



FIELDS INSTITUTE COMMUNICATIONS

THE FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES

Representations of Algebras and Related Topics

Ragnar-Olaf Buchweitz
Helmut Lenzing
Editors



American Mathematical Society



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Providence, Rhode Island

The Fields Institute for Research in Mathematical Sciences

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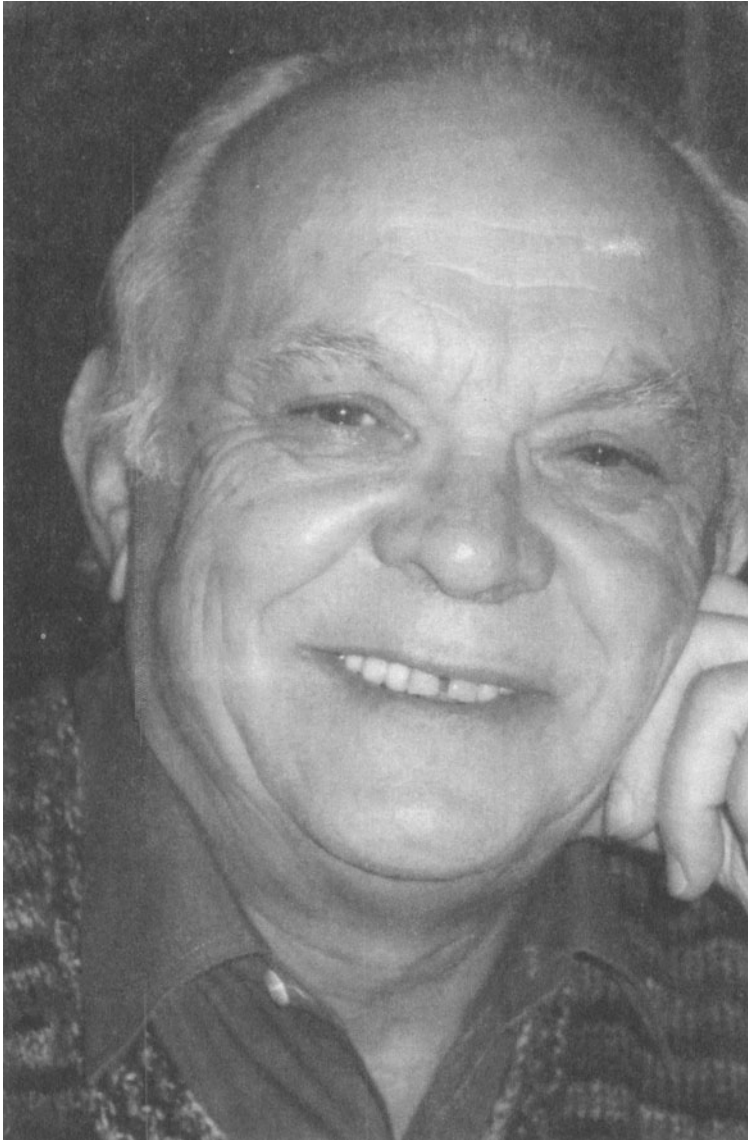
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Vlastimil Dlab

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Dedication

These Proceedings of the Tenth International Conference on Representations of Algebras and Related Topics are dedicated to Professor Vlastimil Dlab on the occasion of his 70th birthday.

Vlasta Dlab, as we are used to call him, was born on August 5, 1932 in the North-Bohemian village of Bzí and graduated from the Charles University at Prague. After a stay at the University of Khartoum he returned to the Charles University in 1964 where he obtained the degree of Dr.Sc. (Doctor of Science) in 1966. In 1965, he joined the Institute for Advanced Studies in Canberra where he stayed for three years. Returning from Australia in 1968, the political situation in Czechoslovakia led him to accept an offer from Carleton University in Ottawa, Canada. He has been working there ever since, now as a Professor Emeritus, interrupted by numerous stays at other first-rate research centres and universities. In 1977, Dlab was elected Fellow of the Royal Society in Canada. For further details in his interesting vita we refer the reader to L. Procházka's article "Sixty years of Professor Vlastimil Dlab", *Czechoslovak Math. J.* 43(118) (1993), 187–192. Here we are going to focus on Dlab's crucial role in the development of the Representation Theory of Finite Dimensional Algebras.

Towards the end of the sixties, Vlasta Dlab had acquired expertise in (mainly abelian) group theory and in ring theory through his work on perfect rings. He became quickly a major player in the newly emerging field of Representations of Finite Dimensional Algebras. From his numerous contributions through research articles, books, and conference volumes we just mention his work on the representation theory of hereditary algebras in the mid-seventies of the last century, joint with C.M. Ringel, laying the foundations of, in particular, tame hereditary representation theory over arbitrary fields, a theory still at the centre of interest. About twenty years ago, he became engaged in the newly developing theory of quasi-hereditary algebras, now one of the corner stones of Finite-dimensional Representation Theory that establishes a secure link to the Representation Theory of Lie Algebras.

