

Ramanujan Mathematical Society Conference  
IISER, Pune, June 23-27, 2014  
Symposium on "Finite groups"

**The following three talks are of 55 min each**

1. **I. B. S. Passi**, Emeritus Professor, Panjab University, Chandigarh and Honorary Professor, IISER Mohali

Title: Automorphisms of Group Extensions

Abstract: Given an exact sequence  $1 \rightarrow N \rightarrow G \rightarrow Q \rightarrow 1$  of groups, I will discuss the problem of extending (resp. lifting) an automorphism of  $N$  (resp.  $Q$ ) to an automorphism of  $G$ .

2. **Ajit Iqbal Singh**, INSA Honorary Scientist, ISI Delhi

Title: Projective representations of finite groups and applications

Abstract. The talk can be thought of as a modest Centenary celebration of the advent of "Projective representations of groups" under the name "Representations of groups by Fractional linear substitutions", courtesy I. Schur. The topic has grown into a big tree nurtured by reputed algebraists, analysts, mathematical physicists and computer scientists. Concepts and basic theory in the context of finite groups will be developed. A few results relevant to applications to Quantum Information theory will be presented. Some concrete examples of nice error bases will be shown including those given by R.F. Werner, K.R. Parthasarathy et al, A. Klappenecker and M. Roetteler.

3. **Ravi Rao**, Professor, TIFR Mumbai

Title and Abstract (to be announced)

## The following five talks of 25 min each

4. **Manoj K. Yadav**, Associate Professor, HRI, Allahabad

Title: Class-preserving automorphisms and central quotients of finite  $p$ -groups

Abstract: An automorphism of a given group is said to be (conjugacy) class-preserving if it maps each element of the group to its conjugate. Notice that all inner automorphisms of any group are class-preserving. The first group having a non-inner class-preserving automorphism was constructed by W. Burnside in 1913, about 100 years ago. This group is a special  $p$ -group of order  $p^6$  for an odd prime  $p$ , and it admits maximum possible number of class-preserving automorphisms. Starting from some historical remarks, I'll discuss about finite  $p$ -groups admitting maximum number of class-preserving automorphisms, and present somewhat surprising results when the nilpotency class of the group is larger than 2. A classification theorem will be presented in most of the cases. On the way, I'll introduce a generalization of Camina groups and report some interesting results. A Camina group is a group whose elements, lying in the complement of its commutator subgroup, have maximal conjugacy class size. A generalization of converse of a theorem of Schur by B. H. Neumann will be discussed, and a classification of finite  $p$ -groups having maximum possible central quotient will be presented as an application. For many other applications of class-preserving automorphisms and a geometric connection, please have a look at a recent article of Boris Kunyavskii available at [www.arxiv.org/abs/1304.5053](http://www.arxiv.org/abs/1304.5053)

5. **Amit Kulshrestha**, Assistant Professor, IISER Mohali

Title: Wedderburn decomposition of special 2-groups over rationals

Abstract: Quadratic forms and representations of finite groups are seemingly two different fields of algebra. In this talk we demonstrate how quadratic forms over the field of order 2 can be utilized to understand the Wedderburn decomposition of certain 2-groups over rationals.

6. **Madhu Raka**, Professor, Panjab University, Chandigarh

Title: Self dual and self orthogonal ideals in the finite group algebra of a cyclic group

Abstract: Let  $G$  be a finite cyclic group of order  $n$  and  $F = \mathbb{F}_q$  be the finite field of order  $q$ . A cyclic code of length  $n$  over  $\mathbb{F}_q$  is an ideal of the group algebra  $FG$ . In this talk we will discuss the existence of self-dual and self-orthogonal ideals in group algebra  $FG$ . If  $FG$  is semi-simple then self-dual ideals do not exist. In fact self-dual cyclic codes of length  $n$  over  $\mathbb{F}_q$  exist if and only if  $q$  is a power of 2 and  $n$  is even. We will explore the necessary and sufficient conditions under which cyclic self-orthogonal codes of length  $n$  over  $\mathbb{F}_q$  exist.

7. **Gurmeet K. Bakshi**, Professor, Panjab University, Chandigarh

Title: Group Rings of finite groups: Primitive central idempotents and central units

Abstract: Let  $G$  be a finite group. In order to understand the algebraic structure of the rational group algebra  $\mathbb{Q}G$ , an essential step is to compute a complete set of primitive central idempotents and the Wedderburn decomposition of  $\mathbb{Q}G$ . These computations, in turn, help to investigate the group of central units in the integral group  $\mathbb{Z}G$ . This talk is a survey on this topic together with some new advances in understanding the centre of the unit group of  $\mathbb{Z}G$ .

8. **Anupam Kumar Singh**, Assistant Professor, IISER Pune

Title and Abstract (to be announced)