

## Report on "Introductory Workshop on the Representation Theory of Finite Groups"

Held at MSRI, February 4, 2008 – February 8, 2008

Organizers: Jonathan Alperin (Chair), Robert Boltje, Markus Linckelmann

### 1. Goals:

The goal of this workshop was to introduce the participants to the representation theory of finite groups. Scheduled were four series of lectures and five single session lectures. The four series were meant to give introductions to four particularly active fields: counting conjectures, representation theory of finite groups of Lie type, representation theory and topology, and Broue's abelian defect group conjecture. The first of these series also included a thorough introduction into the general terminology used in the representation theory of finite groups. The five single talks at the end of the workshop reported on more specialized new results. The idea was to introduce both graduate students and participants of the parallel program on "Combinatorial Representation Theory" to representations of finite groups in order to make upcoming workshops and seminars more accessible for these audiences and to foster interaction between the two programs.

### 2. Description of Lectures:

The first series of lectures on "Block Theory and Counting Conjectures" was held by Burkhard Külshammer. The aim was to introduce terminology used in block theory and use this terminology to present counting conjectures as the Alperin-McKay conjecture, Alperin's weight conjecture and Dade's refinements.

The second series on representations of finite groups of Lie type was split into two parts. Jonathan Brundan gave two talks on the theory in the defining characteristic and Cedric Bonnafé gave a two-lecture introduction into the representation theory in non-defining characteristic, the emphasis being on Deligne-Lusztig theory. Cedric Bonnafé used an almost axiomatic setup for Deligne-Lusztig theory and applied that to a very thorough treatment of the special linear group of degree 2.

The third series on connections between representation theory and topology was held by Markus Linckelmann. He thoroughly presented the basic constructions from simplicial topology and applied them to small categories like fusion systems associated to blocks.

Joe Chuang gave a series of three lectures on Broue's abelian defect group conjecture. This included an introduction to derived equivalences and an outlook on conjectures that could go beyond the abelian defect group case.

Radha Kessar gave a lecture on new work studying sources of simple modules, in particular in finite classical groups. Gabriel Navarro gave a detailed overview of the McKay conjecture, and also his joint work with Isaacs and Malle which reduces the conjecture to quasi-simple groups. Paul Fong reported on recent joint work with Broue

and Srinivasan related to Alperin's weight conjecture for finite reductive groups in non-defining characteristic. Serge Bouc gave an overview of his work on biset functors and applications to the classification of endo-permutation modules. Finally, Dave Benson's talk on "squeezed resolutions" introduced a representation theoretic way of computing the homology of the loop space on the  $p$ -completion of the classifying space of a finite group.

### 3. Achievements:

All four lecture series gave exceptionally high quality introductions to various topics in the representation theory of finite groups, even surpassing the high expectations we had when selecting the speakers. The workshop attracted many graduate students. The ones we talked to were full of praise for the introductory lecture series. MSRI posted videos of all the lectures on their web site. This will be a valuable source not only for the participants of the workshop but also for anybody who wants to become acquainted with the subject. The seminars that took place later in the program always attracted a number of people from the parallel program on "Combinatorial Representation Theory". We would like to think that the successful introductory workshop was one of the reasons for this.

The five more specialized talks made the workshop well rounded. With the reduction of the McKay conjecture to quasi-simple groups and the classification of endo-trivial modules these lectures contained highlights of the research achievements of the last years. Graduate students and post-docs made comments that it felt reassuring that the main open questions and conjectures in the field are not only fascinating but also approachable and that they lead to interesting new connections, for example with algebraic topology.

All of this was made possible by the structure and support given by MSRI!

