Seminars 2014–2015

Date: Monday September 8th.
Time: 3:00 - 5:00
Place: SER 244 (Physics)
Speaker: Mark Fels, USU
Title: Backlund Transformations
Abstract: Backlund Transformations often appear in geometry and integrable systems. I will show how they are used to generate solutions of non-linear partial differential equations. Many Backlund transformation admit a parameter and this fact can be used to find a non-linear superposition formula for solutions which I would like to demonstrate.

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Date: Monday September 22nd.
Time: 3:00 - 5:00
Place: SER 244 (Physics)
Speaker: Mark Fels and Nghiem Nguyen, USU
Title: Solitons, conservations laws, and the stability of solutions to KdV.

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Date: Monday September 29,
Time: 3:00 - 5:00
Place: SER 244 (Physics)
Speaker: Andreas Malmendier, USU Title: Title: Geometric interpretation of periodic solutions to the KdV-equation (I).

I will show that a two-parameter family of periodic solutions to the KdV-equation can be viewed as an elliptically fibered threefold. I will also show that similarly families of hyperelliptic curves give rise to families of more general periodic solutions to the KdV equation as well. As a concrete example, I will then look at a certain simple subvariety sitting inside the aforementioned threefold and construct its double cover, which turns out to be a family of hyperelliptic genus-two curves. I will derive the algebraic relations that relate the corresponding solutions to KdV.

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Date: Monday October 6.
Time: 3:00-5:00
Place: SER 244
Speaker: Stefan Mendez-DIez
Title: Magnets: What Do They Stick To?

Abstract: The purpose of this talk is to explore the interplay between mathematics and physics by taking a closer look at the theory of Electricity and Magnetism following the early paper by Dr. Sheldon Cooper of the same title. We will start with the normal physicist's formulation of Maxwell's equations and then rewrite them from the perspective of a mathematician. This will allow us to describe what charge is as a mathematical object. We will then give a mathematical generalization of Maxwell's equations motivated by string theory and explore how physical phenomena can inform our understanding of the underlying mathematical structures.

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Date: Monday October 13,
Time: 3:00 - 5:00
Place: SER 244 (Physics)
Speaker: Andreas Malmendier, USU
Monday Oct. 13,
Title: Geometric interpretation of periodic solutions to the KdV-equation (II).

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Date: Monday Oct. 20th
Time: 3:00-5:00

Place: SER 244 (usual place)
Speaker: Zhaohu Nie, USU
Title: Lie-Poisson structures and Toda flows Abstract: Through Maple demonstrations, we will discuss the Lie-Poisson structure on the space of lower-triangular matrices, the Casimirs and the coadjoint orbits. We will show that the generic coadjoint orbits are Liouville integrable, and such systems are called Toda flows. We may also discuss the inclusion of the Toda lattice as a Poisson subspace.

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Date: Oct. 27
Time: 3:00-5:00
Place: SER 244
Speaker: Stefan Mendez-DIez
Title: The Mathematics of Supersymmetry
Abstract: In physics, supersymmetry is a pairing between the carriers of mass and energy appearing in theories of subatomic particles. Useful tools when studying supersymmetry mathematically are N-regular, edge N-colored bipartite graphs with signs assigned to the edges and heights assigned to the vertices, subject to certain conditions. Such graphs are known as Adinkras, and have vertices representing the particles in a supersymmetric theory and edges corresponding to the supersymmetry pairings. We will discuss how parts of the structure of an Adinkra can be described using binary linear error-correcting codes, while all of the structure can be captured by a very special case of a geometric construction due to Grothendieck. This talk is designed to be accessible to an undergraduate audience.

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Date: Monday Dec. 1.
Time: 1:00-1:50
Place: BUSINESS 320
Speaker: Ming Xu,
Title Positive Curvature Problem in Finsler Geometry.
Abstract: Finding (new) manifolds with positive flag curvature is one of most important problem in (homogeneous) Finsler geometry. I will report some recent progress on this subject. In the even dimensional case, all manifolds admitting homogeneous Finsler metrics of positive flag curvature are classified, which coincide with those given by Wallach in 1972. In the odd dimensional case, there are some partial results, for example, S. Deng and Z. Hu gave a classification of all positive curved homogeneous Randers spaces with vanishing S-curvature.

