

ABDUS SALAM

SCHOOL OF MATHEMATICAL SCIENCES

AND

NATIONAL CENTER FOR MATHEMATICS

GOVERNMENT COLLEGE UNIVERSITY, LAHORE

REPORT 2017

Abdus Salam
School of Mathematical Sciences

and

National Center for Mathematics

Government College University, Lahore

Report 2017





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Abdus Salam School of Mathematical Sciences



Let us strive to provide equal opportunities to all so that they can engage in the creation of Physics and science for the benefit of all mankind.

*Abdus Salam
Speech at the Nobel Banquet,
December 10, 1979*

CONTENTS

The background features a stylized tree with various mathematical notations and diagrams. The trunk and branches are filled with handwritten-style formulas such as $\lim_{x \rightarrow a} x = a$, $\lim_{x \rightarrow 0} x \cot x$, $\lim_{x \rightarrow 0} \frac{3x^2 + 1}{x^2 + 1} = 3$, $\lim_{x \rightarrow 0} \frac{1}{x} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^2} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^3} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^4} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^5} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^6} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^7} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^8} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^9} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{10}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{11}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{12}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{13}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{14}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{15}} = \infty$, $\lim_{x \rightarrow 0} \frac{1}{x^{16}} = \infty$, 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ABOUT THE SCHOOL

Established in 2003 as an independent center for mathematical sciences, the school is affiliated with the Government College University, Lahore. Abdus Salam School of Mathematical Sciences (AS-SMS) has rapidly evolved into a center of excellence for research as well as advanced learning in mathematical sciences; More than one hundred and forty students have already received doctorates in Mathematics since the school's inception.

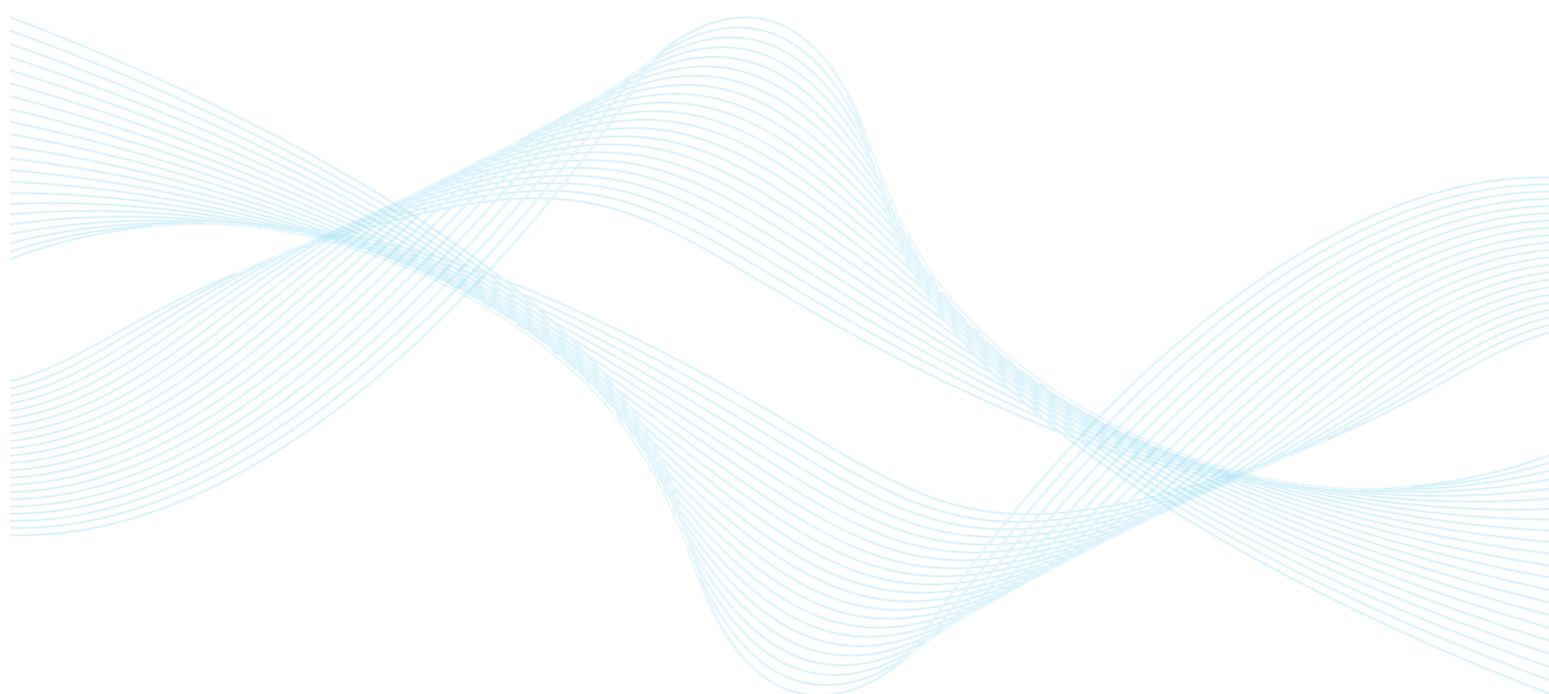
The school aspires to be a center of excellence in mathematical sciences carrying out cutting edge research which pushes the frontiers of knowledge and to be a place which

“help men who are creative and deep and active
and struggling scholars and scientists to get the
job done that it is their destiny to do.”

Robert J. Oppenheimer

The school aims to achieve this by providing faculty and the students with all the help they need and the facilities they require to carry out the work that is their destiny to do. The school makes every effort to provide quality education to its graduate students by engaging faculty which is best in the world in their areas of expertise. A testament to these efforts, AS-SMS was named among the three Emerging Regional Centers of Excellence by the European Mathematical Society in 2011.

The school takes various initiatives for disseminating to the Pakistani academic community the latest developments in mathematical sciences. The school organizes a large number of seminars, colloquia, research schools, intensive courses and lecture series which are open to all students and faculty in the country.



MESSAGE FROM THE VICE CHANCELLOR

There is no doubt that the development and prosperity of a nation is tied to the importance it places and efforts it makes to promote education in all areas but specially in science, technology and mathematics. The crucial role mathematics plays in all natural sciences and its need for technological advancement requires mathematicians with a deep understanding of the subject who can then disseminate a proper understanding of the subject to students of mathematics, natural sciences and engineering. The School of Mathematical Sciences was established in 2003 by the Higher Education Commission at the Government College University (Lahore) to train the next generation of mathematical scientists who carry out work at the frontiers of their field.