# *Introductory Workshop on the Representation Theory of Finite Groups*

## **February 4 -8, 2008**

### *Schedule*

<b>Monday February 4, 2008</b>		
09:15AM - 09:30AM	Opening Remarks	
09:30AM - 10:30AM	Burkhard Kuelshammer	Blocks and Counting Conjectures
11:00AM - 12:00PM	Jonathan Brundan	Representations of Algebraic Groups in Characteristic $p$
12:00PM - 02:00PM	Lunch at MSRI	
02:45PM - 03:45PM	Markus Linckelmann	Representation Theory and Topology
03:45PM - 04:15PM	Afternoon Tea	
04:15PM - 05:15PM	Joe Chuang	Broué's Abelian Defect Group Conjecture
<b>Tuesday February 5, 2008</b>		
09:30AM - 10:30AM	Burkhard Kuelshammer	Blocks and Counting Conjectures
11:00AM - 12:00PM	Jonathan Brundan	Representations of Algebraic Groups in Characteristic $p$
12:00PM - 02:00PM	Lunch at MSRI	
02:45PM - 03:45PM	Markus Linckelmann	Representation Theory and Topology
03:45PM - 04:15PM	Afternoon Tea	
04:15PM - 05:15PM	Joe Chuang	Broué's Abelian Defect Group Conjecture
05:15PM - 06:30PM	Reception	
<b>Wednesday February 6, 2008</b>		
09:30AM - 10:30AM	Burkhard Kuelshammer	Blocks and Counting Conjectures
11:00AM - 12:00PM	Cedric BONNAFE	Introduction to Deligne-Lusztig Theory
<b>Thursday February 7, 2008</b>		
09:30AM - 10:30AM	Cedric BONNAFE	Introduction to Deligne-Lusztig Theory
11:00AM - 12:00PM	Markus Linckelmann	Representation Theory and Topology
12:00PM - 02:00PM	Lunch at MSRI	
02:45PM - 03:45PM	Joe Chuang	Broué's Abelian Defect Group Conjecture
03:45PM - 04:15PM	Afternoon Tea	
04:15PM - 05:15PM	Radha Kessar	On Duality Inducing Automorphisms and Sources of Simple Modules in Finite Classical Groups
<b>Friday February 8, 2008</b>		
09:30AM - 10:30AM	Gabriel Navarro	Around the McKay Conjecture
11:00AM - 12:00PM	Paul Fong	A Bijection towards Counting Conjectures in Finite Reductive Groups
12:00PM - 02:00PM	Lunch at MSRI	
02:45PM - 03:45PM	Serge Bouc	Biset Functors
03:45PM - 04:15PM	Afternoon Tea	
04:15PM - 05:15PM	Dave Benson	Squeezed Resolutions over the Group Algebra of a Finite Group

## Currently Available Videos

- Burkhard Kuelshammer , Blocks and Counting Conjectures February 4,2008, 09:30 AM to 10:30 AM
- Jonathan Brundan , Representations of Algebric Groups in Characteristic p February 4,2008, 11:00 AM to 12:00 PM
- Markus Linckelmann , Representation Theory and Topology February 4,2008, 02:45 PM to 03:45 PM
- Joe Chuang , Broué's Abelian Defect Group Conjecture February 4,2008, 04:15 PM to 05:15 PM
- Burkhard Kuelshammer , Blocks and Counting Conjectures February 5,2008, 09:30 AM to 10:30 AM
- Jonathan Brundan , Representations of Algebric Groups in Characteristic p February 5,2008, 11:00 AM to 12:00 PM
- Markus Linckelmann , Representation Theory and Topology February 5,2008, 02:45 PM to 03:45 PM
- Joe Chuang , Broué's Abelian Defect Group Conjecture February 5,2008, 04:15 PM to 05:15 PM
- Burkhard Kuelshammer , Blocks and Counting Conjectures February 6,2008, 09:30 AM to 10:30 AM
- Cedric Bonnafe , Introduction to Deligne-Lusztig Theory February 6,2008, 11:00 AM to 12:00 PM
- Cedric Bonnafe , Introduction to Deligne-Lusztig Theory February 7,2008, 09:30 AM to 10:30 AM
- Markus Linckelmann , Representation Theory and Topology February 7,2008, 11:00 AM to 12:00 PM
- Joe Chuang , Broué's Abelian Defect Group Conjecture February 7,2008, 02:45 PM to 03:45 PM
- Radha Kessar , On Duality Inducing Automorphisms and Sources of Simple Modules in Finite Classical Groups February 7,2008, 04:15 PM to 05:15 PM
- Gabriel Navarro , Around the McKay Conjecture February 8,2008, 09:30 AM to 10:30 AM
- Paul Fong , A Bijection towards Counting Conjectures in Finite Reductive Groups February 8,2008, 11:00 AM to 12:00 PM
- Serge Bouc , Biset Functors February 8,2008, 02:45 PM to 03:45 PM
- Dave Benson , Squeezed Resolutions over the Group Algebra of a Finite Group February 8,2008, 04:15 PM to 05:15 PM

## Participant List

Name	Role	Institution
Al Sharo, Khaled Ahmad	Participant	UCSC
Alghamdi, Ahmad M.	Participant	Umm Alqura University
Alperin, Jon	Organizer	University of Chicago
Andre, Carlos	Participant	University of Lisbon
Arslan, Ogul	Participant	University of Florida
Assaf, Sami H	Member	MIT
AYEKPLE, YAO ELIKEM	Participant	Kwame Nkrumah University of Science and Technology
Balmer, Paul	Participant	UCLA
Benkart, Georgia M.	Participant	University of Wisconsin