It was serendipitous for our community that Dlab devoted his considerable energy to initiate the series of high-level "International Conferences on Representation Theory" (ICRAs). The first and second ICRA actually took place at Carleton University in 1974 and 1979, respectively, as did the sixth ICRA in 1992. These, and the further conferences in the ICRA series followed the format, established by Dlab, that consists of a conference, dedicated to the presentation of recent results in the field, and a workshop serving both the educational goal to introduce newcomers to the subject and displaying the interaction of Representation Theory with other parts of mathematics. The influence these ICRAs have on the rapid development of the field cannot be overestimated.

These conferences traditionally bring together researchers, young or established, from all over the world, and together with their published conference and workshop volumes, allow for fast transmission of ideas and serve to identify the core of our research community.

It is therefore with great pleasure that we take the opportunity of his seventieth birthday that occurred during the conference to dedicate these Proceedings to Vlasta Dlab. This dedication, of course, is in the name of all participants of this conference and is meant as a small 'thank-you' to Vlasta Dlab for his continuous dedication to the subject and the ICRA series, in particular.

Ragnar-Olaf Buchweitz and Helmut Lenzing

Preface

The Tenth International Conference on Representations of Algebras and Related Topics (ICRA X) took place at the Fields Institute in Toronto, Canada from July 15 to August 10, 2002. Although this meeting adhered to the format of the previous conferences established over 20 years ago, the Scientific Advisory Committee (R. Bautista, S. Brenner, R.-O. Buchweitz (co-chairman), M. C. R. Butler, W. Crawley-Boevey, V. Dlab (co-chairman), Y. Drozd, E. Green, D. Happel, M. Kapranov, B. Keller, H. Lenzing, Shaoxue Liu, M.-P. Malliavin, H. Merklen, J. A. de la Peña, I. Reiten, C. M. Ringel, A. V. Roiter, L. L. Scott, S. O. Smalø, A. Skowroński and H. Tachikawa) decided this time to extend the scope of the meeting by a number of Specialized Workshops.

The materials of the Instructional Workshop and the three Specialized Workshops are published in a separate volume, also in The Fields Institute Communications series.

The contributions to this volume cover a wide range of topics. Among the many subjects complementing topics of Representation Theory proper, we just mention Quantum Groups, the Theory of Lie Algebras, the Geometry and Combinatorics of Tilting Theory, Commutative Algebra, Algebraic Geometry, Homology Theories, Derived and Triangulated Categories. This volume therefore documents the increasing interaction between the Representation Theory of Finite Dimensional Algebras and neighbouring subjects. To stimulate further cross fertilization the Proceedings contain a number of survey articles, written by leading experts in the field, dealing with such interactions.

These Proceedings reflect the current state of the subject and — because of the many interactions with other subjects — will be useful to researchers and graduate students with some algebraic background.

All contributions to these Proceedings have been carefully refereed. We would like to express our gratitude to the authors who submitted contributions, and to all referees for their assistance.

We gratefully acknowledge the hospitality and financial support of The Fields Institute. We would also like to thank Miryam Ali, Alison Conway and Elena Kaufman and the staff of the Institute for their help with the running of the meeting, and Debbie Iscoe for the completion of the editorial work.

Ragnar-Olaf Buchweitz and Helmut Lenzing

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Schedule of Talks

Monday, July 22, 2002

DIETER HAPPEL, TU Chemnitz

Tilting Objects in Hereditary Categories

ASLAK B. BUAN, Norwegian University for Science and Technology

Cotilting for Tame Hereditary Algebras

GABRIELLA D'ESTE, University of Milan

Asymmetries for Cotilting Bimodules

DIRK KUSSIN, Universität Paderborn

Prime Ideals in Orbit Algebras

LUISE UNGER, Fernuniversität Hagen

On a Partial Order of Tilting Modules

LUTZ HILLE, Universität Hamburg

The Irreducible Components of Lusztig's Nilpotent Variety and Crystal Bases

EDSON RIBEIRO ALVARES, Universidade Federal do Paraná

Embedding of Some Translation Quivers into $\mathbb{Z}\Delta$

EDUARDO MARCOS, Universidade de São Paulo

Koszul Modules and Modules with Linear Presentations

FLAVIO ULHOA COELHO, Universidade de São Paulo

Two-sided Gluings of Tilted Algebras

MARK KLEINER, Syracuse University

Hereditary Abelian Categories with a Serre Duality and Comodules over Path Coalgebras

Tuesday, July 23, 2002

MICHALE BAROT, Universidad Nacional Autónoma de México

Generalized Serre-relations

RAYMUNDO BAUTISTA, Instituto de Matematicas, Morelia

On Generic Modules

OLENA DROZD, Kiev Taras Shevchenko University

Reduction Algorithm for Generalized Boxes

YURIY DROZD, Kiev Taras Shevchenko University
Coverings of Tame Algebras

RITA ZUAZUA, Instituto de Matematicas, Morelia
An Exact Structures for Lift Categories

