

## Themen

Ziel des Seminars ist es, die Veröffentlichung *Shard Polytopes* von Arnau Padrol, Vincent Pilaud und Julian Ritter (Juli 2020) ganz oder teilweise zu verstehen. Die folgenden Vorschläge für Vortragsthemen sind darauf ausgerichtet.

### Thema 1: Geometric Preliminaries

- polytopes, (normal) fans, Minkowski sums
- braid fan, permutahedron, generalized permutahedra

Literatur:

- Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*. arXiv:2007.01008, 2. Juli 2020.
- Ziegler, Günter M. *Lectures on Polytopes*. Graduate Texts in Mathematics 152. New York, NY: Springer, 1998.
- Postnikov, Alexander. *Permutohedra, Associahedra, and Beyond*. International Mathematics Research Notices 2009, Nr. 6 (7. Januar 2009): 1026–1106. (arXiv:math/0507163)
- Stanley, Richard P. *An Introduction to Hyperplane Arrangements*. In Geometric Combinatorics, herausgegeben von Ezra Miller, Reiner, Victor, und Sturmfels, Bernd, 389–496. IAS/Park City Mathematics Series BV010402400 13 13. Providence, RI: American MathSoc, 2007. (<http://www-math.mit.edu/~rstan/arrangements/arr.html>)

### Thema 2: Combinatorial Preliminaries

- permutations, noncrossing arc diagrams
- weak order and canonical join and meet representation

Literatur:

- Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020,
- Reading, Nathan. *Noncrossing arc diagrams and canonical join representations*, SIAM J. Discrete Math. 29 (2015), 736–750. (arXiv:1405.6904)
- Corteel, Sylvie. *Crossings and alignments of permutations*, Adv. in Appl. Math. 38 (2007), 149–163. (arXiv:math/0601469)

### Thema 3: Quotientopes

- lattice quotients, quotient fans and quotientopes
- shards
- Minkowski sums of associahedra

Literatur:

- Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.
- Pilaud, Vincent, und Francisco Santos. *Quotientopes*. Bulletin of the London Mathematical Society 51, Nr. 3 (Juni 2019): 406–20. (arXiv:1711.05353)
- Aguiar, Marcelo, und Federico Ardila. *Hopf monoids and generalized permutahedra*. arXiv:1709.07504, 21. September 2017.
- Postnikov, Alexander. *Permutohedra, Associahedra, and Beyond*. International Mathematics Research Notices 2009, Nr. 6 (7. Januar 2009): 1026–1106. (arXiv:math/0507163)

#### **Thema 4: Shard polytopes**

- Definition of shard polytopes
- Basic geometric properties of shard polytopes
- Normal fans of shard polytopes
- Quotientopes from shard polytopes
- A Minkowski identity on shard polytopes

Literatur:

Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.

#### **Thema 5: Minkowski geometry of shard polytopes I**

- Type cones and shard polytopes
- Matroid polytopes and shard polytopes

Literatur:

Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.

#### **Thema 6: Minkowski geometry of shard polytopes II**

- Virtual deformed permutahedra and shard polytopes
- PS-quotientopes via shard polytopes
- (Mixed volumes of shard polytopes)

Literatur:

Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.

#### **Thema 7: Type $B$ combinatorics and geometry**

- Type  $B$  permutations and noncrossing arc diagrams
- Type  $B$  weak order and canonical join and meet representations
- Type  $B$  lattice quotients
- Type  $B$  Coxeter arrangement and permutahedron
- Type  $B$  quotient fans and shards

Literatur:

Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.

#### **Thema 8: Type $B$ shard polytopes and quotientopes**

- Type  $B$  shard polytopes
- Proof of Main Proposition

Literatur:

Padrol, Arnau, Vincent Pilaud, und Julian Ritter. *Shard Polytopes*, arXiv:2007.01008, 2. Juli 2020.