Algebra Seminar
New Mexico State University

Mondays 12:30 - 1:30 in Science Hall 235

Here is a google calendar for the Algebra Seminar.

Spring 2019

February 1: Cameron Calk, Université de Lyon

Title: Time-reversal and directed homotopy

Abstract: Directed topology was introduced as a model of concurrent programs, where the flow of time is described by distinguishing certain "directed" paths in the topological space representing such a program. Algebraic invariants which respect this directedness have been introduced to classify directed spaces. We will discuss the properties of such invariants with respect to the reversal of the flow of time in directed spaces. A known invariant, natural homotopy, has been shown to be unchanged under time-reversal. We will see that it can be equipped with additional algebraic structure witnessing this reversal; when applied to a directed space and to its reversal, the refined invariant yields dual objects.

Fall 2018

November 5: Andreas Reinhart, University of Graz

Title: Arithmetic invariants of monoids of ideals of quadratic orders

October 29: Janet Vassilev, University of New Mexico

Title: Tight interiors of parameter ideals.

Abstract: The tight interior of a module is a dual notion to the tight closure of a module. In this talk we will focus on the tight interior of an ideal and in particular the tight interior of a parameter ideal and methods to compute tight interiors. We will introduce some ideals related to an ideal through its tight interior, that we call $*$-extentions and the $*$-hull. We will discuss conditions on the ring where the *-hull of an ideal is its tight closure and the $*$-core of an ideal is its tight interior.

October 15, 22: Luca Carai, NMSU

Title:Characterization of metrizable Esakia spaces via some forbidden configurations

Abstract: Priestley duality provides a dual equivalence between the category of bounded distributive lattices and the category of Priestley spaces; and Esakia duality provides a dual equivalence between the category of Heyting algebras and the category of Esakia spaces. A Priestley space is a compact topological space X with a partial order $\leq$ such that $x \not\leq y$ implies the existence of a clopen upset U with $x \in U$ and $y \notin U$. Esakia spaces are those Priestley spaces that satisfy the additional condition that the downset of each clopen is clopen.

After a review of these dualities, we show that in the metrizable case Esakia spaces can be singled out by forbidding three simple configurations. Metrizability of a Priestley space yields that the corresponding lattice, given by the collection of all clopen upsets, is countable. Therefore this provides a characterization of countable Heyting algebras. We show that this characterization no longer holds in the uncountable case. This result easily generalizes to the setting of p-algebras, i.e. pseudocomplemented distributive lattices.

October 1, 8: Pat Morandi, NMSU

Title: Specker algebras: a survey

Abstract: In these talks we describe some of the historical motivation for our study of Specker algebras over a commutative ring. The origins of this study is in the work of Baer, Specker, Nöbeling, and Conrad on groups and lattice-ordered groups.

September 17, 24: Jonathan Montaño, NMSU

Title: Asymptotic behavior of symbolic powers

Abstract: The symbolic powers of an ideal is a filtration that encodes important algebraic and geometric information of the ideal and the variety it defines. In this talk we will discuss recent advances on the asymptotic behavior of the number of generators and regularity of symbolic powers.

September 10: Richard Epstein

Title: Two new ways to take account of time in formal logic will be presented.

Abstract: In the first, true propositions are seen as picking out times that can be ordered by relating them with propositional connectives like "before", as in "Spot barked before Dick yelled". New true propositions can be added by relating them to others in the before-after ordering. The ordering need not be linear, for we might not be able to determine whether, for example, "Spot barked" describes a time before, the same as, or after the time that "Tom called Suzy" picks out. The method should be easy to implement in artificial intelligence and is clearer and more flexible than what has been used before in taking account of time.

In the second, we allow talk of times as things and quantify over them. All we assume about times is that there is a before and after (not necessarily linear) and that one time can be within another. This is a new way of talking about time that leads to new mathematical structures and many new questions about how we understand the relation of time and truth.

The talk will be accessible to undergraduates. It should be of interest to people working in mathematics, philosophy, and computer science.

Fall 2017

November 17: Susan Morey, Texas State University

Title: Depth and Cohen-Macaulay Properties of Monomial Ideals through Combinatorial Representations

Abstract: There is a natural one-to-one correspondence between square-free monomial ideals generated in degree two and graphs. Such ideals are called edge ideals of the associated graphs. This correspondence can be extended naturally in multiple ways, including using simple hypergraphs (also called clutters), paths or substructures within graphs, or by starting with directed graphs and using monomial ideals that are not square-free. The goal of this talk will be to use a combination of algebraic and combinatorial techniques to determine information about depth properties of these ideals, with a particular interest in when the ideals have the maximum depth possible, that is, when they are Cohen-Macaulay.

October 30, November 6, 13: Bruce Olberding, NMSU

Title: Complete intersections over zero dimensional rings

October 23: Eloísa Grifo, University of Virginia

Title: Symbolic powers and differential operators

Abstract: Given an ideal I in a polynomial ring, its n-th symbolic power consists of the functions that vanish up to order n at each point in the variety defined by I, which can be described via differential operators. However, this description fails in mixed characteristic. In this talk, we will introduce symbolic powers, discuss the classical Zariski-Nagata theorem, and explain why the usual differential powers are not enough to describe symbolic powers– and how to fix that. This is joint work with Alessandro De Stefani and Jack Jeffries.

October 9, 16: Yongjian Xie, NMSU.

Title: Pasting of lattice-ordered effect algebras

September 25, October 2: Angel Zaldivar, NMSU

Title: The point-free content of module categories

Abstract: Usually to study a ring, one can look the category of left modules over the ring and and observe the categorical properties of certain classes of module to get information of the ring, One of those techniques is localization of the category, as in the commutative case, this is useful. In this series of lectures we will review this technique and eventually this will lead us to the construction of a frame associated to the category modules, the frame of localizations.

September 11, 18: Pat Morandi, NMSU

Title: Canonical extensions of bounded archimedean vector lattices, continued.

August 28: Guram Bezhanishvili, NMSU

Title: Canonical extensions of bounded archimedean vector lattices

Spring 2017

February 20, 27, March 6, 13: Francisco Ávila, NMSU

Title: The Frame of $\mathbb{Q}_p$

January 30, February 6: Louiza Fouli, NMSU

Title: On Chudnovsky's Conjecture

Abstract: Given a finite set of points in the projective space, it is natural to ask what is the least degree of a hypersurface passing through all the points with a given multiplicity. Establishing such a degree is in general very difficult. Chudnovksy in 1981 stated a conjecture concerning a lower bound for this degree. He established his conjecture in the case of the projective plane. In recent years, there has been a renewed interest in this conjecture and various authors have established the conjecture in certain special cases. However, the conjecture is still open in full generality. We will discuss known results and some further progress towards this conjecture. This is joint work with Paolo Mantero and Yu Xie.

Fall 2016

September 16: Anna Romanowska, Warsaw Institute of Technology

Title: Dyadic intervals and dyadic triangles

Spring 2016

April 20, May 4: Bruce Olberding, NMSU

Title: Compactness and holomorphy rings in the space of valuations of a field

April 13: Zahi Fawaz, NMSU

Title: Bounded Archimedean f-Rings

March 30: Luca Spada, University of Salerno

Title: The ind- and pro-completion of an algebraic category.

