

Preface

The title of the Abel Symposium 2009 was “Combinatorial aspects of Commutative Algebra and Algebraic Geometry”. The last couple of decades has seen a shift in commutative algebra and algebraic geometry towards more concrete problems, often related to combinatorics. The above was therefore a natural choice for the title of the symposium. In fact many of the topics of the symposium have risen to prominence only over the last decade. Among those are cluster algebras, tropical geometry and the recent breakthrough in the studies of syzygies of graded modules over polynomial rings, called Boij–Söderberg theory. But also more classical topics were the subjects of talks, like Hilbert schemes, with the more recent approach where the parametrized schemes are multigraded, real algebraic geometry, toric and homogeneous varieties, and cohomology rings and Gromov–Witten invariants. A more recent topic is binomial ideals, and their primary decomposition. The present volume is fortunate to contain a comprehensive introductory survey on this topic by Ezra Miller, exploring its applications to such varied topics as hypergeometric series, combinatorial game theory, and chemical dynamics.

The local organizers of the symposium were:

Gunnar Fløystad, University of Bergen,
Trygve Johnsen, University of Tromsø,
Andreas L. Knutsen, University of Bergen.

The scientific advisory committee consisted of:

Aaron Bertram, University of Utah, Salk Lake City,
David Eisenbud, University of California, Berkeley,
Frank-Olaf Schreyer, University of Saarbrücken,
Mike Stillman, Cornell University,
Ravi Vakil, Stanford University.

The symposium is intended to be a smaller event, limited upwards to forty speakers and participants. There were nineteen invited speakers, leading experts in their fields. The speakers and titles of the talks were as follows.

- (a) Aaron Bertram, *Deconstructing Coherent Sheaves*
- (b) Mats Boij, *Hilbert Functions and Betti Numbers up to Multiples and Parameter Spaces*
- (c) Anders Buch, *Quantum K-Theory of Grassmannians*
- (d) Aldo Conca, *Syzygies of Veronese and Koszul Algebras*
- (e) David Eisenbud, *Boij–Söderberg Theory: Introduction and possible Future Perspectives*
- (f) Sergey Fomin, *Enumeration of Plane Curves and Labeled Floor Diagrams*
- (g) William Fulton, *Character Formulas*
- (h) Jürgen Herzog, *Powers of Componentwise Linear Ideals*
- (i) Joel Kamnitzer, *Equivalences of Derived Categories from Geometric $sl(2)$ actions*
- (j) Dan Laksov, *A Formalism for Equivariant Cohomology*
- (k) Diane Maclagen, *Connected Multigraded Hilbert Schemes*
- (l) Ezra Miller, *Applications of Binomial Commutative Algebra*
- (m) Sam Payne, *Boundary Complexes and Weight Filtrations*
- (n) Frank-Olaf Schreyer, *Boij–Söderberg Theory for Coherent Sheaves on \mathbf{P}^n*
- (o) Jessica Sidman, *Syzygies of the Secant Varieties of Curves*
- (p) Mike Stillman, *Green’s Conjecture and high rank Syzygies on low rank Quadrics*
- (q) Rekha Thomas, *The Convex Hull of a Real Algebraic Variety*
- (r) Jerzy Weyman, *Quivers with Potentials and their Mutations*
- (s) Andrei Zelevinsky, *Cluster Algebras via Quivers with Potentials*

The Abel Symposium 2009 was held Monday June 1. to Thursday June 4. in the town of Voss in Western Norway. Most of Wednesday was devoted to a trip by bus, boat, and train to the spectacular Nærøfjord, which is on UNESCO’s world heritage list, and the Aurlandsfjord. In chilly but clear weather we went ashore from the boat to a small farm by the Nærøfjord and had an ample lunch. At the end of the Aurlandsfjord we took the Flåm railway, a 20 kilometer trip ascending 866 meter to Myrdal, and from there back to Voss.

We would like to express our gratitude to the Abel foundation and the Norwegian Mathematical Society for giving us the opportunity to organize the Abel Symposium 2009. We also thank the administration at the Department of Mathematics, University of Bergen for their kind help and assistance with practical matters, we thank Bjørn Theisen for doing a solid job with typesetting the articles, and we thank Springer Verlag and especially Ruth Allewelt for an excellent job in following up these proceedings.

Bergen and Tromsø,
22. December 2010

Gunnar Fløystad
Trygve Johnsen
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