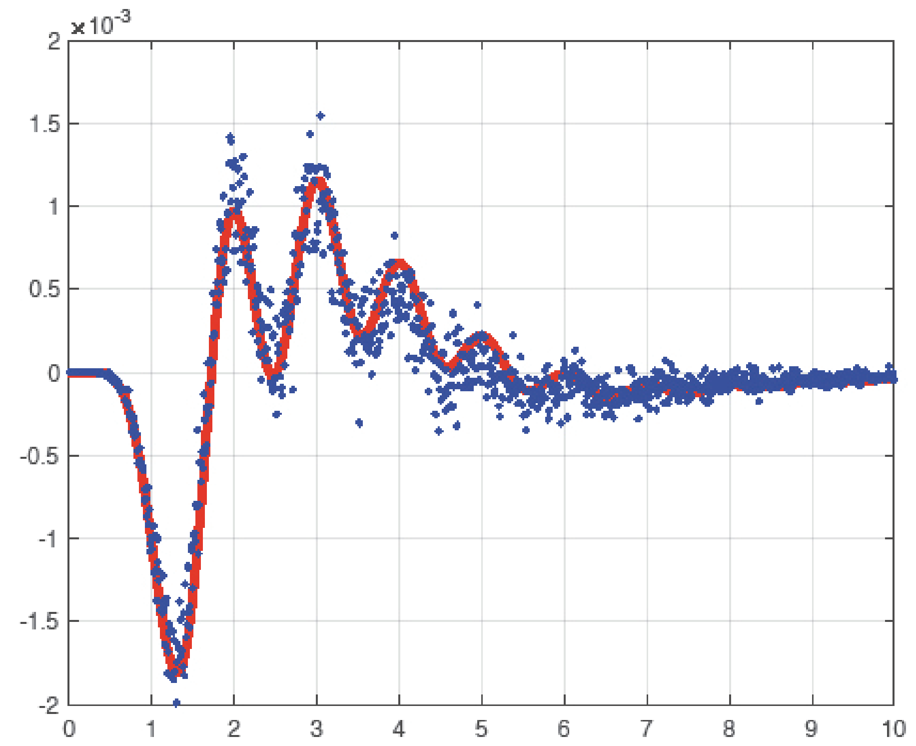
Berlin Mathematical School

# BMS Friday Colloquium

## Friday 26 October 2018 at 14:15

*Tea & Cookies starting at 13:00*

BMS Loft, Urania, An der Urania 17, 10787 Berlin




Finite-size effect in the Odlyzko data set (blue) and its prediction (red)




## Folkmar Bornemann

*(TUM)*


### Finite size effects: Random matrices, quantum chaos and Riemann zeros

Since the legendary 1972 encounter of H. Montgomery and F. Dyson at tea time in Princeton, the statistical correspondence of the non-trivial zeros $\frac{1}{2} + iE$ of the Riemann zeta function with eigenvalues of high-dimensional random matrices poses a big open mathematical problem. An explanation for this mystery is conjured up as follows: if the values $E$ formed the spectrum of a Hamiltonian operator with chaotic classical mechanics, then they would behave statistically like eigenvalues of random matrices (quantum chaos). Thanks to extensive calculation of Riemann zeros by A. Odlyzko, overwhelming numerical evidence can be found for the correspondence. In the largest data set of $10^9$ zeros at height $E = 10^{22}$, even finite size effects can be observed in the fluctuation statistics whose precise prediction was recently made possible by the numerical evaluation of operator determinants and their perturbation series (joint work with P. Forrester and A. Mays, Melbourne).

Folkmar Bornemann has been at the TU München since 1998, where he is professor and chair of numerical analysis and scientific computing. His focus is on the interplay between efficient algorithms and basic mathematical analysis of a problem. Bornemann got his PhD and did his habilitation at the FU Berlin in 1991 and 1997, respectively. From 1994 to 1998, he was head of Numerical Analysis and Modelling at ZIB, and from 1996 to 1997 he was a visiting researcher at the Courant Institute at NYU. Bornemann's awards include the SIAM 100-Digit Challenge (2002), the Ernst-Reuter Prize (1992) and the Joachim Tiburtius Prize (1990).

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