Abstract: Given a category C one can form its ind- or pro-completion by taking all formal directed (co-)limits of objects in C. The ?correct? arrows to consider are then families of some special equivalence classes of arrows in C. For general reasons, the ind-completion

of a category C is dually equivalent to the pro-completion of the dual category Cop. Ind- and pro- completions are very useful objects but cumbersome to use, because of the involved definitions of arrows between objects. I will show that if C is an algebraic category, then the situation considerably simplifies. I will then use this result to propose a duality for the whole class of MV-algebras. This is a joint work with V. Marra (University of Milan).

March 23: Pat Morandi, NMSU
Title: Schemes

March 2, 9: John Harding, NMSU
Title: Automorphisms of decompositions

Fall 2015

October 21, November 4, 11, 18: Dave Finston, NMSU
Title: Quotients of factorial affine varieties which are not schemes
Abstract: It was recently shown that every proper triangular action of the additive group on complex 4-space is a translation with quotient isomorphic to complex 3-space. More generally, if the action fixes a coordinate function, the algebra of invariants is a polynomial ring in three variables if it is regular, and the action is again a translation if it is proper. Analogous results fail in higher dimension, and for general factorial affine fourfolds, the quotient by a proper action need not even be a scheme. Examples of these phenomena, and how they give rise to algebraic spaces which are not schemes and varieties which are not quasiprojective, will be explained.

October 7: Jameson Cahill, NMSU
Title: Geometry of unit norm tight frames
Abstract: In this talk, we settle a long-standing problem on the connectivity of spaces of finite unit norm tight frames (FUNTFs), essentially affirming a conjecture first appearing in Dykema and Strawn (2003). Our central technique involves continuous liftings of paths from the polytope of eigensteps to spaces of FUNTFs. After demonstrating this connectivity result, we refine our analysis to show that the set of nonsingular points on these spaces is also connected, and we use this result to show that spaces of FUNTFs are irreducible in the algebro-geometric sense, and that generic FUNTFs are full spark.

September 23, 30: Jameson Cahill, NMSU
Title: Algebraic aspects of phase retrieval
Abstract: Phase retrieval is the problem of recovering a signal from the absolute values of linear measurements. Although this problem has a very rich history stretching back to the early twentieth century it has seen a flurry of activity in recent years. One of the interesting things about this problem is that it has attracted the attention of researchers from many

different areas of mathematics. In this talk I will focus on some of the more algebraic aspects of the current research in this area.

September 2, 9, 16: Bruce Olberding, NMSU

Title: Topological aspects of the ring of integer-valued polynomials

Abstract: The theory of the ring $Int(\mathbb{Z})$ of polynomials $f(X)$ in $\mathbb{Q}[X]$ for which $f(\mathbb{Z})$ is contained in $\mathbb{Z}$ (where $\mathbb{Z}$ = integers and $\mathbb{Q}$ = rationals) draws on valuation theory, number theory, p-adic analysis and commutative algebra. We discuss how topological methods can be applied in this context to describe the ideal theory of the ring $Int(\mathbb{Z})$. This is joint work with Giulio Peruginelli (University of Padova).

Spring 2015

April 28: Dave Finston, NMSU

Title: Exotic Spheres, Affine Fibrations, and a Conjecture of Dolgachev-Weisfeiler

Abstract: It is useful in the investigation of affine algebraic varieties X to study morphisms with simple fibers to better understood varieties Y. For instance X might have the structure of a vector bundle over Y. Here X is locally the product of Y with an affine space and the coordinates on the fibers are transformed by nonsingular linear transformations over open subsets of Y. More generally X might be locally a product over Y but the coordinate transformations are by automorphisms of the affine spaces over open subsets of Y. Even more generally fibers over points in Y might merely be affine spaces (X is then called an affine space fibration over Y). When Y is affine it is known that affine space bundles are actually vector bundles, and the Dolgachev-Weisfeiler conjecture asserts that under mild hypotheses affine space fibrations are themselves bundles. These notions will be discussed along with a class of examples that serve as test cases for the conjecture.

April 21: Sebastian Walcher, RWTH Aachen

Title: Invariant curves and integrating factors for planar polynomial vector fields

April 10: David Vogan, MIT

Title: New applications of Clifford Theory

Abstract: Suppose H is a subgroup of index two in G. Clifford Theory describes very simple and powerful relationships between the representation theory of H and of G. Here are the basic statements (writing $\widehat{H}$ for the set of irreducible representations of H).

1) The action of G defines a permutation δ of order two of $\widehat{H}$.

2) Tensoring with a character of G/H defines a permutation σ of order two of $\widehat{G}$.

3) Each δ-fixed irreducible of H extends to exactly two irreducibles of G, which are interchanged by σ.

4) Each σ-fixed irreducible of G restricts to the sum of two irreducibles of H, which are interchanged by δ.

These facts say that each of the sets $(\widehat{H}, \delta)$ and $(\widehat{G}, \sigma)$ determines the other in a very simple way.

I'll explain what else needs to be done to compute the characters in $\widehat{G}$ from knowledge of the characters in $\widehat{H}$. I'll recall some classical examples (like the alternating group inside the symmetric group) and look at some new ones (where H is a real reductive Lie group).

March 13, 31, April 13: Bruce Olberding, NMSU

Title: Topological approaches to intersections of valuation rings

March 6: Rudolf Seising, History of Science, Friedrich-Schiller-Universitat Jena

Title: A History of Fuzzy Sets and Computing with Words

Abstract: After a brief review of ordinary fuzzy sets, we will discuss further developments in its theory and application, including some historical and philosophical questions concerning the times of the Vienna Circle. Again, much of the discussion and history is based on direct consultation with Lotfi Zadeh.

February 23: Lokendra Paudel, NMSU

Title: The group of divisibility of a finite character intersection of valuation rings

Abstract: The group of invertible fractional ideals of a Prüfer domain R is a lattice-ordered group (ℓ-group) and coincides with the group of divisibility of R in the case when R is a Bézout domain. In this talk we'll discuss the ℓ-groups that occur as a group of invertible fractional ideals of a finite character Prüfer overring of the domain $D = k[x_1, x_2, \ldots, x_n]$, where k is a field and $x_1, x_2, \ldots, x_n$ are indeterminates for k.

February 9, 16: Pat Morandi, NMSU

Title: Pierce Sheaves

Abstract: Pierce showed that for a commutative ring R, one can represent R as the ring of global sections of a sheaf of indecomposable rings over a Stone space. The Stone space is the dual space to the Boolean algebra of idempotents of R. This contracts the Zariski representation, which is a sheaf of local rings over the prime spectrum of R. In this talk we will recall Pierce's construction. We will also discuss morphisms in the category of Pierce spaces, which requires the notion of the pullback of a sheaf. The resulting pullback sheaf has an interesting ring of global sections, which we will describe and relate to the notion of Specker algebras that we studied in recent work.

