Plenary Sessions

Monday

16:00 Robert Soare - Mathematics and the Turing Renaissance (Keynes Lecture Theatre 1)

Abstract: David Hilbert greatly influenced the foundations of mathematics from 1900 to 1930. First, Hilbert wanted a finite consistency proof for mathematics, beginning with arithmetic. Second, he proposed the *Entscheidungsproblem* (decision problem), which was to find an algorithm to decide whether a given statement in the language of mathematics is valid. In 1931 Kurt Gödel dramatically refuted the first program.

Turing and Alonzo Church (Turing's subsequent thesis adviser at Princeton) worked independently on the *Entscheidungsproblem*. Their approach was: (1) to find a precise mathematical definition for the computable functions; and (2) to demonstrate that every informally computable function was captured by the formal definition. Gödel doubted that this was even possible because "the notion of a finite computation is not defined, but serves as a heuristic principle." In 1934 and 1935 Church proposed two different solutions, but Gödel rejected both, even though the second was based on Gödel's own definition in 1934 of a recursive function. In contrast, Gödel immediately accepted Turing's 1936 analysis and wrote, "That this really is the correct definition of mechanical computability was established beyond any doubt by Turing."

By 1937, the three definitions of computable functions had been proved mathematically equivalent. In retrospect, Church got it right and got it first. Why should Church not get the credit? The problem, however, was not simply a mathematical one. Turing demonstrated extraordinary creative insight into the nature of computability. Like Michelangelo, Turing saw the figure in the marble more clearly than anyone else. Why Turing and not Church? The reply is, "Why Michelangelo and not Donatello?" This lecture will include slides of Renaissance art and a careful comparison to make this point.

http://www.people.cs.uchicago.edu/~soare/Art/

18:30 Andrew Hodges – The Life and Work of Alan Turing
(Public Lecture – Woolf Lecture Theatre)

Abstract: Nowadays it is widely acknowledged that Turing's 1936 definition of computability, and his discovery of the concept of the universal machine, provided the foundation for the digital computer in 1945. But Turing was not simply a logician. In this talk, I shall bring out how Turing's 1936 work arose out of a wide field of enquiry with many mathematical elements, and also from his own individual experience as a young man. Then, that Turing's broad approach to mathematics, science and technology led him through the wartime cryptographic work into his own electronic computer plan of 1945. This breadth of mathematical knowledge, philosophy and application also created the basis for his Artificial Intelligence plans and for his theory of biological growth.

Tuesday

11:30 Christine Bessenrodt - On the combinatorics of quasisymmetric functions. (KLT 1)

Abstract: Symmetric functions are ubiquitous in mathematics and its applications. Their importance in diverse areas such as invariant theory, representation theory, algebraic geometry and statistics has increased along with the development of combinatorial tools, the most prominent ones being Young diagrams and tableaux. Originating with Stanley's theory of P-partitions, in 1983 Gessel introduced quasisymmetric functions, which display only a shift-invariance; they have since been a useful tool in many areas of algebraic combinatorics. For the theory of symmetric functions, they lead to refinements of fundamental features such as the basis of Schur functions and corresponding structure constants. Via a specialization of the nonsymmetric Macdonald polynomials, Haglund, Luoto, Mason and van Willigenburg recently defined quasisymmetric Schur functions and showed that these form a basis of the Hopf algebra of quasisymmetric functions; jointly with Luoto and van Willigenburg, we have generalized this further and linked it to pendants of Schur functions in the Hopf algebra of noncommutative symmetric functions. Some properties of these quasisymmetric functions and associated new combinatorics involving compositions and suitably defined tableaux will be discussed which substantiate that the new bases are truly counterparts of the classical Schur basis of the Hopf algebra of symmetric functions.

17:00 Christiane Tretter - Operator theory and applications: a fruitful interplay.
(Keynes Lecture Theatre 1)

Abstract: The theory of linear operators is an important tool to investigate the stability of physical systems or their time evolution. In turn, applications from physics and engineering have contributed considerably to the advances of operator theory. The most prominent example of this fruitful interaction is the interplay between quantum mechanics and the theory of self-adjoint operators in Hilbert spaces.

In this talk recent advances and applications of operator theory are presented. Special attention is paid to non-selfadjoint eigenvalue problems which occur frequently e.g. in hydrodynamics or magnetohydrodynamics. Here numerical calculations may fail to produce reliable results and, thus, rigorous analytical information provided by operator theoretic methods is highly desirable.

Wednesday

11:30 LMS meeting/ Idun Reiten - Quivers in representation theory (Keynes Lecture Theatre 1)

Abstract: Quivers (i.e.directed graphs) have played an important role in the representation theory of finite dimensional algebras and related topics. In particular, we explain how, associated with a finite quiver without oriented cycles, there are finite dimensional path algebras kQ, preprojective algebras, Coxeter groups and cluster categories. The introduction of the latter, in work with Buan, Marsh, Reineke and Todorov, was motivated by the theory of cluster algebras of Fomin and Zelevinsky. We discuss categories with similar properties as cluster categories, associated with preprojective algebras and elements of Coxeter groups, from work with Buan, Iyama and Scott. We also discuss a correspondence between elements in the Coxeter group associated a quiver Q and certain subcategories of kQ-modules, from recent work with Oppermann and Thomas.

17:00 Presentation from the Newton Institute (Keynes Lecture Theatre 1)

Thursday

11:30 Martin Lorenz - Prime ideals and group actions in noncommutative algebra
(Keynes Lecture Theatre 1)

Abstract: Having originated from number theory, the notion of a prime ideal has become central in many different branches of algebra. This talk will focus on the role of prime ideals in the representation theory of noncommutative algebras and the use of group actions as an efficient tool in organizing the spectrum of all prime ideals of a given noncommutative algebra.

The emphasis will be on the case where an affine algebraic group G acts rationally by automorphisms on R. Then the prime spectrum of R is partitioned into "G-strata", each of which can be described in terms of the prime spectrum of a certain *commutative* algebra. Recent work on quantized coordinate algebras R of algebraic varieties has revealed that, in many examples of interest, there is a suitable choice of the acting group G, usually an algebraic torus, such that there are only finitely many G-strata. The resulting finite set tends to carry an intricate combinatorial structure.