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WORKSHOP ON NON-ASSOCIATIVE ALGEBRAS AND THEIR APPLICATIONS

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Editorial

The first examples of non-associative rings and algebras appeared in the mid-19th century. Since then the theory has evolved into an independent branch of algebra, exhibiting many points of contact with other fields of mathematics and natural sciences. The aim of this workshop was to bring together mathematicians, physicists and other natural scientists interested in this field, with a focus on increasing the quality of research, promoting interaction among researchers and discussing new directions for the future.

Many important classes of non-associative algebras, such as Jordan algebras, have originated in a physics context or have been developed due to their applications in physics. Superalgebras and their representations, supermodules, provide an algebraic framework for formulating supersymmetry in theoretical physics, though they first appeared (as graded algebras) in the context of algebraic topology and homology. They also play an important role in the related field of supergeometry where they enter the definitions of graded manifolds, supermanifolds and superschemes. Vertex operator algebras (VOAs) were first considered by physicists in connection with chiral algebras and two-dimensional conformal field theory, and subsequently by mathematicians who noticed remarkable links between finite simple groups and modular functions. Some axiomatic approaches to VOAs inspired the introduction of code algebras. Potential algebras are a powerful tool to obtain the spectrum and scattering amplitude of quantum mechanical models in a purely algebraic setting. The Lie ageing algebra has been studied in connection with a class of non-equilibrium phenomena known as 'ageing' which are related to strongly interacting many-body problems. The first four papers in these proceedings are contributions to problems in these areas.

Many generalisations of Lie and associative algebras have been introduced to tackle a variety of problems in mathematics and physics. Leibniz algebras come in two forms, satisfying variants of the Jacobi identity implying that right or left multiplications by an element are derivations; those in which both are derivations are called symmetric. A Leibniz algebra which is also anti-commutative is a Lie algebra. They have natural connections to a variety of areas, including algebraic K-theory, classical algebraic topology, differential geometry, homological algebra, loop spaces, noncommutative geometry and physics. Hom–Lie algebras first appeared in the study of quantum deformations of Witt and Virasoro algebras; they are generalisations of Lie algebras, where the Jacobi identity is twisted by a linear map. They are related to discrete and deformed vector fields, and differential calculus. Triple systems were introduced by Jacobson in 1949 to study subspaces of associative algebras closed under triple commutators and triple anti-commutators. They are important in the study of symmetric spaces and their generalisations. As is well known, the Cayley–Dickson process arises from the doubling procedure which produces quaternion and octonion algebras, the latter of which are examples of alternative algebras. Coalternative algebras are dual, in a categorical sense, to alternative algebras. The next four papers fall into these areas.

Crossed product algebras are important in the theory of central simple algebras: any central simple algebra over a local or global field is a crossed product algebra. Certain non-associative algebras have been employed systematically to build fast decodable space-time block codes, used for wireless digital data transmission, for example, in mobile phones, laptops or portable TVs. Delsarte–Goethals code belongs to a family of non-linear binary error-correcting codes. The last two papers relate to these areas.

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Talks

- Helena Albuquerque (University of Coimbra), *Algebras, Superalgebras and Quasialgebras*
- Elisabete Barreiro (University of Coimbra), *The structure of Leibniz superalgebras admitting a multiplicative basis*
- Vladimir Bavula (Sheffield University), *Classification of simple weight modules over the Schrödinger algebra*
- Saïd Benayadi (University of Lorraine), *Poisson admissible algebras and Symmetric Leibniz algebras*
- Georgia Benkart (University of Wisconsin-Madison), *G2-invariants from cross product algebras*
- Jose Brox (University of Coimbra), *Nonassociative products in nonassociative algebras with involution*
- Yolanda Cabrera (Universidad de Málaga), *Evolution algebras*
- Manuel Ceballos (Universidad Loyola Andalucía), *Filiform Lie algebras*
- Vladimir Dotsenko (Trinity College Dublin), *A unified framework for PBW type theorems*
- Alberto Elduque (University of Zaragoza), *Gradings on semisimple algebras*
- Alice Fialowski (Eotvos Lorand University), *Lie algebras with invariant inner product, and their cohomology*

- Waldemar Hołubowski (Silesian University of Technology), *Ideals and derivations in Lie algebras of infinite matrices*
- Benedikt Hurle (Université de Haute-Alsace), *Alpha-type Cohomologies and Deformations of Hom-algebras*
- Natalia Iyudu (Edinburgh University), *Hilbert series and Koszulity for quadratic algebras via the Groebner bases*
- Julian Külshammer (Universität Stuttgart), *Understanding quasi-hereditary algebras using A-infinity algebras*
- Abdenacer Makhlouf (University of Haute Alsace), *Quantum Deformations, Twistings and Hom-Type algebraic structures*
- Sandro Matterai (University of Lincoln), *Exponentials of derivations in prime characteristic*
- Consuelo Martinez (University of Oviedo), *Superconformal algebras and their representations*
- Justin McInroy (Bristol University), *Code algebras, axial algebras and VOAs*
- Tobias Moede (TU Braunschweig), *Searching for new simple Lie algebras in small characteristic*
- Fernando Montaner (University of Zaragoza), *Some Herstein-like theorems on Tracers in associative systems*
- Jacob Mostovoy (Cinvestav IPN), *Leibniz homology and differential graded Lie algebras*
- Mária Pilar Páez-Guillán (University of Santiago de Compostela), *On Whitehead's quadratic functor for supermodules*
- Alexander Premet (University of Manchester), *Lie algebras without strong degeneration and the Richardson property*
- Susanne Pumpluen (University of Nottingham), *Nonassociative algebra obtained from skew polynomial rings and their applications*
- Elizabeth Remm (Universite de Haute Alsace, Mulhouse), *Geometrical Structures on Lie algebras*
- Johan Richter (Lunds Universitet), *Non-associative Ore extensions*
- Ignacio Rúa (University of Oviedo), *Nonassociative rings and nonlinear codes*
- Ivan Shestakov (University of Sao Paulo), *The speciality problem for Malcev algebras*
- Stanislav Shkarin (Queen's University, Belfast), *Construction of hypercyclic multiplication operators via factoring nonassociative normed algebras*
- Sergey Shpectorov (University of Birmingham), *Jordan algebras, Matsuo algebras, double axes*
- Morten Wesche (TU Braunschweig), *Enumeration of class 2 associative algebras over finite fields*

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