January 26: Andreas Reinhart, Institut für Mathematik und wissenschaftliches Rechnen, Karl-Franzens-Universität

Title: On conductors of ring extensions

Abstract: Let S be a commutative ring with identity, R a unitary subring of S, and I an ideal of S. For $X, Y, Z \subseteq S$ set $(X :_Y Z) = \{x \in Y \mid xZ \subseteq X\}$. We say that I is an R-conductor ideal of S if $I = (V :_S S)$ for some intermediate ring V of R and S. The study of conductor ideals plays a certain role in factorization theory. Alongside with

the Picard group they are important to describe the behavior of factorizations in orders of algebraic number fields and their generalizations. The $\mathbb{Z}$-conductor ideals of principal orders of algebraic number fields have already been investigated by P. Furtwängler in 1919. He provided a complete description of these ideals. The main goal of this talk is to present generalizations of Furtwängler's results. Among others we show that if S/I is a Noetherian ring and $R/I \cap R$ is a principal ideal ring, then I is an R-conductor ideal of S if and only if every $M \in \text{spec}(S)$ with $I \subseteq M$ satisfies $R + M \subsetneqq S$ or $(I :_R M) \subseteq I$. We elaborate the limitations of our results by providing several counterexamples.

Fall 2014

December 1: Elbert Walker, NMSU

Title:Equations for the truth value algebra of type-2 fuzzy sets.

Abstract: This talk is about an algebra that arises in fuzzy set theory. Our main concerns are determining what equations it satisfies, its local finiteness, and whether or not it has a finite equational basis. We begin with preliminary material and motivation, and end with some outstanding problems and suggestions for further research.

November 12: Brian Harbourne, University of Nebraska

Title: Using, computing and bounding Waldschmidt constants

Abstract: Motivated by work in number theory, in the 1970s Waldschmidt defined an asymptotic measure of the least degree of a polynomial ideal in n variables with given order of vanishing on a finite set of points in projective space. In the case of generic points in P2, determining the value of Waldschmidt's constant is equivalent to an open conjecture of Nagata. Recent work has related Waldschmidt's constant to an ideal containment problem: which symbolic powers of the ideal of the points are contained in a given power of the ideal? Waldschmidt constants are also relevant to an open question of Eisenbud and Velasco. Joint work with E. Guardo and A. Van Tuyl generalizes some of this work from points to lines in projective 3-space. Additional joint work with M. Dumnicki, T. Szemberg and H. Tutaj-Gasińska extends this to r-planes in projective N-space.

November 3: Jonathan Montaño, Purdue University

Tittle: Minimal multiplicities and depth of blowup algebras

Abstract: In this talk we discuss recent generalizations to non m-primary ideals of the conditions of minimal multiplicity. In a Cohen-Macaulay ring, we discuss the interplay among these conditions and the depths of blowup algebras. We will also show a bound on the reduction number of ideals having Cohen-Macaulay associated graded algebra.

October 27: Louiza Fouli, NMSU

Title: Conjectures on Symbolic Powers, Part II.

October 20: Louiza Fouli, NMSU

Title: Conjectures on Symbolic Powers, Part I.

Abstract: Given a finite set of points X in the projective space $\mathbb{P}_k^N$, for some N, it is natural to ask what is the least degree, α_m, of a hypersurface $F \neq 0$ passing through all the points with a given multiplicity m. Chudnovksy conjectured in 1981 that $\frac{\alpha_m}{m} \geq \frac{\alpha(X)+N-1}{N}$, where $\alpha(X)$ is the minimum degree of a hypersurface passing through every point in X. He established his conjecture in the case $N = 2$, but the conjecture is still open in full generality. We will discuss known results and some further progress towards this conjecture. This is joint work with Paolo Mantero and Yu Xie.

October 13: Bruce Olberding, NMSU

Title: Quadratic transforms of regular local rings, Part II

October 6: Bruce Olberding, NMSU

Title: Quadratic transforms of regular local rings

Abstract: Quadratic transforms arise in algebraic geometry as the blow-ups of nonsingular varieties at a closed point. Locally, this corresponds to blowing up a regular local ring at a maximal ideal and localizing to obtain another regular local ring. We discuss some classical results for local quadratic transforms in dimension two. In higher dimensions many of these results break down, and we discuss some recent joint work with William Heinzer, Alan Loper and Hans Schoutens that seeks to describe sequences of local quadratic transforms in arbitrary dimension.

September 29: John Harding, NMSU

Title: Quantum Structures

September 22: Pat Morandi, NMSU

Title: Compactifications and proximities of ordered topological spaces, Part III

September 15: Pat Morandi, NMSU

Title: Compactifications and proximities of ordered topological spaces, Part II

September 8: Pat Morandi, NMSU

Title: Compactifications and proximities of ordered topological spaces, Part I

Abstract: In these talks we'll start by discussing the notion of compactification of a topological space and of an ordered topological space. We'll discuss Smirnov's result that compactifications of a space X can be classified by proximities on the space, which are certain relations on the power set of X. We'll then see how to treat an ordered topological space as a bi-topological space. By means of point-free methods, one can then work with frames instead of spaces, and biframes instead of bispaces. We'll then see how to generalize the notion of a proximity to the biframe setting and classify compactification of biframes. We'll then recover Nachbin's characterization of which ordered spaces have a compactification.

Spring 2014

April 16: Kulumani Rangaswamy, University of Colorado at Colorado Springs

Title: The Irreducible Representations of Leavitt path algebras

Abstract: Let L be the Leavitt path algebra of an arbitrary graph E over a field K. The prime and primitive ideals of L will be described using the graphical properties of E. This will lead to methods of constructing non-isomorphic irreducible representations of L by using infinite paths, sinks and special vertices in the graph E. As an application, a solution to a problem of Kaplansky on primitive rings will be described.

April 9: Greg Oman, University of Colorado at Colorado Springs

Title: Rings whose multiplicative endomorphisms are power functions.

Abstract: Let R be a commutative ring. For any positive integer m, the power function $f : R \to R$ defined by $f(x) := x^m$ is easily seen to be an endomorphism of the multiplicative semigroup $(R, *)$. In this talk, I will characterize the commutative rings R with identity for which every multiplicative endomorphism of $(R, *)$ is equal to a power function. I will close with some open questions and some partial answers due to Ryzard Mazurek.

April 2: Carollan Ehn, NMSU

Title: Curves over Finite Fields and Applications to Cryptography, Part II.

March 19: Carollan Ehn, NMSU

Title: Curves over Finite Fields and Applications to Cryptography, Part I.

March 12: Andreas Reinhart, Karl-Franzens-Universitat

Title: Monadically Krull domains and weak factorization properties

Abstract: Recall that a Krull domain is an integral domain whose nonzero t-ideals are finite t-products of prime t-ideals. If we consider Krull domains with "nice" divisor class group, then it is possible to shift questions about their element factorizations to so called block monoids. In this situation much is known about the structure of element factorizations. It is clear that many interesting types of domains, like orders in algebraic number fields and rings of integer-valued polynomials can fail to be Krull. Several attempts have been made to study element factorizations in such domains. One of these attempts leads to the investigation of monadically Krull domains. This class of domains is of importance, since rings of integer-valued polynomials over factorial domains are monadically Krull. In this talk we discuss the connections between monadically Krull domains and other types of domains (e.g., FF-domains, IDPF-domains, radical factorial domains).

March 5: Fred Richman, Florida Atlantic University

Title: Minimal zero-dimensional extensions

Abstract: A commutative ring is zero dimensional if each prime ideal is maximal. Arapovic showed that any zero-dimensional extension of a ring contains a unique minimal zero-dimensional extension. Quotient fields of integral domains are minimal zero-dimensional

extensions. However, there are other minimal zero-dimensional extensions, even of the ring of integers. We classify such extensions given certain hypotheses on the ground ring. Time permitting, I will talk a little about a constructive approach to this subject.

