Lecturer: **F. Eisenbrand (Max-Planck-Institut)**.
Title: **Fast Algorithms for Integer Programming in Fixed Dimension**.
This course provides an introduction to the algorithmic geometry of numbers and its applications in the field of integer programming. We start by introducing lattices, reduction algorithms like the LLL algorithm, Korkine-Zolotareff reduction and algorithms for the shortest vector problem. Then we prove the flatness theorem, which is the basis for the polynomial time algorithms to solve the integer programming problem in fixed dimension. Finally we treat a recent algorithm for integer programming in fixed dimension, whose running time matches the running time of the Euclidean algorithm for greatest common divisor computation, if the number of constraints is fixed. For varying number of constraints m, the algorithm has an expected running time of $O(m + \varphi \log m)$, where φ is the largest binary encoding length of a number appearing in the input. The prerequisites for the course are basics in linear algebra and integer linear programming.