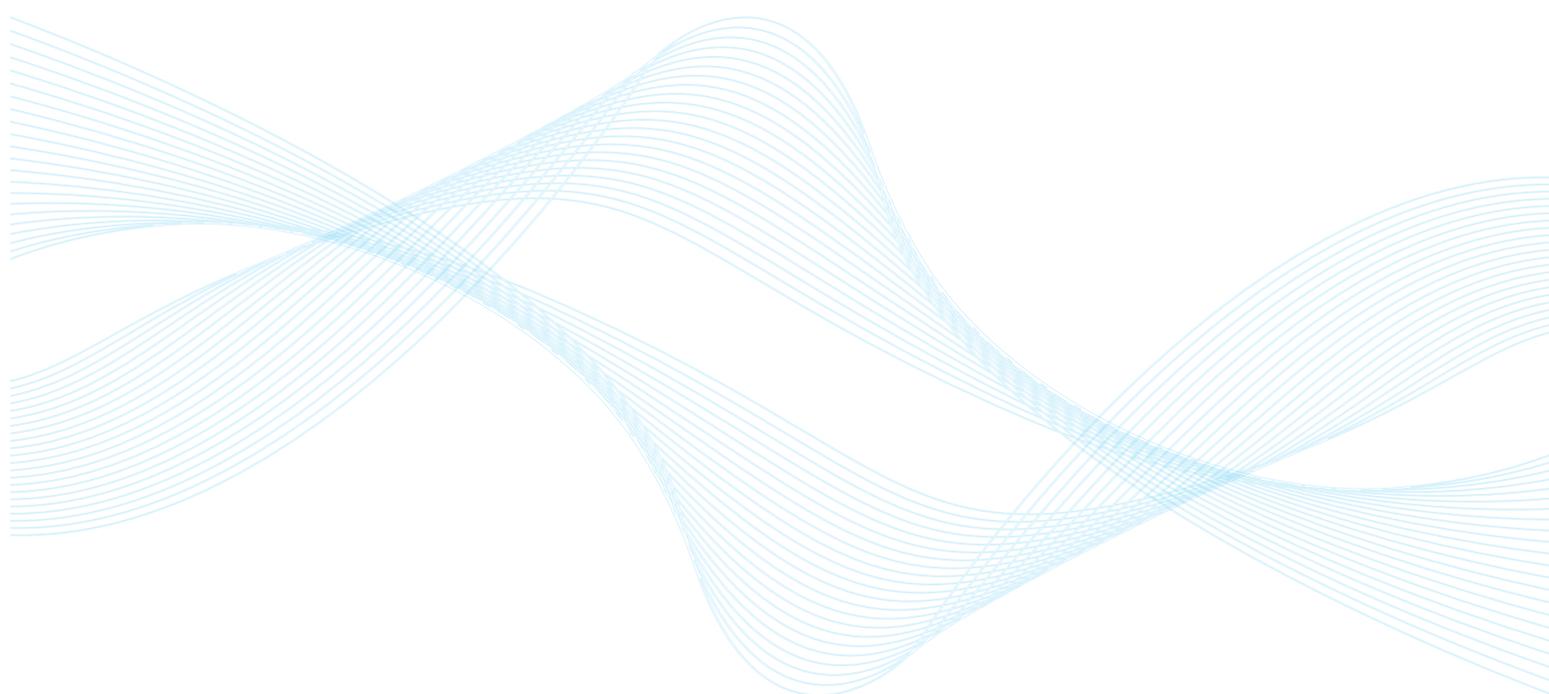


The school was later named as Abdus Salam School of Mathematical Sciences to pay tribute to one of the most illustrious student and later faculty member of the Government College University (Lahore) Prof. Abdus Salam who had won the 1979 Nobel prize in physics. The school enjoys the reputation of being a center for excellence in mathematics. The faculty members of the school are endeavoring to build modern research center by organizing seminars, invited lectures, workshops and other academic activity for students and faculty of all universities in Pakistan.

The school now has research collaboration with leading research institutions such as Center of Mathematical Sciences and Applications at Harvard university, Simon Center for Geometry and Physics and Center for Theoretical Physics of the Universe at Seoul National University. I sincerely wish the school success in the various initiatives being planned for the future.

Hassan Amir Shah (SI)

Chairman Board of Governors
Vice Chancellor,
Government College University, Lahore



MESSAGE FROM THE DIRECTOR GENERAL

The influence of science and technology has completely reshaped the world in the last hundred years. The economic benefits that we derive from it have made its understanding and development one of the corner stones of economic policies in almost all countries. The appreciation of science and mathematics should not only be because of its immediate or longer term economic benefits but also as a tool for understanding the world we live in and the societal benefits such an understanding brings. The science today is asking and in some answering the most fundamental questions about the universe. It is developing a world view from the very small to the very big. Thanks to the work of physicists such as Abdus Salam we now have a very good understanding of the particles that make up the world. At the very large scale we have a very good understanding of how the universe evolved from few seconds after the Big Bang. Scientists can now make measurements which have an accuracy equivalent to measuring the distance to the nearest star with an error smaller than the width of a human hair. In coming years we will see many technologies based on these and similar experiments just as technologies we take for granted today came from experiments of the past. This is also one of the reasons for a longer term investment in fundamental sciences. Unfortunately, in Pakistan we have not been able to develop this beyond the horizon perspective and are lagging in all areas of science, engineering and mathematics.



The Abdus Salam School of Mathematical Sciences is one of the few places in the country where cutting edge research in areas of mathematics and theoretical physics is being carried out. The School has also played an important role in the development of mathematics research and education in the country. With more than 140 graduates teaching in a number of public and private sector universities in Pakistan the school's efforts in producing good mathematicians is now influencing mathematics around the country.

The school also hosts the National Center for Mathematics and in this role is actively involved in the promotion of mathematical sciences in the country. All over the world the universities are the primary driving force behind pure and applied research. The school and the center emphasize the need for Pakistani universities to conduct research directed towards problem solving and organize various academic activities to help students of all universities learn not only the basics but also the cutting edge work in areas of mathematics and theoretical physics. Some of the leading mathematicians and physicists of the country have contributed to these activities. In the coming years the school and the center plans to carry out academic activities throughout the year related with research and teaching of mathematical sciences in the country with the hope of changing the research culture in the country from that of paper writing to problem solving.

Ghulam Murtaza

Director General

Salam Chair & Distinguished National Professor,
Government College University, Lahore

PROGRAMMES

The school offers full time MPhil and PhD programs in Mathematics. The students are admitted to the MPhil program based on their GPA in the undergraduate studies, performance in the admission examination and the interview conducted by the faculty of the school. In the past the school had an MPhil leading to PhD program in which students who performed well in the MPhil continued their studies for the PhD degree. Starting in 2016 the school eliminated MPhil leading to PhD program on the recommendation of the HEC and admission to PhD program now requires a separate admission examination.

MPhil Program of the school is of two year duration with each academic year divided into two semesters. In the first two semesters the students take courses and the last two semesters are devoted to working on a thesis. The course work in MPhil requires students to take ten core courses which cover all important areas of mathematics.

Students with MPhil, MS or an equivalent degree in mathematics can apply for admission to the PhD program and are admitted after passing an admission test prepared by the faculty of the school. During the first two semester the students in the PhD program take various courses from a list of core courses which would be of help in their research. The students have to pass a comprehensive examination after finishing the course work and before starting research. The school has 23 MPhil and 33 PhD students at the moment. Keeping in mind the best international practices and unlike most public sector universities the school provides all its students financial assistance to ensure they can devote all their time to course work and research.



FACULTY

The school has both local and foreign faculty engaged in teaching, research and MPhil/PhD student supervision. The faculty also interacts, collaborates and mentors the postdoctoral fellows of the school.