March 3: Paolo Mantero, University of California, Riverside

Title: A "general" approach to the Harbourne-Huneke Conjecture and the Chudnovsky Conjecture

Abstract: A long-standing conjecture by Chudnovsky predicts the existence of a lower bound for the degree of any hypersurface in $\mathbb{P}^n$ passing through a fixed set of points X with multiplicity m (for any $m > 0$). Harbourne and Huneke in 2011 showed that this conjecture would follow from a new conjecture that they propose (which would give refined comparison information between symbolic and ordinary powers of the ideal defining X).

In this talk we will discuss these two conjectures and prove some results when X is a set of "general" points. All the terminology and the ideas will be introduced and explained during the talk (that will be accessible to students).

This is joint work with L. Fouli and Y. Xie.

February 26: John Harding, NMSU

Title: Some incomplete comments on topological Boolean algebras.

February 19: Louiza Fouli, NMSU

Title: Symbolic Powers of Ideals.

Abstract: This will be an introductory talk on the topic of symbolic powers of ideals and their connection to various open conjectures. I plan to make the talk accessible to students.

February 12: Elbert Walker, NMSU

Title: Abelian Group Theory, Mathematical Sciences, NMSU, 1957-1987, Part II

Abstract: The second talk will be mainly a discussion of the contributions of those at NMSU to Abelian group theory. Homological methods will predominate. Topics include quotient categories and its applications, totally projective groups, and groups as modules over their endomorphism ring. Characterizations of projectives and injectives in categories associated with the category of Abelian groups is a main theme. The specific work of various Ph.D. students and faculty at NMSU will be emphasized.

February 5: Elbert Walker, NMSU

Title: Abelian Group Theory, Mathematical Sciences, NMSU, 1957-1987.

Abstract: This first talk will be a discussion of SOME of the main theorems in Abelian group theory that were proved before 1957, the year the study of Abelian group theory began at NMSU. It is background material mostly. Emphasis is on direct sum decompositions of certain classes of Abelian groups into direct sums of cyclic groups, and similar theorems. Another main theorem, namely Ulm?s theorem, and some of its generalizations will also be

discussed. The main contributors to the subject before 1957 and their later connections to NMSU will be mentioned.

January 29: Don Johnson, NMSU

Abstract: An answer, finally, to a question that I posed 27 years ago concerning the existence (or not) of a certain type of representation of Archimedean lattice-ordered groups. This is part II.

January 22:Don Johnson, NMSU

Abstract: An answer, finally, to a question that I posed 27 years ago concerning the existence (or not) of a certain type of representation of Archimedean lattice-ordered groups.

Fall 2013

January : Rick Ball, University of Denver

Title: The arithmetic of $C(X)$.

November 13: Pat Morandi, NMSU

Title: Sheaves of Specker Algebras, Part III

November 6 : Pat Morandi, NMSU

Title: Sheaves of Specker Algebras, Part II

October 30: Pat Morandi, NMSU

Title: Sheaves of Specker Algebras, Part I

October 23: Guram Bezhanishvili, NMSU

Title: The algebra of finitely valued normal functions, Part II.

October 16: Guram Bezhanishvili, NMSU

Title: The algebra of finitely valued normal functions.

October 9: Imad Jaradat, NMSU

Title: On the geometric quotient of proper triangular $\mathbb{G}_a-$action on $\mathbb{A}^n_{\mathbb{C}}$, Part II.

October 2: Imad Jaradat, NMSU

Title: On the geometric quotient of proper triangular $\mathbb{G}_a-$action on $\mathbb{A}^n_{\mathbb{C}}$.

Abstract: In this talk, I will discuss some progress toward a conjecture of David Finston which asserts that all proper actions of the additive group of complex numbers ($\mathbb{G}_a(\mathbb{C})$) on complex affine $4-$space ($\mathbb{A}^4_{\mathbb{C}}$) admit quotients isomorphic to affine three space. For actions on $\mathbb{A}^n_{\mathbb{C}}$, the assertion is true for $n < 4$ but false for $n > 4$.

September 25: John Harding, NMSU

Title: Plonka sums and Birkhoff systems.

September 11: Elbert Walker, NMSU

Title: Mathematical properties of the algebra of truth values of fuzzy sets of type 2.

August 14: Andy Kustin, University of South Carolina

Title:Blowups and fibers of morphisms.

Spring 2013

April 24, May 1: Louiza Fouli, NMSU

Title: Depth and projective dimension of powers of edge ideals of graphs

Abstract: This talk is based on joint work with Susan Morey. We will consider edge ideals of graphs and discuss algebraic invariants such as depth and projective dimension. The edge ideal of a graph is a square-free monomial ideal of degree 2 in a polynomial ring. We make use of graph theoretic properties in order to give bounds for the projective dimension and equivalently bounds for the depth of the ideal. We will also discuss such bounds for higher powers of edge ideals. The talk will be fairly elementary at first.

April 10, 17: Guram Bezhanishvili, NMSU

Title: Rings of Real-Valued Continuous Functions

April 3: Darrell Haile, Indiana University

Title: Clifford Algebras of Forms

Abstract: Let F be a field and let $f(x_1, \ldots, x_n)$ be a form, that is, a homogeneous polynomial, with coefficients in F. One can associate a noncommutative F-algebra C_f to f, given by $C_f = F\{u_1, u_2, \ldots, u_n\}/I$, where $F\{u_1, u_2, \ldots, u_n\}$ is the free associative algebra in n variables and I is the ideal of relations necessary to produce the identity $(x_1u_1 + x_2u_2 + \cdots + x_nu_n)^d = f(x_1, x_2, \ldots, x_n)$, where d is the degree of f. This algebra is called the Clifford algebra of f. If f has degree 2, the Clifford algebra is the usual Clifford algebra of a quadratic form and in particular is a finite dimensional F-algebra. If the degree is greater than two the Clifford algebra is no longer finite dimensional but still has many interesting properties. We will discuss in particular the case of degree 3, which has connections to elliptic curves and central simple algebras of dimension 9.

March 6, 13, 20: Bruce Olberding, NMSU

Title: Prüfer domains and the projective line

Abstract: Let F be a field, let D be a subring of F, and let Z be a subspace of the space of all valuation rings between D and F that have quotient field F. When $F \in Z$, then Z is a locally ringed space whose ring of global sections is $A = \bigcap_{V \in Z} V$. All rings between D and F that are integrally closed in F arise in such a way. Motivated by applications in areas such as multiplicative ideal theory and real algebraic geometry, a number of authors have formulated criteria for when A is a Prüfer domain. We give geometric criteria for when

A is a Prüfer domain that reduce this issue to questions of prime avoidance; these criteria are framed in terms of morphisms of Z into the projective line over D.

February 25: Paolo Mantero, University of California-Riverside

Title: Almost complete intersections of high multiplicity are Cohen-Macaulay

Abstract: The multiplicity $e(R)$ of a ring R is a classical invariant giving a (rough) indication of how complicated is a ring/singularity. Upper and lower bounds for the multiplicity in terms of other invariants have attracted many mathematicians over the years (from Del Pezzo and Bertini to the Multiplicity Conjecture, recently proved by Eisenbud and Schreyer).