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Date: Monday Dec. 1.
Time: 3:00-5:00
Place: SER 244
Speaker: Oscar Varela, Center for the Fundamental Laws of Nature, Harvard University
Title: Consistent supergravity truncations
Abstract: Supergravity theories are extensions of Einstein's theory of General Relativity that incorporate supersymmetry, a symmetry between fermions and bosons. Their relation to String/M-Theory leads to the consideration of formulations of supergravity in spacetime dimensions higher than four, especially ten and eleven. Lower dimensional physics can still be retrieved from the higher dimensional supergravities via Kaluza-Klein dimensional reduction. A desirable property of dimensional reduction, not necessarily guaranteed to hold, is that it be "consistent" in a certain sense I will explain. Consistency is important for AdS/CFT applications but, as it happens, it turns out to be a very rare feature. I will review recent progress in building consistent dimensional reductions of supergravity, including massless and massive modes, and paying attention to the underlying mathematical structures.

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Date: Monday Jan. 12
Time: 3:00
Location: SER 244
Speaker : Jan Gutt
Title: The Wei-Norman method and cominuscule induction.

Abstract: The Wei-Norman ansatz allows one to reduce the problem of computing development (i.e. time ordered exponential) in a reductive complex Lie group to a system of vector Riccati equations, provided no simple factor is of type G2, F4 or E8. I will explain this result, originally due to Charzy?ski and Ku?, as an instance of so-called cominuscule induction.

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Date: Monday Jan. 26.
Time: 3:00:
Where: SEE 244
Speaker: Jan Gutt,
Title: Introduction to Parabolic Geometry.

Jan will give an introduction since we will have a visitor for a few weeks who will give a number of talks related to parabolic geometry.

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Date: Wed. Jan. 28.
Time- 3:00
Where- SER 244 .
Title - Parabolic geometry- Continued.

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Date: Monday FEB. 2 , Wed. Feb.4, and Fri. Feb. 6
Time:
3:00-5:00 (All talks)
Place: SER 244 (All talks)
Speaker: Dennis The, Australian National University
Title : Symmetry gaps for geometric structures
ABSTRACT: For a given geometric structure, there is often a gap between the maximal and "submaximal", i.e. next realizable (infinitesimal) symmetry dimensions. This was first observed in the late 19th century for Riemannian metrics and such gaps were subsequently classified for various other geometric structures.

Parabolic geometries are a diverse class of geometric structures that include conformal, projective, CR, 2nd order ODE systems, and large classes of generic distributions. More abstractly, such structures can be viewed as "curved versions" of generalized flag varieties. In recent work, Boris Kruglikov and I found a uniform approach to the symmetry gap problem for parabolic geometries. Remarkably, in many cases this geometric problem reduces to (Dynkin diagram) combinatorics, and some submaximally symmetric models can be "immediately" found (in a sense that I will describe).

In part 1, I will describe the problem, give examples, describe our main theorems, and state (but not prove) some of the parabolic machinery relevant to the problem. In part 2, I will prove a couple of our key results.

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Date: Monday FEB. 9
Time: 3:00-5:00
Place: SER 244
Speaker: Mark Fels and Jan Gutt, USU
Title: Applications of Double Fibrations

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Date: Friday Feb. 20th
Time: 12:00-2:00
Place: SER 244
Speaker- Dr. Vincent Bouchard, University of Alberta
Title: Topological recursion, quantum curves and WKB expansion
Abstract: In this talk I will define what the topological recursion formalism is, and how it encodes enumerative invariants in many different contexts. Then I will describe how this information can (conjecturally) be repackaged in a beautiful way via quantum curves and WKB expansion. I will also sketch the lines of a proof of the relation between these topics for simple enumerative geometric problems.