Afshan Sadiq
Assistant Professor
PhD: Abdus Salam School of Mathematical Sciences (2010)
Specialization: Algebra
Email: afshanadil@sms.edu.pk



Imran Anwar
Associate Professor
PhD: Abdus Salam School of Mathematical Sciences (2008)
Specialization: Algebra
Email: imrananwar@sms.edu.pk



Amer Iqbal
Visiting Professor
PhD: Massachusetts Institute of Technology (2000)
Specialization: Theoretical and Mathematical Physics
Email: amer@alum.mit.edu



The foreign faculty of the school visit the school to teach courses and to supervise MPhil/PhD students. They also offer intensive courses and short lecture series on topics of interest to students. The foreign faculty currently engaged in teaching and research activities with MPhil/PhD students and postdoctoral fellows include the following esteemed individuals:

Andrea Fenovcikova
Department of Applied Mathematics and Informatics
Technical University of Kosice,
Kosice, Slovakia



Dan Grigore Timotin,
Institute of Mathematics
of the Romanian Academy
Bucharest, Romania



Constantin Fetecau
Academy of Romanian Scientists
Bucuresti, Romania



Dorin Popescu
University of Bucharest
Bucharest, Romania



Georgi Eremiev Karadzhov
Bulgarian Academy
of Sciences Bulgaria



Vieru Dumitru
"Gh. Asachi" Technical University of Iasi,
Romania



Barbu Berceanu
Institute of Mathematics of the Romanian Academy
Bucuresti, Romania



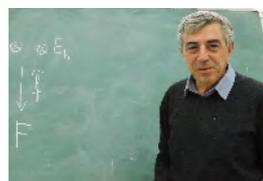
Dimitar A. Kolev
Department of Mathematics
University of Chemical Technology and Metallurgy, Sofia, Bulgaria



Gerhard Pfister
Fachbereich Mathematik Universitat Kaiserslautern
Germany



Johann Davidov
Institute of Mathematics and Informatics
Bulgarian Academy of Sciences, Sofia, Bulgaria



Peter Schenzel
Institut für Informatik
Martin-Luther-Universität Halle, Germany



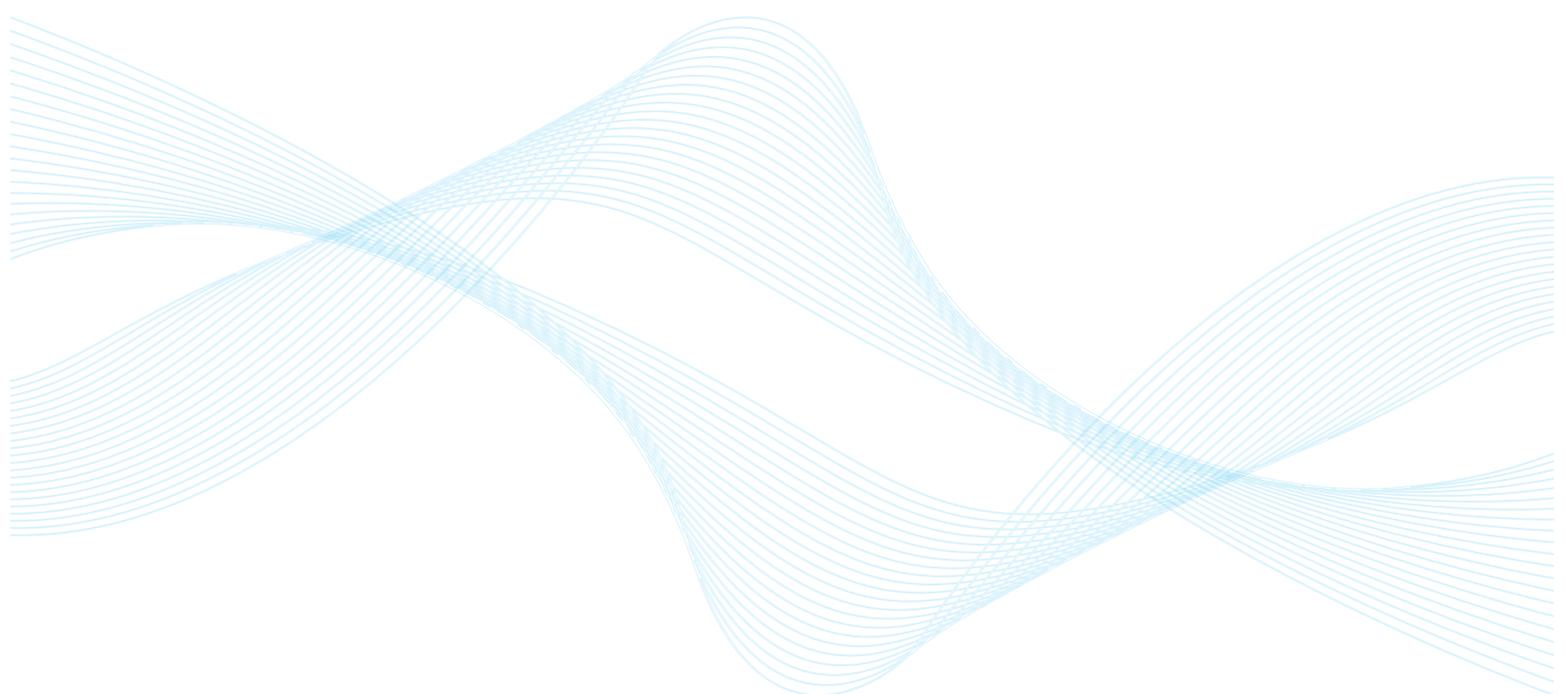
Rein Leo Zeinstra
University of Hamburg
Osterstrasse Hamburg, Germany



Tzanko Donchev
University of Architecture, Civil Engineering and Geodesy
Bulgaria



Viviana Ene
Ovidius University of Constanta,
Romania



POSTDOCTORAL FELLOWS

The school has always tried its best to provide space and facilities to young researchers to enhance their skills and understanding by interacting with eminent foreign and local faculty of the school who are experts in their areas of research. The Postdoctoral Fellowships are offered by the school every year to local and foreign scientist to spend nine months in the school. In recent years the financial support has been increased to make the fellowship more attractive for recent graduates. In the last couple of years the school had the following postdoctoral fellows:

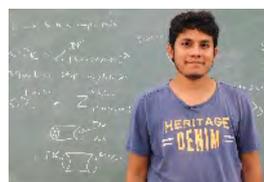
Safyan Ahmed
PhD: Abdus Salam School of Mathematical Sciences
Combinatorial Commutative Algebra



Muhammad Azeem Khadam
PhD: Abdus Salam School of Mathematical Sciences
Algebraic Geometry



Muhammad Norman Muteeb
PhD: Scuola Internazionale Superiore di Studi Avanzati (SISSA)
Theoretical Physics



Syeda Laila Naqvi
PhD: University of Leicester
Numerical Analysis and Computational Mathematics



Abdul Rauf Nizami
PhD: Abdus Salam School of Mathematical Sciences
Combinatorics and Knot Theory



Shafiq Ur Rehman
PhD: Abdus Salam School of Mathematical Sciences
Commutative Algebra and Multiplicative Ideal Theory



Azhar Ali Zafar
PhD: Abdus Salam School of Mathematical Sciences
Fluid Dynamics



The Students who finished their MPhil in 2016-2017 are listed below

Adeel Ahmad
Supervisor: Dimitar Kolev
Thesis Title: Perturbed Nonlinear Oscillator

Ghazanfar Abbas
Supervisor: Imran Anwar
Thesis Title: Algebraic Characterization of Degree Monotone Paths of Simple Graphs

Ali Ahmed
Supervisor: Afshan Sadiq
Thesis Title: Algorithms For Primary Decomposition

Numan Amin
Supervisor: Amer Iqbal
Thesis Title: Tropical Geometry and Quantum Curves