In the present talk we consider homogeneous ideals I of the shape $I = J+(F)$, where J is a Cohen-Macaulay ideal and F is an element not in J. We prove a new upper bound on the multiplicity of R/I (in terms of $e(R/J)$ and $\deg(F)$. We then consider ideals I of maximal multiplicity and prove that they have high depth ($\operatorname{depth}(R/I)$ is at least $\dim(R/I)-1$), and characterize numerically when they are Cohen-Macaulay.

Applications of the above results are: (1) a generalization of a theorem of Engheta, bounding the multiplicity of almost complete intersection ideals, (2) the fact that almost complete intersections generated in one degree of maximal multiplicity are Cohen-Macaulay, and (3) a multiplicity-based sufficient condition for quasi-Gorenstein rings to be Gorenstein.

February 20: Julio Urenda Castañeda, NMSU

Title: An algorithmic approach to the embedding problem in affine 3-space

Abstract:

A polynomial map $\alpha : \mathbb{C}^r \to \mathbb{C}^n$ for $1 \leq r < n$ is an embedding of $\mathbb{C}^r$ in $\mathbb{C}^n$ if $\operatorname{im}(\alpha)$ is closed in the Zariski topology and $\alpha : \mathbb{C}^r \to \operatorname{im}(\alpha)$ is an isomorphism of algebraic varieties. An embedding $\alpha : \mathbb{C}^r \to \mathbb{C}^n$ is called rectifiable if there exists a $\mathbb{C}$-isomoprhism of $\mathbb{C}^n$ such that $(\phi \circ \alpha)(u) = (u_1, \ldots, u_r, 0, \ldots, 0)$ for all $u = (u_1, \ldots, u_r) \in \mathbb{C}^r$. The embedding problem asks if every embedding is rectifiable. The case $r = 1$ and $n = 2$ was established by Abhyanker and Moh. Craighero proved that every embedding is rectifiable for $r = 1$ and $n \geq 4$. We discuss a possible counterexample for the case $r = 1$ and $n = 3$ and an algorithm related to this problem.

January 30: Simplice Tchamna Kouna, NMSU

Title: Completions of Noetherian local rings

Fall 2012

December 5: Elbert Walker, NMSU

Title: Partial Orders on the Truth Value Algebra of Finite Type-2 Fuzzy Sets.

Abstract: The algebra of truth values for fuzzy sets of type-2 consists of all mappings from the unit interval into itself, with operations certain convolutions of these mappings

with respect to pointwise max and min. Here we replace each copy of the unit interval by a finite chain and investigate the partial orders induced by the two binary operations of the resulting algebra, with the emphasis on when these partial orders and their intersection are lattice orders.

November 28: Elbert Walker, NMSU

Title: Partial Orders on the Truth Value Algebra of Type-2 Fuzzy Sets.

Abstract: The algebra of truth values of type-2 fuzzy sets consists of all mappings of the unit interval into itself with operations certain convolutions of these mappings with respect to pointwise max and min. It has two basic binary operations. These operations are idempotent, commutative, and associative, so each induces a partial order on the elements of the algebra. These partial orders are not equal. The basic goal is the study of these partial orders, and the partial order given by their intersection. Some principal results are that neither partial order is a lattice order, and under the partial order given by the intersection of these two partial orders, the set of convex elements is a disjoint union of complete lattices.

November 7: Taewon Yang, NMSU

Title: Notes on orthoalgebras in categories.

Abstract: The notion of orthoalgebra was introduced in the early 1980s by Foulis and Randall as an extended model for the propositional logic of quantum mechanics with tensor products. Using the canonical orthoalgebra of all decompositions of an object in a suitable category, we show that a certain interval in the orthoalgebra also arises from decompositions.

October 17, 24, 31: Bruce Olberding, NMSU

Title: The topology of the Zariski-Riemann space of valuation rings

Abstract: In the forties, Zariski defined a topology on the space of valuation rings of a field that is compatible with the geometry of projective models of the field. He proved that this topology is quasicompact and used this as a step in his proof of resolution of singularities of three-folds. More recently, the Zariski-Riemann space has been studied as a spectral space. We discuss applications, as well as shortcomings, of this topological viewpoint.

September 26: Anthony Hager, Wesleyan University

Title: Hulls of Archimedean lattice-ordered groups and the free distributive lattice on 2.

Abstract: In a category C a hull class H with hull operator h is: H is a class of C-objects for which each C-object A has a unique minimal essential extension to an H-object hA. (E.g., injective hulls ,when they all exist.) The family of hull classes/operators in C usually forms a complete lattice (not a set, though). Categories of ordered algebra (e.g., Boolean algebras, ℓ-groups, f-rings,...) usually have many such (H, h) (e.g., Dedekind completeness, projectability, rings of quotients,...) We focus on W: Archimedean ℓ-groups with weak order unit (e.g., any $C(X)$) and its monocoreflective subcategory BW (aka, W^*) where the unit is strong (e.g., bounded functions $BC(X)$ (aka , $C^*(X)$). We'll display a zillion or so (H, h). The functor B compresses the hull class lattice of W onto that of

$BW : (H, h)$ goes to (BH, Bh). Call H and H' B-equivalent if $BH = BH'$, and denote by $[H]$ an equivalence class (which is sometimes not a set). The situation is examined using words and equations in B and h (e.g., some h satisfy $Bh = hB$, and some others satisfy $h = hB$, and ...). The collection of words is an ℓ-semigroup order-isomorphic to $F(2)$, the free 0-1 distributive lattice on 2 generators. Each (H, h) in W determines a quotient $Q(h)$ of $F(2)$, which corresponds to a subset of $[H]$. Equational equivalence of the h's is roughly isomorphism of the $Q(h)$'s. (This is joint work with Ricardo Carrera.)

September 19, October 3, 10: Pat Morandi, NMSU

Title: Anisotropic Splitting of Algebras with Involution

Abstract: In this talk we will introduce the notion of a central simple algebra with involution, give some examples, and see how the theory gets its motivation from quadratic form theory. In particular, the notion of isotropic and anisotropic quadratic forms has analogues for algebras with involution important idea in the theory of central simple algebras is the idea of a splitting field. If A is an F-central simple algebra, then K is a splitting field if $A \otimes_F K \cong M_n(K)$, the ring of $n \times n$ matrices over K. In future talks we will explore the question: If (A, σ) is an anisotropic algebra with involution with center F, is there a splitting field K of F for which $(A \otimes_F K, \sigma \otimes \mathrm{id})$ is split but still anisotropic. An affirmative answer would give a useful tool for extending results about quadratic forms to algebras with involution. We give a sufficient condition in terms of Clifford algebras for (A, σ) to have an anisotropic splitting.

September 12: Dave Hren, NMSU

Title: Fibers of Complete Scalar Extensions

Abstract: Let (R, m) be a local, Noetherian domain with quotient field Q. Heinzer, Rotthaus, and Sally showed that the dimension of the generic formal fiber is $\dim(R) - 1$ if and only if R is birationally dominated by a residually finite DVR by establishing a $1 - 1$ correspondence between prime ideals in the generic formal fiber of R of height $\dim(R) - 1$ and residually finite DVR overrings. In this talk, we discuss a generalization of their result using the notion of a complete scalar extension introduced by Schoutens.

