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KAY MAGAARD (1962-2018)

We would like to dedicate this volume of the Albanian Journal of Mathematics to the memory of the former Editor and our dear friend and colleague, Kay Magaard (1962 – 2018). With Kay's passing, the mathematical community lost one of its most distinguished members, whose outstanding work is long lasting and has profoundly influenced many others.

Kay Magaard was an unusually broad and prolific mathematician. His research covers a great variety of topics in group theory, but also in many other fields of mathematics where groups, i.e. symmetries play a significant role. A particular focus of his work lies in groups of Lie type, finite and infinite, and related structures such as braid groups and Iwahori-Hecke algebras. Kay was well versed in all aspects of finite simple groups. He was in particular interested in enhancing the classification theorem by investigating maximal subgroups and irreducible representations of the finite simple groups, and then also in applying his findings to questions outside group theory. A recurrent feature of his work was his experimental and algorithmic approach.

Beginning with his PhD thesis from the year 1990, supervised by Michael Aschbacher, he was interested in the description and classification of maximal subgroups of groups of Lie type, and in particular classical groups. Since then, he has coauthored about ten publications devoted to this topic, although this is not always visible from a first glance at the titles. For example, his papers on the irreduciblilty of tensor products, symmetric and alternating powers of certain irreducible representations or the imprimitivity of irreducible representations of finite simple groups are motivated in part by Aschbacher's famous theorem on maximal subgroups of classical groups. An irreducible representation of a finite simple group (or more generally, a quasisimple group) yields an embedding of the group into a classical group. If this representation is also tensor decomposable or imprimitive, this embedding generally does not give rise to a maximal subgroup.

More than ten papers of Kay and coauthors are devoted to various other aspects of groups of Lie type. The majority of these is motivated by the constructive recognition problem for finite matrix groups. Topics are generation properties of particular series of groups of Lie type and identification algorithms using the black box model. Three papers contribute to the general representation theory theory of groups of Lie type.

A collection of seven papers of Kay reflects much of his recent work. These are devoted to the description and computation of the generic ordinary character tables of Sylow p-subgroups of series of groups of Lie type of characteristic p. The word "generic" refers to the fact that a description of the character tables is given in a parametrized form which applies to all groups in the series. An example is the series of Chevalley groups $D_4(q)$, where q is any prime power. Such generic tables are particularly useful in the ℓ-modular character theory of these groups for primes $\ell \neq p$.

Two papers of Kay deal with the representation theory of general finite groups, one with the character theory of a particular series of finite groups. Another two important papers, more than 150 pages in total, coauthored with Gernot Stroth, contribute a particular difficult piece to the revision project of the classification of the finite simple groups. Namely, the results build a bridge between two distinct strategies approaching this revision.

Four articles of Kay and coauthors are concerned with the theory of finite permutation groups. Particular impressive is his work towards a classification of those such groups, whose elements have only few fixed points. This program has been completed for permutation groups with each element having at most three fixed points. If the elements of a finite permutation group have at most one fixed point, this group either acts regularly or is a Frobenius group; the structure of Frobenius groups was elucidated by Frobenius. This series of papers thus continues Frobenius' work, but it also has applications to topology.

Much of the research of Kay was devoted to applications of the theory of finite simple groups, their subgroups and representations. These applications sometimes lie inside, sometimes outside group theory. An example of the latter is a major contribution to the classification of distance transitive graphs. Examples for the former are provided by a series of three important papers of Kay with coauthors dealing with the $k(GV)$-problem. This goes back to a famous question of Richard Brauer in modular representation theory. In this particular setting, which arises as a minimal configuration in the context of Brauer's question, G is a finite group acting faithfully and irreducibly on the finite vector space V with $|G|$ and $|V|$ coprime. In this situation, Brauer's question suggests that the number of conjugacy classes of the semidirect product GV should be at most equal to $|V|$. After a long tour of reductions and the handling of special cases by numerous authors including John Thompson, Kay and his collaborators managed to finally settle this problem which has been open for such a long time.

With more than 20 articles, applications to topology and algebraic geometry constitute the largest portion. These include applications to curves and surfaces, settling in particular a conjecture of Guralnick and Thompson on the composition factors of monodromy groups of Riemann surfaces of genus 0. Recent investigations are concerned with Beauville structures of quasisimple groups, where Kay and his coauthors prove a conjecture of Bauer, Catanese and Grunewald. A common feature of most of these investigations is the calculation of fixed point ratios of permutation groups and character ratios of groups of Lie type. These require detailed knowledge on the ordinary character tables of such groups, in particular deep insight into the results of Deligne-Lusztig theory. Kay was the main force behind the classification of the full automorphism groups of algebraic curves of a given genus $g \geq 2$ and determining the inclusion among the loci of curves with prescribed automorphism group in the moduli space of curves. Together with Shaska, Shpectorov, and Völklein they devised algorithms and wrote software to determine the braid orbits. With Shaska and Völklein, Kay studied geometrically decomposable 2-dimensional Jacobian varieties and with Völklein general curves of genus 3 and Weierstrass points on Hurwitz curves. His expertise in both computational group theory and algebraic geometry was truly impressive.

The breadth and the profoundness of Kay's contributions to mathematics, in particular to the theory of groups of Lie type and the finite simple groups, is absolutely remarkable; no less impressive was his potential to identify relevant problems outside group theory, to which he could successfully apply his knowledge. His ability to inspire others for his ideas is also unmatched. His articles exhibit the incredible number of 67 coauthors. The undersigned are two of them. We gratefully acknowledge our fortune of having been able to profit from Kay's immense intuition and insight.

Gerhard Hiss
Tony Shaska