Faraha Ashraf
Supervisor: Andrea Fenovcikova
Thesis Title: Metric Dimension of Subdivided Graphs

Shamas Bilal
Supervisor: Tzanko Donchev
Thesis Title: One Sided Perron M-dissipative Differential Inclusions

Azhar Farooq
Supervisor: Amer Iqbal
Thesis Title: Symmetries And Conserved Quantities

Kamran Haider
Supervisor: Dimitar Kolev
Thesis Title: Qualitative Analysis of a Nonlinear System in Depending On Parameters

Qamar Hussain
Supervisor: Georgi E. Karadzhov
Thesis Title: $\sum(p)$ Method Of Extrapolation Spaces

Nimra Javed
Supervisor: Imran Anwar
Thesis Title: The Waldschmidt Constant Oor Monomial Ideals Of Simplicial Complexes

M. Ahsan Khan
Supervisor: Dan Timotin
Thesis Title: Similinear Differential Inclusions Under Dissipative Conditions

Yasir Mahsud
Supervisor: Amer Iqbal
Thesis Title: Dimension of The Space of Vector Valued Modular Forms

Ali Ovais
Supervisor: Amer Iqbal
Thesis Title: Symmetric Functions and Fermionic Fock Space

Ali Raza
Supervisor: Amer Iqbal
Thesis Title: L-functions In Number Theory

Said Waqas Shah
Supervisor: Rein Leo Zeinstra
Thesis Title: A Proof of the Malgrange-Ehrenpreis Theorem by Hilbert Spacmethods

Umar Shahzad
Supervisor: Amer Iqbal
Thesis Title: Toric Geometry and Partition Function of Compactified Webs

Awais Shaukat
Supervisor: Barbu Berceanu
Thesis Title: Some Classical And Modern Invariants Of Knots, Links And Braids

M. Yameen
Supervisor: Amer Iqbal
Thesis Title: Toric Calabi-yau Threefolds and Their Partition Functions

The Students who finished their PhD in 2016-2017 are listed below

Malik Tusif Ahmed
Supervisor: Tiberiu Dumitrescu
Thesis Title: Radical and Invertible-radical Factorization in Commutative Rings

Naveed Akhtar
Supervisor: Ioan Tomescu
Thesis Title: Classes Of Graphs Having External Topological Indices

Shehraz Akhtar
Supervisor: Constantin Fatecau
Thesis Title: Natural Convection Flows of Viscous Fluids and Different Motions of Couple Stress Fluids

Misbah Arshad
Supervisor: Ioan Tomescu
Thesis Title: Extremal Graphs with Respect to General Sum-connectivity Index

Asma
Supervisor: Vasile Lupulescu
Thesis Title: Fractional Differential Equations with Volterra Operators

Imran Abbas Baloch
Supervisor: Imdat Işcan
Thesis Title: Harmonically (s,m) -convex Functions and Related Inequalities

Faryal Chaudhry
Supervisor: Viviana Ene
Thesis Title: Hankel Ideals Associated with Graphs

Asfand Fahad
Supervisor: Josip Pečarić
Thesis Title: Generalization of Steffensen's Inequality and Related Results

Absar Ul Haq
Supervisor: Johann Davidov
Thesis Title: Harmonic Almost (pseudo-) Hermitian Structures

Rida Irfan
Supervisor: Viviana Ene
Thesis Title: Homological Properties Of Binomial Edge Ideals

Tahira Jabeen
PhD Supervisor: Vasile Lupulescu
Thesis Title: Differential Equations With Causal Operatorsm.

Kamran Jamil
PhD Supervisor: Ioan Tomescu
Thesis Title: Graph Indices and Graph Productsm.

Azeem Khadam
Supervisor: Peter Schenzel
Thesis Title: Local Bezout Inequalities and Homological Methods

Itrat Abbas Mirza
Supervisor: Vieru Dumitru
Thesis Title: The Study of Transport Processes in Fluid Dynamics

Maria Naseem
Supervisor: Martin Bača
Thesis Title: Total and Entire Labeling of Graphs

Niat Nigar
Supervisor: Constantin Fatecau
Thesis Title: Free Convection Flows of A Viscous Fluids And Various Motions of Rate Type Fluids

Muhammad Rafaqat
Supervisor: Tzanko Donchev
Thesis Title: Approximation & Viability of Dynamical Systems

Anam Rani
Supervisor: Tiberiu Dumitrescu
Thesis Title: Characterizations of Perinormal Rings With Zero Divisors

RESEARCH HIGHLIGHTS

The school has active research groups in mathematics and theoretical physics.

- String Theory
- Functional Analysis
- Computational Algebra
- Multiplicative Ideal Theory
- Graph Theory
- Combinatorial Commutative Algebra
- Fluid Dynamics

STRING THEORY

The string theory group this year made some important progress on two fronts. They were able to determine the refined topological string partition function of the Calabi-Yau threefold which is the total space of the canonical bundle over the two dimensional projective space. The usual refined topological vertex technique could not be used for this Calabi-Yau threefold and this was an open problem. On a different front the group along with collaborators studied six dimensional little strings and their realization in F-theory using double elliptically fibered Calabi-Yau threefolds. This study led to a new set of dualities connecting various little string theories. It was also shown that a subsector of the partition function of little strings is given by a symmetric orbifold conformal field theory.

Papers

Refined topological strings on local \mathbb{P}^2

Amer Iqbal, Can Kozçaz

Journal of High Energy Physics 2017 (3)

Triality in little string theories

Brice Bastian, Stefan Hohenegger, Amer Iqbal, Soo-Jong Rey

arXiv preprint arXiv:1711.07921 (2017)

Bound states of little strings and symmetric orbifold conformal field theories,

Ambreen Ahmed, Stefan Hohenegger, Amer Iqbal, Soo-Jong Rey

Physical Review D 96 (8), 081901 4 2017

Dual Little Strings and their Partition Functions

Brice Bastian, Stefan Hohenegger, Amer Iqbal, Soo-Jong Rey

arXiv preprint arXiv:1710.02455 (2017)

Dual little strings from F-theory and flop transitions
Stefan Hohenegger, Amer Iqbal, Soo-Jong Rey
Journal of High Energy Physics 2017 (7), 112

FUNCTIONAL ANALYSIS

Rewayat Khan, a student in the functional analysis group, worked on a new class of operators, the matrix valued truncated Toeplitz operators (MTTOs). These operators act on general model spaces, and are a natural generalization of (scalar) truncated Toeplitz operators, whose theory has been much developed in the last decade, since their introduction in a seminal paper of Sarason. Following interesting results were obtained by Rewayat Khan:

- different characterizations of MTTOs,
- determination of the degree of freedom of the symbol,
- dimension of the space of MTTOs in case of a finite dimensional model space,
- description of some finite rank MTTOs. These results appeared in the paper:

Matrix valued truncated Toeplitz operators: basic results
Rewayat Khan, Dan Timotin
Complex Analysis and Operator Theory
published online 20 April 2017, DOI 10.1007/s11785-017-0675-3.

Ahsan Khan investigated block Toeplitz matrices, especially with regard to multiplication properties. He was able to identify a family of maximal sub-algebras of block Toeplitz matrices, closely related to the generalized circulants in the scalar case. He obtained the following interesting results:

- proof that a large class of maximal sub-algebras of block Toeplitz matrices are of this type.
- for entries belonging to certain algebras, all maximal sub-algebras of block Toeplitz matrices are of this type.
- example when not all are of this type.