September 5: Lokendra Paudel, NMSU

Title: Weak Approximation for Valuation Overrings of Affine Domains

Abstract: The group of divisibility of an integral domain is the multiplicative group of nonzero principal fractional ideals of the domain. The goal of this presentation is to describe the lattice-ordered groups (l-groups) that occur as a group of divisibility of a Bézout overring of an affine domain $D = k[x_1, x_2, ..., x_n]$. We focus especially on the finitely generated l-groups that arise as the group of divisibility of a finite intersection of valuation overrings of D.

August 29: Simplice Tchamna, NMSU

Title: The ideal completion of a local Noetherian domain.

Abstract: The ideal topology on a commutative ring R is the linear topology which has as a fundamental system of neighborhoods of 0 the nonzero ideal of R. We will present the relations between the ideal completion and the $\mathfrak{m}$-adic completion of a local Noetherian domain. In particular, we will discuss the properties satisfied by one completion and not the other.

Spring 2012

May 2: Simplice Tchamna Kouna, NMSU

Title: Connections between the ideal topology and the $\mathfrak{m}$-adic topology

Abstract: The main purpose of this talk is to use our knowledge of the $\mathfrak{m}$-adic topology to study in depth the ideal topology of a local Noetherian domain.

April 18: Lance Miller, University of Utah

Title: Hilbert-Kunz functions of determinantal varieties

Abstract: E. Kunz in 1976 introduced a positive characteristic variant of Hilbert-Samuel theory where powers of an ideal are replaced by Frobenius powers. Unfortunately he erroneously concluded the corresponding limit defining the multiplicity does not exist! P. Monsky later showed the error in Kunz's conclusion and how the associated multiplicity, called the Hilbert-Kunz multiplicity, is deeply related to singularity theory and tight closure. This multiplicity is the first coefficient of a function called the Hilbert-Kunz function, which is not in general polynomial like. This talk will introduce Hilbert-Kunz theory and discuss some work on computing the Hilbert-Kunz functions of determinantal varieties via Grobner basis. This is joint work with I. Swanson.

April 4, 11: David Hren: NMSU

Title: Scalar Extensions of Local Rings.

Abstract: We will discuss the concept of a scalar extension and a scalar completion of a local Noetherian domain R and will then show a connection between the generic fibers of the scalar completions of R and the DVR overrings of R.

March 14, 28: Lokendra Paudel, NMSU

Title: Group of divisibility of integral domains.

Abstract: If D is a domain with quotient field K, then the group of divisibility of D is the group of non-zero principal fractional ideals of D. The Krull-Kaplansky-Jaffard-Ohm Theorem states that given an l-group G, there exists a Bézout domain, whose group of divisibility is order isomorphic to G. In this talk, we'll discuss about the partially ordered groups that occur as a group of divisibility of integral domains.

March 7: Paolo Mantero, Purdue University

Title: Liaison classes of non-licci ideals

Abstract: A vast part of literature on liaison (via complete intersections) has addressed questions relative to the most relevant, and well-behaved, class of ideals in linkage: licci ideals (these ideals generalize perfect ideals of codimension 2 and Gorenstein ideals of codimension 3). However, for a non-licci ideal I, there are few results describing the structure of the linkage class of I.

In this talk we introduce a theoretical definition for 'minimal' ideals in any even linkage class. We show that these ideals exist under reasonable assumptions on the linkage class, and, in general, if they exist they are (essentially) unique. We then show that these ideals minimize homological invariants (e.g. Betti numbers, multiplicity, etc.) and they enjoy the best homological and local properties among all the ideals in their even linkage class. This justifies why they are, in some sense, the 'best' possible ideals in the even linkage class.

We provide several classes of ideals that are the minimal representatives of their even linkage classes (including determinantal ideals) and, if time permits, show an easy application to produce more evidence towards the Buchsbaum-Eisenbud-Horrocks Conjecture.

February 29: Dilia Rueda, NMSU

Title: Construction of Ga-Bundles over the Winkelmann Quotient

February 1, 8, 15, 22: Pat Morandi, NMSU

Title: Symmetry groups of wallpaper patterns.

Abstract: Around 1900 symmetry groups of wallpaper patters were classified, finding that there are exactly 17 such groups, up to isomorphism. This series of talks will explore the mathematical ideas behind the classification. There is a nice intersection of Euclidean geometry, group theory, and linear algebra in this study. We will approach the classification through the idea of group extensions, whose study led to the development of homological algebra. These talks will be geared to graduate students

Fall 2011

November 30: Tom Marley, University of Nebraska

Title: Frobenius and Injectives

Abstract: We consider properties of the Frobenius functor on the category of left modules over a commutative ring of prime characteristic. It is well known (and in any case easy to see) that the Frobenius functor preserves projective modules. It has also been proved that if the ring is Gorenstein then Frobenius preserves injective modules as well. In this talk, I'll discuss what other rings have this property as well as what this property implies about the ring.

November 16: Simplice Kouna-Tchamna, NMSU

Title: Connections between the R-topology and the $\mathfrak{m}$-adic topology.

Abstract: We discuss the R-topology when $(R, \mathfrak{m})$ is a Noetherian local ring with maximal ideal $\mathfrak{m}$. There are many ways to define a linear topology on a given ring $(R, \mathfrak{m})$, the $\mathfrak{m}$-adic topology being the most studied. The literature on the $\mathfrak{m}$-adic topology is immense. On the other hand, the R-topology is almost ignored, with the main exception of the work of Matlis, who used it in his studies of torsion-free and cotorsion modules. We will discuss some properties of the R-topology and establish connections between the $\mathfrak{m}$-adic topology and the R-topology

October 26, November 2, November 9: Pat Morandi, NMSU

Title: Lattice-Ordered Algebras and Rings of Continuous Functions

Abstract: In this talk I will discuss joint work of Guram Bezhanishvili, Bruce Olberding, and myself about the category of bounded Archimedean lattice-ordered $\mathbb{R}$-algebras (bals). These are subalgebras of $C(X)$, with X compact Hausdorff. We have various characterizations of the algebras of the form $C(X)$ inside this category. The first talk will focus on examples and basic properties of bals. Subsequent talks will give various interesting subcategories, and will discuss the characterizations of C^*-algebras we have found.

October 19: Dave Finston and Imad Jaradat, NMSU

Title: A locally trivial G_a action on $\mathbb{C}^5$ whose algebraic quotient is singular.

Abstract: A locally trivial G_a action on a factorial affine scheme X admits a geometric quotient X/G_a which has the structure of a quas-iaffine scheme. As such the quotient morphism $X - - > X/G_a$ is a principal G_a bundle, locally trivial for the Zariski topology, so that if X is smooth so is X/G_a. The algebraic quotient $X//G_a$, defined to be the spectrum of the ring of invariants of the ring of regular functions on X need not be smooth. An example is given of such an action on $\mathbb{C}^5$ that exhibits a strange connection with du Val surface singularities. No such example can arise in lower dimensions.

October 5, October 12: Bruce Olberding, NMSU

Title: Topological and geometric properties of the Zariski-Riemann space of valuation rings

Abstract: For a subring D of a field F, the Zariski-Riemann space X of F/D is the set of all valuation rings containing D and having quotient field F. The Zariski-Riemann space admits a natural topology that is compatible with the geometry of projective integral schemes. We look at connections between the topology and geometry of this space, as well as how this connection manifests in an additional structure on X, that of being a locally ringed space.