Benson, Dave J.	Member	University of Aberdeen
Berg, Chris	Participant	UC Davis
Bhatt, Sheela	Participant	Eritrean Institute of Technology
Bird, Katherine Anne	Participant	University of Illinois at Chicago
Blomgren, Martin	Participant	KTH
Bogdanic, Dusko	Participant	University of Oxford
Boltje, Robert	Organizer	University of California, Santa Cruz
Bonnafe, Cedric	Member	Centre National de la Recherche Scientifique
Bouc, Serge	Member	CNRS - Université de Picardie
Brichard, Joelle	Participant	Columbia University
Brundan, Jonathan	Speaker	University of Oregon
Carlson, Jon F.	Participant	University of Georgia
Chebolu, Sunil Kumar	Participant	University of Western Ontario
Chlouveraki, Maria	Participant	École Polytechnique Fédérale de Lausanne (EPFL)
Chuang, Joe	Participant	University of Bristol
Coskun, Olcay	Participant	Bilkent University
Dabbaghian-Abdoly, Vahid	Participant	Simon Fraser University
Danz, Susanne	Participant	University of Jena
Deshpande, Priyavrat C.	Participant	The University of Western Ontario
Dexter, Kathleen D	Participant	University of Illinois at Chicago
Doty, Stephen	Participant	N/A
Elliot, Jason Walter	Participant	University of Illinois
Eu, Sen-Peng	Participant	U of Minnesota
Fel'shtyn, Alexander	Participant	Boise State University and Szczecin University
Fong, Paul	Member	University of Illinois, Chicago
Futory, Vyacheslav	Participant	Universidade de Sao Paulo
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Goodman, Frederick	Participant	University of Iowa
Graber, John	Participant	University of Iowa
Gramain, Jean-Baptiste B	Participant	EPFL
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Grime, Matthew	Participant	University of Bristol
Halverson, Tom	Participant	University of Macalester
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Herman, Allen	Participant	University of Regina
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Jones, Brant	Participant	University of California, Davis
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Kamnitzer, Joel	Member	American Institute of Mathematics
Kantor, William U.	Participant	University of Oregon
Kashuba, Iryna	Participant	University of Sao Paulo
Kato, Syu	Participant	Kyoto University
Kessar, Radha	Member	University of Aberdeen
Kivran-Swaine, Terence Joseph	Participant	The Graduate Center of CUNY
Koshitani, Shigeo	Participant	Chiba University
Kuelshammer, Burkhard	Participant	University of Jena
Kujawa, Jonathan R	Member	University of Oklahoma
Kunugi, Naoko	Participant	Tokyo University of Science
Le, Tung Thien	Participant	Wayne State University
Lin, Zongzhu	Participant	Kansas State University
Linckelmann, Markus	Organizer	N/A
Loukaki, Maria	Participant	University of Crete
Lyle, Sinead	Participant	University of East Anglia
Lynd, Justin	Participant	The Ohio State University
MacQuarrie, John William	Participant	The University of Manchester

Maisch, Filix Portocarrero	Participant	UCSC
Maroti, Attila	Participant	USC
Mathas, Andrew	Participant	University of Sydney
Mazza, Nadia	Member	University of Aberdeen
Mbirika, Abukuse (Aba)	Participant	University of Iowa
Miller, Michael Gateway	Participant	UC Santa Cruz
Mitra, Dipra Ranjan	Participant	University of Regina
Moci, Luca	Participant	Roma Tre
Mogel, Jennifer	Participant	University of California, Santa Cruz
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Naehrig, Natalie	Participant	RWTH Aachen University
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Nikolova-Popova, Daniela Borislavova	Participant	Florida Atlantic University
Noeske, Felix	Participant	RWTH Aachen University
Onofrei, Sylvia Elena	Participant	Kansas State University
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Orrison, Michael	Participant	Harvey Mudd College
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Poonen, Bjorn	Participant	UCB - University of California, Berkeley
Ragnarsson, Kari	Participant	University of Illinois, Chicago
Rainbolt, Julianne Geering	Member	St. Louis University
Salminen, Adam	Participant	University of Evansville
Sangroniz, Josu	Participant	Universidad del Pais Vasco
Sanus, Lucia	Participant	Universitat de Valencia
Saunders, Neil John	Participant	University of Sydney
Schaps, Mary	Participant	Bar_Ilan University
Shalile, Armin	Participant	Oxford University
Skyner, Tony	Participant	Bristol University
Späth, Britta Kerstin	Participant	N/A
Srinivasan, Bhama	Participant	University of Illinois, Chicago
Stancu, Radu	Participant	University of Kansas
Sun, Jie	Participant	University of Alberta
Swenson, Daniel	Participant	University of Minnesota
Symonds, Peter	Participant	University of Manchester
Thiem, Nat	Participant	University of Colorado
Tiep, Pham Huu	Participant	University of Florida
Turull, Alexandre	Participant	University of Florida
Vazirani, Monica Joy	Member	University of California, Davis
Wakefield, Thomas Philip	Participant	Kent State University
Walter, Marty	Participant	University of Colorado
Webb, Peter	Participant	University of Minnesota
Williams, Adrian Leonard	Participant	Maharakham University
Wolff, Tom	Participant	Ohio University
Yamamoto, Makoto	Participant	University of California
Zárate, Alma Leticia	Participant	CINVESTAV IPN
Zorrilla Masías, Henry	Participant	Universidad Nacional Federico Villarreal