These results appeared in the paper:

A family of maximal algebras of block Toeplitz matrices,

Muhammad Ahsan Khan:
submitted to An. St. Univ. Ovidius Constanta, Ser.
Mat.

Ali Raza and Irshaad Ahmed investigated two problems. The first dealt with general Holmstedt's formulae for the K-functional and optimal embedding for inhomogeneous Sobolev spaces defined on \mathbb{R}^n : The classical Holmstedt formula for the K-functional has been extended to more general cases by many authors in recent years. They together with Georgi E. Karadzhov considered the most general case thus covering many previous results. Moreover, two of the results are in a final form that can not be improved.

The second problem involved the most general case of optimal embeddings for inhomogeneous Sobolev spaces. The case of inhomogeneous Sobolev spaces $W^k E$ on \mathbb{R}^n for $k=1$ is investigated by Vybiral in the class of rearrangement invariant Banach function spaces. The case of all $k < n$ is treated by Milman, Martin and Pustylnik, who proved an optimal embedding in a rearrangement invariant set. Ali Raza and Irshaad Ahmed investigated the most general case which in the subcritical case can not be improved.

Reiteration in K-interpolation method for quasi-normed spaces

Irshaad Ahmed, Georgi Karadzhov, Ali Raza,
C. r. de l'Acad. bulgare des Sci. 69 (2016), No 4,
405-410.

Optimal embeddings of generalized inhomogeneous Sobolev spaces

Irshaad Ahmed, Georgi Karadzhov, Ali Raza,
C. r. de l'Acad. bulgare des Sci., 70 (2017).

General Holmstedt's formulae for the K-functional,
Irshaad Ahmed, Georgi Karadzhov, Ali Raza
Journal of Function Spaces, 2017.

COMPUTATIONAL ALGEBRA

Shamsa Kanwal and collaborators generalized the concept of r-standard bases to any monomial ordering. They developed a theory and algorithms of border basis and Janet bases for non-well orderings in a general setting and analyzed modular and parallel algorithms to compute them. They also gave a modular and parallel implementation of r-

standard bases in Singular and compared the results with other implementations. They compared their implementation of Janet bases with the implementation in Singular based on the algorithm of Gerd and proved the corresponding verification theorem for the modular approach.

They also developed a theory, algorithms and implementations to compute sagbi bases for local orderings in a parallel and modular setting..

They gave an algorithm to compute standard bases of an infinite dimensional vector space given by the sum of two modules over different rings and explained how these standard bases can be computed using modular methods. This work has important applications in singularity theory.

Khawar Mehmood and collaborators studied the problems in singularity theory from computational algebra perspective. They developed and implemented algorithms to study curve singularities:, a classifier for unimodal parametrized plane curves and a procedure to compute various invariants of plane curves. They also developed a procedure to compute the normal form of plane curves which can be used to study the corresponding moduli spaces.

Papers

On the classification of simple maps from the plane to the plane

Muhammad Ahsan Binyamin, Hasan Mahmood,
Shamsa Kanwal

J. Algebra Appl. 16, No. 10, (2017).

classifyMapGerms.lib. A Singular 4-0-2 library for computing the standard basis of the tangent space at the orbit of an algebraic group action

Deeba Afzal, Shamsa .Kanwal, Gerhard Pfister

rStandard.lib, Singular 4-0-2 to compute Janet bases and border bases

Shamsa Kanwal, Gerhard Pfister

Tangent Space at the Orbit of an Algebraic Group Action

Deeba Afzal, Shamsa Kanwal, Gerhard Pfister

To appear in Bull. Math. Soc. Sci. Math. Roumanie

Standard Bases with Special Generators of the

Leading Ideal

Shamsa Kanwal, Gerhard Pfister

To appear in Bull. Math. Soc. Sci. Math. Roumanie

Characterization of uni-modal parametric plane curve singularities.

Muhammad Ahsan Binyamin, Hasan Mahmood, Junaid Alam Khan, Khawar Mehmood, J. Algebra Appl. 16, No. 2. (2017).

Simple Singularities of Parametrized Plane Curves in Positive Characteristic,

Khawar Mehmood, Gerhard Pfister (Submitted)

Unimodal Singularities of Parametrized Plane Curves

Khawar Mehmood, Gerhard Pfister

Bulletin Mathematique de la Societe des Sciences Mathematiques

de Roumanie, Volume 60(108)/2017, Issue no. 4, pages 417-424.

Bimodal Singularities of Parametrized Plane Curves

Khawar Mehmood, Muhammad Ahsan Binyamin (Submitted)

MULTIPLICATIVE IDEAL THEORY

Vaughan, Yeagy and Olberding studied the integral domains whose ideals are products of radical ideals. Malik Tauseef Ahmed along with his supervisor Tiberiu Dumitrescu gave two different extensions of these results for commutative rings with zero-divisors. They characterized the rings whose regular ideals are products of radical ideals. They also studied the rings whose ideals are products of radical ideals. Olberding introduced and studied the ZPUI (Zerlegung Prim und Umkehrbaridealen) domains, i.e. those integral domains for which every proper nonzero ideal can be factored as a product of an invertible ideal times a nonempty product of prime ideals. They introduced and studied a more general concept: the ISP-domains. A domain A is an ISP-domain if each proper ideal of A can be written as an invertible ideal multiplied by a nonempty product of proper radical ideals. Their main result shows that an ISP-domain is strongly-discrete Prufer with every nonzero prime ideal contained in a unique maximal ideal.

Badawi introduced and investigated the concept of 2-absorbing ideal (natural extension of "prime ideal"); an ideal I of a commutative ring R is a 2-absorbing ideal (TA-ideal) if whenever a, b, c are from R and $abc \in I$, then at least one of the elements ab, ac, bc is in I . Muzammil Mukhtar and his supervisor Tiberiu Dumitrescu introduced and studied two-absorbing factorization rings (TAF-rings), i.e. those commutative rigs whose ideals are products of TA-ideals. They characterized the TAF-rings in general, the TAF-domains and the Noetherian TAF-domain.

Epstein and Shapiro introduced and studied the perinormal domains: those domains A whose Going-Down-overrings are flat A -modules.

Anam Rani and her supervisor Tiberiu Dumitrescu broadly extended the main result that the Krull domains are perinormal by showing that every P-domain (i.e. a domains whose localizations at the prime ideals associated to principal ideals are valuation domains) is perinormal.

Later they extended their result to the case of rings with zero-divisors. They also gave a partial answer to a conjecture concerning the behavior of perinormality with respect to polynomial extensions.

Papers

SP-rings with zero-divisors

M.T. Ahmed and T. Dumitrescu

To appear in Comm. Algebra.

Domains with invertible-radical factorization

M.T. Ahmed and T. Dumitrescu

To appear in Bull. Korean. Math. Soc.

A note on perinormal domains

T. Dumitrescu and A. Rani

To appear in J. Comm. Algebra.

Perinormal rings with zero divisors

T. Dumitrescu and A. Rani

To appear in J. Applied Algebra

Commutative rings with two-absorbing factorization

M. Mukhtar, M.T. Ahmed and T. Dumitrescu

To appear in Comm. Algebra.