September 28: David Hren, NMSU

Title: The catapower of a local Noetherian Ring

Abstract: For a local Noetherian ring, there is associated to it a complete local Noetherian ring called the catapower. I will talk about some of the properties that the catapower satisfies, comparing it to the ring's completion. Time permitting, I will also begin looking

at the generic fiber of the catapower of a local Noetherian domain as a means of studying DVR overrings.

September 14, 21: Louiza Fouli, NMSU

Title: The defining equations of Rees algebras of square-free monomial ideals

Abstract: We will discuss a construction that enables us to determine the defining equations of the Rees algebra for certain square-free monomial ideals in a polynomial ring over a field. We also determine specific classes of square-free monomial ideals that are of linear type. This is joint work with Kuei-Nuan Lin.

September 7: Christian Haesemeyer, UCLA

Title: Quadratic zero cycles and motivic homotopy theory

Abstract: The Chow-Witt groups of a smooth variety are constructed from closed irreudcible subsets of those varieties together with a quadratic form at the generic points of those subsets. They have been used, for example, to study whether stably trivial vector bundles on affine varieties are trivial. In this talk, I report on joint work with A. Asok connecting the Chow-Witt group of zero cycles of a smooth complete variety to its stable A^1-homotopy groups, and to the question of detecting whether such a variety has an (ordinary) zero cycle of degree one, or a rational point. I will aim to give a very quick introduction to motivic homotopy theory in the process.

August 31: Dave Finston, NMSU

Title: On the failure of the cancellation property for factorial affine varieties

Abstract: The affine cancellation problem asks for complex affine varieties X, Y whether an isomorphism of their cylinders $X \times \mathbb{C}, Y \times \mathbb{C}$ implies the existence of an isomorphism between X and Y. While Danielewski found counterexamples to this problem among smooth surfaces with nontrivial Picard group, the problem has a positive solution for surfaces with trivial Picard group. The problem remains open for affine spaces of dimension greater than or equal to 3 (i.e. if $X \times \mathbb{C}$ is isomorphic to $\mathbb{C}^4$, it is unknown whether or not X must be isomorphic to $\mathbb{C}^3$). It is natural therefore to consider smooth affine threefolds with trivial Picard group. The first such counterexamples were found by Finston and Maubach, but these varieties are topologically distinct from affine spaces. More recently, contractible counterexamples were found, as were counterexamples among certain affine open subsets of $\mathbb{C}^3$ (by Dubouloz and coworkers). The aforementioned examples all have nontrivial Makar Limanov invariant, unlike other recent examples found by Dubouloz and Finston. The latter are again topologically distinct from affine spaces. It is natural to wonder whether a smooth contractible three dimensional affine variety with trivial Makar Limanov invariant satisfies cancellation and whether these conditions characterize $\mathbb{C}^3$ as a variety.

Spring 2011

March 31: Louiza Fouli, NMSU

Title: Balanced ideals.

Abstract: Let R be a Noetherian ring and let I be an ideal. Recall that J is a reduction of I if $J \subseteq I$ and $I^{n+1} = JI^n$ for some nonnegative integer n. An ideal I is called balanced if $J : I$ is independent of the minimal reduction J of I. We will discuss properties of balanced ideals and also generalizations of this notion.

March 16: Bruce Olberding, NMSU

Title: Intersections of valuation rings over projective surfaces.

Abstract: Let D be a two-dimensional Noetherian domain, and let X be a projective model over D; i.e., there exist $x_1, , x_n \in D$ such that X is the projective scheme covered by $Spec(D[\frac{x_1}{x_i}, \ldots, \frac{x_n}{x_i}])$, where $i = 1, , n$. Then there is a morphism d from the locally ringed space $Zar(D)$ of all valuation overrings of D to X. We consider subspaces Z of $Zar(D)$ such that the restriction of d to Z has fibers that are Noetherian subspaces of $Zar(D)$. (A simple and easy-to-realize example of such a subspace Z is when each point $x \in X$ has at most one valuation ring in Z centered on it.) We describe the locally ringed space Z in terms of its underlying topology and its structure sheaf of rings. This leads to some natural examples of Prüfer and almost Dedekind overrings of two-dimensional Noetherian domains.

March 16: Bruce Olberding, NMSU

Title: The arc space of $X^2 - Y^3 = 0$.

Abstract: In an unpublished paper of 1968, J. Nash showed that the space of arcs of a variety is a scheme that encodes information about the structure of a minimal resolution of singularities of the scheme. As part of a study of the singular locus of the space of arcs, Reguera showed in 2009 that the space of arcs of the plane curve $X^2 - Y^3 = 0$ has a point whose local ring has a reduced image that is a one-dimensional analytically ramified Noetherian ring. We outline Reguera's description of this ring.

February 16: Janet Vasseliv, University of New Mexico

Title: When is a closure operation both a Nakayama closure and a semiprime operation?

Abstract: Let (R, m) be a local ring. We say $I- > I^c$ is a closure operation on the set of ideals of R if for all ideals I of R: (1) I is a subset of I^c, (2) I a subset of J implies I^c is a subset of J^c and (3) $(I^c)^c = I^c$. We say a closure operation is a Nakayama closure if I a subset of J and J a subset of $(I + mJ)^c$, implies that $I^c = J^c$. A closure operation is semiprime if $I^c J^c \subseteq (IJ)^c$. Several well known closure operations, such as integral closure and tight closure, are both Nakayama closures and semiprime operations. We will exhibit that there are Nakayama closures which are not semiprime and semiprime operations which are not Nakayama and discuss some conditions which will ensure a closure operation is both semiprime and Nakayama.

February 9: Bruce Olberding, NMSU

Title: Analytically ramified local rings and finite normalization

Abstract: The completion of a local Noetherian ring preserves many properties but also sometimes introduces new complications, such as zero divisors or nilpotent elements. We look at a few classical algebraic examples of how some of the complications arise, as well as a newer geometric one arising from the Nash problem on the space of arcs.

Fall 2010

December 1: Patrick Morandi, NMSU

Title: Maximal orders over Dedekind domains, 2

Abstract: This is a continuation of the Nov 18 seminar.

November 18: Patrick Morandi, NMSU

Title: Maximal orders over Dedekind domains, 1

Abstract: Let F be a field and D an F-central division algebra. Suppose F is the quotient field of a Dedekind domain A. An A-order in D is a subring R such that R is integral over A and $R \otimes_A F = D$. A maximal order is an order which is maximal with respect to inclusion among orders in D. In these talks we give some of the historical motivation for considering orders (they were a critical part of the classification of division algebras over number fields in the 1930s), some examples, a little structure theory, and given, time, prove the theorem that each integer is the sum of four squares of integers by considering the arithmetic properties of maximal orders in the division ring of rational quaternions.

November 10: Adrien Dubouloz, CNRS, Universite de Bourgogne

Title: Polynomial automorphisms and infinite dimensional algebraic groups

Abstract: Given a polynomial ring R in n variables over a field, it is a natural problem to construct a geometric object whose "points" would correspond to automorphisms of R. Intuitively, such an object should have the structure of an infinite dimensional algebtraic group. In the sixties, Shafarevich proposed a natural solution to this problem, but it turned out that certain parts of his approach were too vague to be considered as giving a fully satisfactory answer to the problem. Later on, Kambayashi proposed a more rigorous construction of the "variety of polynomial automorphisms" as the open prime spectrum of a suitable topological algebra. But since then, the properties of this object remained mysterious. In this talk, I will explain how to construct a natural extension of the category of finitely generated algebras (or of algebraic schemes) in which we can re-interpret the Kambayashi variety as a universal object that essentially represent the functor of polynomial automorphisms. (Joint work with Jean-Philippe Furter)

October 27: Louiza Fouli, New Mexico State University

Title: Constraints for minimal reductions of edge ideals, II

Abstract: This is a continuation of the Oct 20 algebra seminar.

