OLGUTA BUSE (Indiana University-Purdue University Indianapolis)
Symplectic and Contact Packing Problems
We will introduce the audience to concepts such as symplectic packing problems and to what is now known about the concept of packing stability (joint with R. Hind and E. Opshtein). Then we introduce a proposal on how to develop contact analogues of these questions and present one of our recent result in the contact world of lens spaces. This is done in collaboration with David Gay.

RACHEL DAVIS (Purdue University)
Introduction to Reciprocity Laws
We will introduce cyclotomic fields and discuss the relation to quadratic reciprocity and to patterns of the splitting of prime ideals in Galois extensions.

TEENA GERHARDT (Michigan State University)
Computations in Algebraic K-Theory
Algebraic K-theory brings together classical invariants of rings with homotopy groups of topological spaces. In general algebraic K-theory groups are difficult to compute, but in recent years methods in equivariant stable homotopy theory have led to many important K-theory computations. I will introduce algebraic K-theory as well as this approach to K-theory computations, and discuss several successes of these methods.

BARBARA KEFITZ (Ohio State University)
Linear and Nonlinear Waves in Gas Dynamics
This talk explores some puzzles of multidimensional conservation laws (quasilinear hyperbolic partial differential equations) by looking at two types of characteristic families in a model system: the Euler equations of compressible fluid flow. There is as yet no existence theory for such systems, and a considerable amount of recent activity raises questions of whether these equations, and others like them, are even well-posed. The classical theory of characteristics provides a framework that unifies some observations, and suggestions directions for further study.

GLORIA MARI-BEFFA (University of Wisconsin-Madison)
Geometric Realizations of Completely Integrable PDEs: Continuous and Discrete Cases
The Vortex filament flow (VF) is a well known evolution of filaments that when written in terms of the curvature of the filament becomes the well-known non-linear Schrodinger (NLS) equation, a completely integrable PDE. Thus VF is said to be an Euclidean realization of NLS. During the last few decades there has been a flurry of literature discovering new local realizations of most integrable PDEs and investigating the consequences of this and similar connections between geometric curve flows and integrable systems, not only in Euclidean but in most other classical geometries (projective, conformal, symplectic, etc). The studies included the generation of Hamiltonian structures from the background geometry and the lifts of these structures to the curves. In this talk we will briefly describe this connection and will focus on the more recent discrete case, including the effective use of discrete moving frames. For discrete integrable flows and maps most problems remain open.
Claudia Polini (University of Notre Dame)

Curves singularities and Rees rings

Determining the defining equations of Rees rings is a classical problem in elimination theory, commutative algebra, and algebraic geometry that recently has drawn a great deal of interest by applied mathematicians in geometric modeling. The defining ideals of Rees rings give the implicit equations of varieties that are given parametrically and provide information about the singularities of these varieties. We will discuss these problems for rational curves in projective space.

Camelia Pop (University of Minnesota-Twin Cities)

Transition Probabilities for Degenerate Diffusions Arising in Population Genetics

We study the transition probabilities of a class of degenerate diffusions arising as models for gene frequencies in population genetics. The processes we consider are a generalization of the classical Wright-Fisher model, and they are defined through their infinitesimal generator, which is a boundary-degenerate operator defined on compact manifolds with corners, of which simplices and convex polyhedra are particular examples. Under suitable conditions, we find that the transition probabilities have a singular structure that described the absorbing and reflecting behavior of the underlying diffusion on the boundary components of the compact manifold with corners. This is joint work with Charles Epstein.

Dima Sinopova (University of Illinois at Chicago)

Combinatorial Principles and Large Cardinals

Large cardinals are objects with very strong reflection properties: if something holds at a large cardinal $\kappa$, it must also hold for many cardinals below. A large cardinal axiom asserts the existence of such a cardinal and provides a strict strengthening of ZFC. Large cardinals imply compactness-type combinatorial properties: if something holds at every substructure, then it holds at the whole structure. Key examples are the tree property and failure of Jensen's square, which follow from large cardinals but can hold at small cardinals. A main theme in set theory is how much compactness-type combinatorial principles can be forced from large cardinals. In other words how un-L-like can the universe be, where L is Gödel's constructible universe. We will introduce some background on combinatorial principles and large cardinals, and then discuss some recent results on the forcing the tree property.

Betsy Stovall (University of Wisconsin-Madison)

Recent Progress on the Restriction Problem for Flat Manifolds

The Fourier restriction problem asks for the optimal range of exponents $(p,q)$ for which the operator defined by restricting the Fourier transforms of Schwartz functions to lower dimensional manifolds extends as a bounded operator from $L^p$ to $L^q$. Curvature of the manifold turns out to be a crucial issue. In this talk we will give an introduction to the general restriction problem and describe some recent progress and open questions for manifolds whose curvature vanishes on some nonempty set.

Xiaoyi Zhang (University of Iowa)

On the Critical Nonlinear Schrodinger Equations

I will give a high level overview on the well-posedness theory for the nonlinear Schrodinger equation in the critical regularity.