Perinormal polynomial domains
Anam Rani and Tiberiu Dumitrescu
To appear in Internat. Electr. J. Algebra

COMBINATORIAL COMMUTATIVE ALGEBRA

Much progress has been made in the study of subdivision of simplicial complexes. It led to many important discoveries in exploring the connection between enumerative combinatorics and algebra. For instance, the barycentric subdivision of simplicial complexes has been extensively studied in the literature. In our ongoing project, we address the enumerative behavior of the interval subdivision. The Interval subdivision of a $(d-1)$ -dimensional simplicial complex on a vertex set V was introduced by Walker. We analyze the behavior of f - and h -vectors under the interval subdivision. We give the formulation of the transformation matrices for f - and h -vectors in our ongoing project.

In another project, we discuss various classes of simplicial complexes associated to simple graphs. We discussed the algebraic characterization spanning simplicial complexes associated Jhangir's graph. In another ongoing project, we introduce the concept of monotone simplicial complexes associated to simple graphs by using the degree sequence of the graph.

We succeeded to give certain construction of graphs for which the associated monotone simplicial complex is Cohen-Macaulay.

The shellability of a simplicial complex is a well known combinatorial property that carries strong algebraic interpretations. We address the existing algebraic criterion for shellability of simplicial complexes and succeeded to give an efficient algebraic criterion.

On Algebraic Characterization of SSC of the Jahangir's Graph $J_{\{n,m\}}$
Z. Raza, A. Kashif, I. Anwar
Open Mathematics, accepted for publication.

An efficient algebraic criterion for shellability
I. Anwar, Z. Kosar, S. Nazir

arXiv:1705.09537v3

GRAPH THEORY

In [1] we proved the existence of the edge irregular reflexive k -labeling for the generalized friendship graphs (a symmetric collection of cycles meeting at a common vertex), and there is determined the exact value of the reflexive edge strength for several subfamilies of the generalized friendship graphs.

In [2] we estimate the bounds of the total H -irregularity strength of graphs and determine the exact values of the total H -irregularity strength for several families of graphs namely, paths, ladders and fans. In the paper [3] we studied the existence of the total (respectively, edge and vertex) G -irregularity strengths of the graph which contains exactly n subgraphs isomorphic to the graph G and proved that the exact values of the total (respectively, edge and vertex) G -irregularity strengths of the investigated family of graphs equal to the lower bounds..

The paper [4] estimates the lower and upper bounds of the entire face irregularity strength for the disjoint union of multiple copies of a plane graph and proves the sharpness of the lower bound in two cases. Ivančo and Jendro in 2006 conjectured that the total edge irregularity strength of graph G is the maximum of two lower bounds $(|E(G)| + 2)/3$ and $(\Delta(G) + 1)/2$ for all graphs G except the complete graph of order 5.

In the paper [5] the conjecture of Ivančo and Jendro is verified for the strong product of two cycles.

The Klein-bottle fullerene is a finite trivalent graph embedded on the Klein-bottle such that each face is a hexagon. The paper [6] deals with the problem of labeling the vertices, edges and faces of the Klein-bottle fullerene in such a way that the label of a face and the labels of the vertices and edges surrounding that face add up to a weight of that face and the weights of all 6-sided faces constitute an arithmetic progression of difference d . The paper proves the existence of such labelings for several differences d .

In the paper [7] we proved that every graph of fans is cycle (a,d) -antimagic. The paper [8] proves that

the disjoint union of generalized prisms admits a super d -antimagic labeling. The paper [9] proves the existence of 3-total edge product cordial labeling of the hexagonal grid.

1. On Edge Irregular Reflexive Labellings for the Generalized Friendship Graphs

M Bača, M Irfan, J Ryan, A. Semanicova, D Tanna
Mathematics 5 (4), 67

2. On H-irregularity strength of graphs

F. Ashraf, M. Baca, M. Lascsakova, A. Semanicova
Discussiones Mathematicae Graph Theory 37 No. 4 (2017), 1067-1078.

3. On H-irregularity strengths of G-amalgamation of graphs

F. Ashraf, M. Baca, A. Semanicova, A. Shabbir
Electronic Journal of Graph Theory and Applications 5 No. 2 (2017), 325- 334.

4. On entire face irregularity strength of disjoint union of plane graphs

M. Baca, M. Lascsakova, M. Naseem, A. Semanicova
Applied Mathematics and Computation 307 (2017), 232-238.

5. On total edge irregularity strength of strong product of two cycles

M. Baca, M. K. Siddiqui
Utilitas Math. 104 (2017), 255- 275.

6. Face labelings of Klein-bottle fullerenes

M. Baca, M. Naseem, A. Shabbir
Acta Mathematicae Applicatae Sinica 33 No. 2 (2017), 277-286.

7. Fans are cycle-antimagic

A. Ovais, A. M. A. Umar, M. Baca, A. Semanicova
Australasian Journal of Combinatorics 68 No. 1 (2017), 94-105.

8. Super d -antimagic labelings of disjoint union of generalized prisms

M. Baca, M. Numan, A. Semanicova
Utilitas Mathematica 103 (2017), 299-310.

9. On 3-total edge product cordial labeling of honeycomb

A. Ahmad, M. Baca, M. Naseem, A. Semanicova
AKCEJ. Graphs. Combin. 14 (2017), 149-157]

FLUID DYNAMICS

Fluid Dynamics group have been focused on the following topics:

1. Effects on the heat transfer in natural convection flows of nanofluids near a heated vertical plate. The studied models are described by the fractional differential equations with time-fractional Caputo and Caputo-Fabrizio derivatives. It was found that the fractional parameter has significant influence on the thermal boundary layer thickness; therefore the processes with thermal memory can be adequately described with Caputo time-fractional derivative.

2. Two-dimensional boundary layer flows of Maxwell fluids with generalized fractional constitutive equations. Flows with/without thermal effects were studied and interesting analytical solutions were obtained using the generalized method of separating variables coupled with Laplace transform method.

3. Unsteady magneto-hydrodynamic free convection flows of Newtonian /non-Newtonian fluids near a vertical plate with different mechanical and thermal conditions. Also, the case of a porous medium with variable permeability was studied.

4. The general solutions to unsteady unidirectional motions of rate type fluids in cylindrical domains and general solutions for hydromagnetic free convection flow over an infinite plate have been obtained. It was shown that, in such type of flows the velocity and the shear stress satisfy the differential equations of the same form.

5. Fractional advection-diffusion equation in half-space has studied. The fundamental solutions and solutions for the Dirichlet problem were determined. A comparison with classical advection-diffusion equation was made.

