



Berlin  
Mathematical  
School

## BMS Friday Colloquium

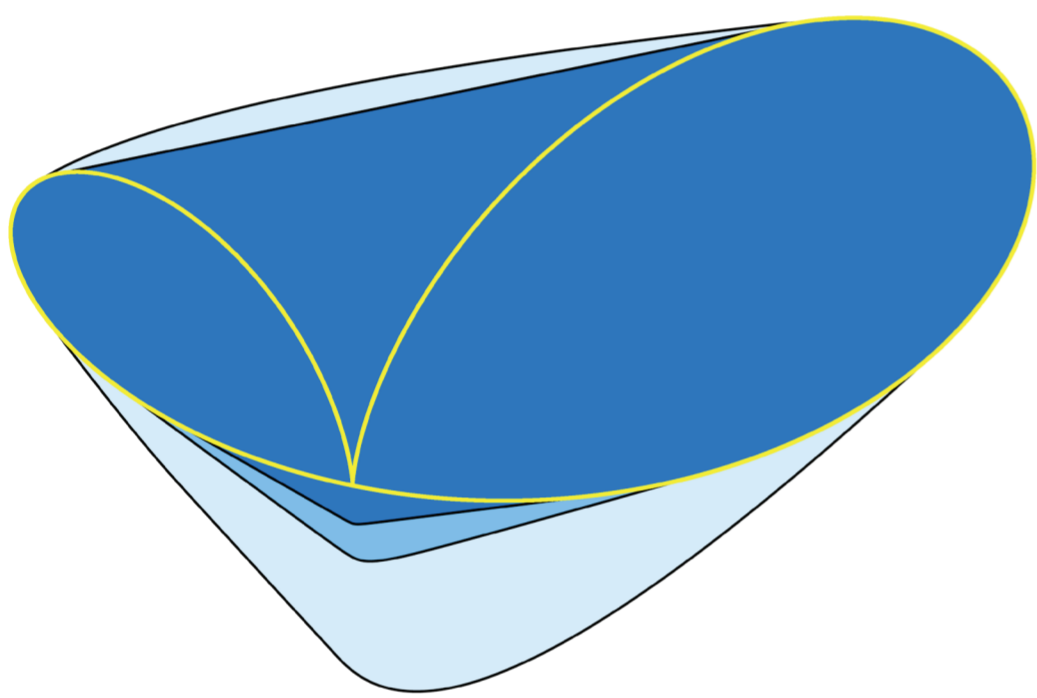
Friday 24 November 2017 at 14:15

*Tea & Cookies starting at 13:00*

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

### Claus Scheiderer

*(U Konstanz)*



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### Spectrahedral Shadows

A spectrahedron is an affine-linear section of the cone of positive semidefinite matrices. Interior point methods can be used to efficiently optimize linear objective functions over spectrahedra (known as semidefinite programming). Semidefinite programs (SDPs) have wide expressive abilities, and are used in discrete mathematics, optimal control, and other fields to model or approximate practical problems. The feasible sets of SDPs are the linear images of spectrahedra, called spectrahedral shadows. In view of the wide range of applications, one would like to characterize these sets by their geometric properties. It has been conjectured that every convex semialgebraic set is a spectrahedral shadow (Helton-Nie conjecture).

In his talk, Scheiderer will first discuss examples and constructions of spectrahedral shadows, and then exhibit non-trivial conditions that are necessary to represent a convex set as a spectrahedral shadow. These obstructions are related to sums of squares representations of positive polynomials. They will allow Scheiderer to disprove the Helton-Nie conjecture and to give explicit counterexamples. Many natural questions remain open and Scheiderer will address some of them.

Claus Scheiderer is a professor of geometry at the University of Konstanz. His main research interests include real algebraic geometry, linear algebraic groups and quadratic form theory. Scheiderer completed his PhD at U Erlangen in 1985 and did his habilitation at U Regensburg in 1993. After holding positions at U Regensburg and U Köln, he was awarded a Heisenberg Fellowship in 1997. In 1999, Scheiderer became professor for algebra at U Duisburg and then followed a call to U Konstanz in 2004.