October 20: Louiza Fouli, New Mexico State University

Title: Constraints for minimal reductions of edge ideals

Abstract: In this talk we will be discussing minimal reductions of ideals in Noetherian local rings. Recall that J is a reduction of I if J is a subideal of I and it has the same integral closure as I. When the ring is a Noetherian local ring with infinite residue field then there are infinitely many reductions of I. The core of I is defined to be the intersection of all its reductions. We will focus on the class of square–free monomial ideals and their reductions and cores. These ideals arise as edge ideals of graphs. We make use of the structure of the associated graph and determine restrictions on the generators of minimal reductions. Using these restrictions we are able to compute the core of these ideals.

October 13: David Hren, New Mexico State University

Title: Dimension of the Generic Formal Fiber

Abstract: Let R be a local, Noetherian ring and R^* its completion. Matsumura initiated the study of the dimension of the fibers of the map on the prime spectra induced by the inclusion $R- > R^*$; we'll review this work.

October 6: Bruce Olberding, New Mexico State University

Title: Zariski's Connectedness Theorem and the exceptional prime divisors of a two-dimensional local domain, III

Abstract: This is a continuation of the Sept 29 algebra seminar.

September 29: Bruce Olberding, New Mexico State University

Title: Zariski's Connectedness Theorem and the exceptional prime divisors of a two-dimensional local domain, II

Abstract: This is a continuation of the Sept 22 algebra seminar.

September 22: Bruce Olberding, New Mexico State University

Title: Zariski's Connectedness Theorem and the exceptional prime divisors of a two-dimensional local domain

Abstract: This talk focuses on the blow-up algebras of a two-dimensional local Noetherian domain, with the goal of giving algebraic and valuation-theoretic interpretations of the exceptional divisor of the blow-up.

September 15: Jesse Elliot, California State UniversityChannel Islands

Title: t-closure and integer-valued polynomial rings

Abstract: The operation of t-closure on the ideals of an integral domain is a useful tool for studying certain classes of integral domains, such as the UFD's, Krull domains, and PVMD's. In this talk I will introduce the t-closure operation and give some applications to the theory of integral domains and in particular to the study of integer-valued polynomial rings.

September 8: Patrick Morandi, New Mexico State University

Title: Algebras with Involution and Isotropicity Questions, Part II

September 1: Patrick Morandi, New Mexico State University
Title: Algebras with Involution and Isotropicity Questions, Part I

Spring 2010

April 28: Gabriele Fusacchia, Universita di Padova
Title: Injective modules and semistar operations

April 21: David Finston, New Mexico State University
Title: The Fundamental Theorem of Algebra

April 14: Tom Marley, University of Nebraska, Lincoln
Title: Finiteness properties of local cohomology modules
Abstract: Local cohomology modules are almost always not finitely generated. However, in many cases they possess certain "finiteness" properties, such as finite Bass numbers, finite sets of associated primes, and "cofiniteness" (a property defined by Hartshorne). I will review some of these results, provide some interesting counterexamples to show not every local cohomology module possesses these properties, and discuss some questions that remain open.

April 7: Patrick Morandi, New Mexico State University
Title: Division Algebras, Noncrossed Products, and Valuation Theory, Part II

March 31: Patrick Morandi, New Mexico State University
Title: Division Algebras, Noncrossed Products, and Valuation Theory, Part I

March 18: Carol Walker, New Mexico State University
Title: Bass's Whitehead and Grothendieck groups for preabelian categories.

March 10: Elbert Walker, New Mexico State University
Title: Local rings and direct sum decompositions of modules, Part II

March 3: Elbert Walker, New Mexico State University
Title: Local rings and direct sum decompositions of modules, Part I

February 24: Janet C. Vassilev, University of New Mexico
Title: Some surprising features of local rings with test ideal $\mathfrak{m}$.
Abstract: We will discuss tight closure and test ideals in the setting of local semigroup rings and monomial quotients of power series rings. Then we will exhibit some interesting applications that arise when the test ideal is the maximal ideal.

February 18: Susan Morey, Texas State University
Title: Blowup algebras

Abstract: Given an ideal I in a ring R, the family of algebras known as the blowup algebras includes the Rees algebra, the associated graded ring, and the symbolic Rees algebra. In this talk, I will define these algebras and give some background indicating why they are of interest. I will then give a series of results detailing how properties of the ideal I relate to properties of the various blowup algebras. I am particularly interested in finding conditions under which the Rees algebra is Cohen-Macaulay. Symbolic powers of ideals prove useful in this study, which leads to a need for more information about associated primes of powers of ideals.

February 10: David Finston, New Mexico State University

Title: A Danielewski Approach to Triangular Ga Actions

Abstract: A celebrated result of Kaliman asserts that every fixed point free action of the additive group of complex numbers on complex 3 space is actually a translation in some coordinate system. As such the space of orbits is isomorphic to complex 2 space. This is not true in higher dimensions. There are many examples of fixed point free actions on complex 4 space which are "improper" in the sense that the space of orbits doesn't even have the structure of a variety. I'll discuss the conjecture that proper actions on complex 4 space are translations, as well as an approach to proving it in some important cases using Danielewski surfaces. It should be noted that the conjecture is false in dimension 5.

February 3: Anton Dochtermann, Dartmouth College

Title: Cellular resolutions of hypergraph edge ideals

Abstract: Given an ideal I in the polynomial ring $S = k[x_1, ..., x_n]$, a basic problem in commutative algebra is to describe a (minimal) free resolution of I. One particularly geometric method is through the construction of a 'cellular resolution', where the syzygies of I are encoded by the faces of a polyhedral (or more generally CW) complex. For a (hyper)graph G on n vertices, the edge ideal I_G is defined to be the monomial ideal in S generated by the edges of G. We show how a certain "space of directed edges" of G gives rise to a labeled complex which, under conditions on G, supports a minimal cellular resolution of the edge ideal. These complexes are naturally realized as subcomplexes of a well known 'mixed subdivision' of a dilated simplex. In particular we obtain explicit cellular resolutions of the edge ideals of (complements of) "interval" graphs (and their hypergraph generalizaitons), extending results of Nagel and Reiner. This is joint work with Alex Engstrom (UC Berkeley).

January 27: Lars W. Christensen, Texas Tech University:

Title: Floor plans in local algebra

Abstract: Let R be a commutative noetherian local ring. In a paper from 2003, Schoutens proves that every finitely generated R-module can be built from the prime ideals in the singular locus $Sing(R)$ by iteration of a few simple constructions. Schoutens also proved that the Krull dimension of a singular ring R provides an upper bound for the number of iterations required to build any module in $mod(R)$, and it follows from recent work of Takahashi that this bound is sharp if R is an isolated singularity. In the talk I will show

exactly how many iterations are required; it is based on work in progress joint with Jesse Burke.