THOMAS BRÜSTLE, Universität Bielefeld
Tame Tree Algebras

CLAUDE CIBILS, Université de Montpellier
The Hochschild Cohomology Algebra of an Extension

EDWARD GREEN, Virginia Tech
Hochschild Cohomology Rings of Monomial Algebras

HIROSHI NAGASE, Osaka City University
Relative Hochschild Cohomology and Smoothness

OEYVIND SOLBERG, Norwegian University for Science and Technology
Support Varieties and Hochschild Cohomology Rings

CHRISTOF GEISS, Universidad Nacional Autónoma de México
The Indecomposable Representations of the Quaternion Algebra

Wednesday, July 24, 2002

DAN ZACHARIA, Syracuse University
Selfinjective Koszul Algebras

BERNHARD KELLER, Université Paris 7
A-infinity-Yoneda Algebras via Twisting Cochains: An Example

DAG MADSEN, Universität Bielefeld/NTNU, Trondheim
Generalized Koszul Duality

ROBERTO MARTINEZ-VILLA, Universidad Nacional Autónoma de México
Koszul Algebras and Sheaves over Projective Space

A. MARTSINKOVSKY, Northeastern University
Non-commutative Sheaf Cohomology and Vogel Cohomology over Koszul Quiver Algebras

JAN SCHRÖER, University of Leeds
Stable Endomorphism Algebras of Modules over Special Biserial Algebras

JENS BENDER, Bergische Universität Wuppertal
Minimal Singularities in Orbit Closures of Matrix Pencils

MARY SCHAPS, Bar-Ilan University
Blocks of Group Algebras, Tiltings, and Decomposition Matrices

GRZEGORZ BOBINSKI, Nicholas Copernicus University, Torun
Exact Functors Between Module Categories

ANGELA HOLTSMANN, Universität Bielefeld
Multiple Flag Varieties of Tame Type: The s -tame Dimension Vectors of Stars

HENNING KRAUSE, Universität Bielefeld
Realizability of Modules over Tate Cohomology

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IDUN REITEN, Norwegian University for Science and Technology
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JOSE ANTONIO DE LA PENA, Universidad Nacional Autónoma de México
Supercanonical Algebras

HELMUT LENZING, Universität Paderborn
Hereditary Noetherian Categories with a Commutative Function Field

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VOLODYMYR MAZORCHUK, University of Uppsala
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MASAHISA SATO, Yamanashi University
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SVERRE O. SMALØ, Norwegian University for Science and Technology
Finiteness of Global Dimension

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MIRJANA VUKOVIC, University of Sarajevo, Bosnia and Herzegovina
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GLADYS CHALOM, Universidade de São Paulo
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Semiartinian Rings with Primitive Factors Artinian

H. MERKLEN, Universidade de São Paulo
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BERNT TORE JENSEN, Norwegian University for Science and Technology
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KENNETH K. NWABUEZE, University of Brunei
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FANG LI, Zhejiang University
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SHEILA BRENNER, University of Liverpool
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O. IYAMA, Himeji Institute of Technology
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ANDRE BEINEKE, Universität Bielefeld
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MARIA JOSE SOUTO, Universidade da Corunha
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JUSTYNA KOSAKOWSKA, Nicholas Copernicus University, Torun
Generic Extensions of Posets Representations

GREGORZ SWARA, Nicholas Copernicus University, Torun
Desingularizations and Geometry of Orbit Closures in Module Varieties

IGOR BURBAN, Universität Kaiserslautern
Derived Tameness of Certain Associative Algebras

XUEQING CHEN, Carleton University
Properly Stratified Endomorphism Algebras

JIN YUN GUO, Hunan Normal University
Selfinjective Koszul Algebras of Finite Complexity

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The Incidence Algebras of Tame Type

ALEXANDER ZAVADSKIJ, Universidad Nacional de Colombia
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ZYGMUNT POGORZALY, Nicholas Copernicus University, Torun
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AMNON NEEMAN, The Australian National University
A Survey of Well Generated Triangulated Categories

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Resulting from the Tenth International Conference on Representations of Algebras and Related Topics held at The Fields Institute (Toronto, ON, Canada), this collection of research and survey articles, honoring Vlastimil Dlab's seventieth birthday, reflects state-of-the-art research on the topic.

Leading experts contributed papers, demonstrating the interaction between representation theory of finite dimensional algebras and neighboring subjects. A wide range of topics are covered, including quantum groups, the theory of Lie algebras, the geometry and combinatorics of tilting theory, commutative algebra, algebraic geometry, homology theories, and derived and triangulated categories. The book is suitable for graduate students and researchers interested in the theory of algebras.

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