Papers:

1. Natural Convection Flow of Fractional Nanofluids over an Isothermal Vertical Plate with Thermal Radiation
Constantin Fetecau, Dumitru Vieru, Waqas Ali Azhar
Applied Sciences-Basel, Vol.: 7, Issue: 3, Article Number: 247.
2. Free convection flow of some fractional nanofluids over a moving vertical plate with uniform heat flux and heat source
Waqas Ali Azhar, Dumitru Vieru, Constantin Fetecau
Physics of Fluids, Published: AUG 2017; Vol. 29, Issue: 8, Pag. 1-12.
3. Influence of time-fractional derivatives on the boundary layer flow of Maxwell fluids
Yasir Mahsud, Nehad Ali Shah, Dumitru Vieru
Chinese Journal of Physics, Vol.: 55 Issue: 4 Pages: 1340-1351.
4. Heat transfer analysis in a Maxwell fluid over an oscillating vertical plate using fractional Caputo-Fabrizio derivatives
Ilyas Khan, Nehad Ali Shah, Yasir Mahsud, Dumitru Vieru
The European Physical Journal Plus, Vol.: 132 Issue: 4.
5. Analysis of unsteady natural convective radiating gas flow in a vertical channel by employing the Caputo time-fractional derivative
Bakhtiar Ahmad, Syed Inayat Ali Shah, Sami Ul Haq, Nehad Ali Shah
The European Physical Journal Plus, 2017, 132:380.
6. Heat transfer analysis of fractional second-grade fluid subject to Newtonian heating with Caputo and Caputo-Fabrizio fractional derivatives: A comparison
Muhammad Imran Asjad, Nehad Ali Shah, Maryam Aleem, Ilyas Khan
The European Physical Journal Plus, 2017, 132:340.
7. General solution for MHD-free convection flow over a vertical plate with ramped wall temperature and chemical reaction
Nehad Ali Shah, Azhar Ali Zafar, Shehraz Akhtar
Arabian Journal of Mathematics, 2017, pp. 1-12, doi: 10.1007/s40065-017-0187-z,
8. General Solutions for Hydromagnetic Free Convection Flow over an Infinite Plate with Newtonian Heating, Mass Diffusion and Chemical Reaction
Constantin Fetecau, Nehad Ali Shah, Dumitru Vieru
Communications in Theoretical Physics, Vol. 68, Issue: 6, 2017.
9. On some rotational flows of non-integer order rate type fluids with shear stress on the boundary
Azhar Ali Zafar, Nehad Ali Shah, Niat Nigar
Ain Shams Engineering Journal, doi: 10.1016/j.asej.2016.08.018.
10. First general solutions for unsteady unidirectional motions of rate type fluids in cylindrical domains
Nehad Ali Shah, Constantin Fetecau, Dumitru Vieru
Alexandria Engineering Journal, doi: 10.1016/j.aej.2017.03.014.
11. Free convection flows over a vertical plate that applies shear stress to a fractional viscous fluid
Nehad Ali Shah, Zafar Ali Azhar, Constantin Fetecau
Alexandria Engineering Journal, doi: 10.1016/j.aej.2017.08.023.
12. Fundamental solutions to advection-diffusion equation with time-fractional Caputo-Fabrizio derivative
Itrat Abbas Mirza, Dumitru Vieru
Computers & Mathematics with Applications, Vol.: 73, Issue: 1 Pages: 1-10.
13. Unsteady helical flows of a size-dependent couple-stress fluid
Qammar Rubbab, Itrat Abbas Mirza, Imran Siddique, Saadia Irshad
Advances in Mathematical Physics, vol. 2017. Article ID: 9724381, doi: 10.1155/2017/9724381.
14. Magneto-hydrodynamic free convection flows of a viscoelastic fluid in porous medium with variable permeability heat source and chemical reaction
Imran Siddique, Itrat Abbas Mirza
Results in Physics, Vol. 7, 2017, 3928-3937.
15. Effects of fractional order convective flow of an Oldroyd-B fluid along a moving porous hot plate with thermal diffusion
Constantin Fetecau, Dumitru Vieru, Corina Fetecau, Itrat Abbas Mirza
Heat Transfer Research, Vol. 48, Issue 12, 2017, 1047-1068,
DOI: 10.1615/HeatTransRes.2017016039.

TRAVEL GRANTS

The school provides generous travel grants to its students and faculty to attend academic events and to carry out collaborative research. This important initiative has resulted in many interesting and important results which have appeared as publications in top mathematics and theoretical physics journals.

In the past couple of years the following students have made use of the school's travel grant to attend workshops, conferences and to visit their supervisors when they are abroad.

Shamsa Ishaq (France)
 Anam Rani (Romania)
 Asma Khalid (Romania)
 Herolistra Baskoroputro (Romania)
 Khawar Mehmood (Germany)
 Muhammad Irfan (Slovakia)
 Rewayat Khan (Romania)
 Shamsa Kanal (Germany)
 Ali Ovais (Slovakia)
 Muhammad Ahsan Khan (Romania)
 Zunaira Kosar (Romania)
 Muhammad Yameen (Romania)

The faculty travel grant was initiated about a year ago and provides the faculty travel and other support to attend workshops, conferences and to make collaborative visits. The faculty travel grant resulted in the following visits by the faculty.

Imran Anwar
 Institute for Advanced Studies in Basic Sciences, Zanjan, Iran (August 5 - August 17, 2017)
 Visit to attend First Research School on Commutative Algebra and Algebraic Geometry and to give a talk in the school.

Amer Iqbal
 Center for Theoretical Physics of the Universe
 Seoul National University, Seoul
 Collaborative visit from March 12 - March 26, 2017

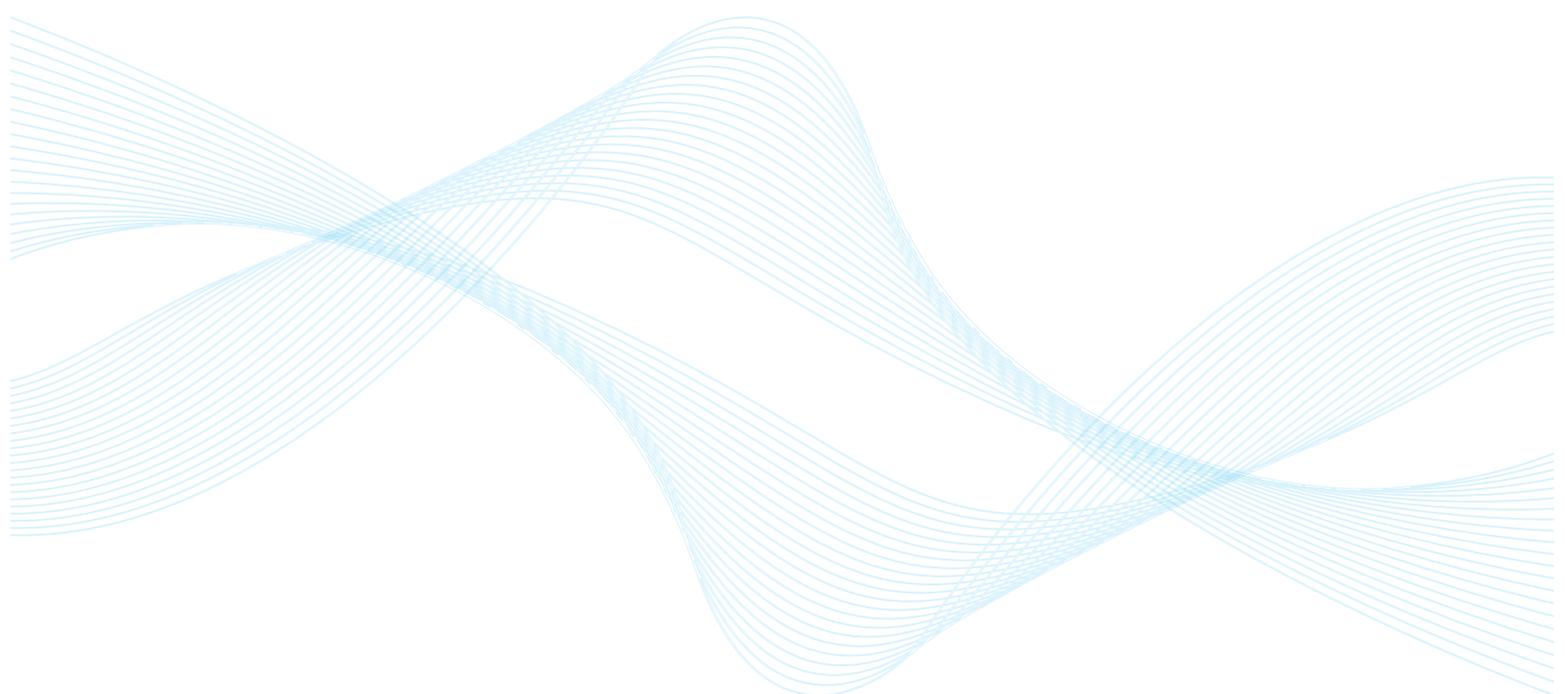
Isaac Newton Institute University of Cambridge
 (April 09 - April 13, 2017)

