the following individuals served as members of the selection committee:

- Carolyn Gordon
- Marianne Korten
- Richard Taylor (Chair)

A list of previous recipients of the Ruth Lyttle Satter Prize in Mathematics may be found on the AMS website at https://www.ams.org/prizes-awards/pabrowse.cgi?parent_id=35.