Visit to attend workshop on Physics and Knot Homologies and to give a talk in the workshop.
 Talk Title: BPS States of M5-Brane on T^3

Jefferson Laboratory Harvard University
 Collaborative visit from May 06 - May 26, 2017

Simon Center for Geometry and Physics
 Visit to attend the 2017 Simon Summer Workshop in Mathematics and Physics (July 17 - June 24, 2017)

Center for Theoretical Physics of the Universe
 Seoul National University, Seoul
 Collaborative visit from August 01 - August 15, 2017



Short Courses

The school organized several short courses this year on various topics which were of interest to the students.

SHORT COURSE

Algebraic Topology

Barbu Berceanu
Department of Mathematics, Institute of Mathematics Simion Stoilow, Romania

January 30 – February 23, 2017

Topics: Homotopy equivalences, Fundamental Groups, Van-Kampen Theorem, Free product of groups, Cell complexes, Covering spaces, Homotopy invariance, Mayer-Vietoris sequences, simplicial and singular homologies.

There is no registration fee for this course but we are restricted to limited number of participants. Undergraduate students and graduate students are encouraged to attend this course. For registration, contact imrananwar@sms.edu.pk.

Abdus Salam School of Mathematical Sciences
G. C. University, Lahore

SHORT COURSE

Differential Geometry of Curves

Johann Davidov
Institute of Mathematics and Informatics
Bulgarian Academy of Sciences

March 20 – April 19, 2017

Topics: Curves in Euclidean spaces, Frenet frames, Plane curves, Space curves, Relations between the curvature and the torsion, Frenet equations, Fundamental theorem of the local theory of curves, Curves in the Minkowski space Frenet equations in the Minkowski space, Global theory of curves, Global theory of curves

There is no registration fee for this course but we are restricted to limited number of participants. Undergraduate students and graduate students are encouraged to attend this course. For registration, contact imrananwar@sms.edu.pk.

Abdus Salam School of Mathematical Sciences
G. C. University, Lahore



GRADED FREE RESOLUTIONS AND HILBERT FUNCTIONS

IMRAN ANWAR
ABDUS SALAM SCHOOL OF MATHEMATICAL SCIENCES



STARTING SEPTEMBER 20, 2017
WEDNESDAY & FRIDAY @ 11AM

THE AIM OF THESE SEMINARS IS TO EXPLAIN THE GRADED ALGEBRAIC STRUCTURES, FREE RESOLUTIONS OF GRADED RINGS AND MODULES, BETTI NUMBERS, HILBERT FUNCTION AND HILBERT SERIES WITH ILLUSTRATING EXAMPLES. IT WILL PROVIDE A GLIMPSE ON SOME EXCITING DIRECTIONS IN WHICH COMMUTATIVE ALGEBRAISTS ARE WORKING.

NATIONAL CENTER FOR MATHEMATICS &
ABDUS SALAM SCHOOL OF MATHEMATICAL SCIENCES,
G. C. UNIVERSITY, LAHORE



INTRODUCTION TO BASIC PRINCIPLES OF FLUID MECHANICS

Constantin Fetecau & Dumitru Vieru
Academy of Romanian Scientists

October 02 – November 29, 2017
Monday and Wednesday: 15:00-17:00

Using the principles of classical fluid mechanics we shall present the basic equations of the fluid motion in a concise mathematical way. The basic equations of fluid motion will be determined based on the following fundamental principles of the continuum hypothesis and the conservation laws. Theoretical/practical aspects of fluid dynamics and the importance and utility of the Navier-Stokes equations will be studied.

National Center for Mathematics
& Abdus Salam School of Mathematical Sciences
G. C. University

Short Course

ADVANCED ALGEBRAIC TOPOLOGY

Barbu Berceanu

Institute of Mathematics of the Romanian Academy

October 30, 2017 - November 23, 2017

Monday-Wednesday: 2:00 PM - 4:00 PM

Thursday: 11:00 AM - 1:00 PM

Topics: Simplicial complexes, homology, Betti numbers, torsion, homotopical invariance, excision, Eilenberg-Steenrod's axioms, Mayer-Vietoris sequence, Kunnet Theorem, CW-complexes, cellular homology, cohomology, products, Poincare duality, Steenrod algebra.

There is no registration fee for this course but we are restricted to limited number of participants. Students are encouraged to attend this course. For registration please email: imrananwar@sms.edu.pk

**ABDUS SALAM SCHOOL OF MATHEMATICAL SCIENCES,
G. C. UNIVERSITY, LAHORE, PAKISTAN**

Workshops

The school organized two workshops and a symposium this year after a gap of couple of year

Understanding Salam

January 28-29, 2017

In this two day activity, dedicated to celebrate Prof. Abdus Salam's lasting contributions to theoretical physics four big ideas of contemporary physics to which Salam contributed heavily were explained starting from beginning. The school was of interest to graduate students and other physicists (scientists) interested in learning about Salam's theories and their phenomenal impact on physics. About a 100 participants from varous universities attended this workshop.

UNDERSTANDING SALAM

January 28-29
Abdus Salam School of Mathematical Sciences, Lahore!

Two Day School on Salam's Big Ideas

Jamil Aslam, QAU
Unity of Fundamental Interactions and Salam

Amer Iqbal, AS-SMS & LUMS
Understanding Symmetry and Symmetry Breaking

Babar Qureshi, LUMS
Superspace for Supersymmetry

Rizwan Khalid, NUST
Grand Unification: Are Protons Forever?

In this two day activity, dedicated to celebrate Prof. Abdus Salam's lasting contributions to theoretical physics, four big ideas of contemporary physics to which Salam contributed heavily will be explained starting from beginning. The school should be of interest to graduate students and other physicists (scientists) interested in learning about Salam's theories and their phenomenal impact on physics.

Accommodation and travel support will be provided to registered participants. To register, send email to:
salam.event@sms.edu.pk
Full Program and Details:
www.sms.edu.pk/salamevent

Workshop on Contemporary Topics in Analysis, Algebra and Geometry

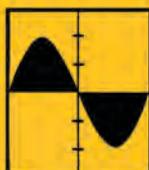
August 15-19, 2017

This five day Workshop was devoted to the discussion of contemporary topics in core mathematics at advanced undergraduate level. Short courses were delivered on selective topics of broader interest from analysis, algebra and geometry. Students and faculty from all over the Punjab attended the workshop. A majority of the participants were provided accommodation by the school. The workshop was funded by the Higher Education Commission, Punjab Higher Education Commission and the school.

Workshop on Contemporary Topics in Analysis, Algebra and Geometry

August 15-19, 2017

This five day Workshop is devoted to discuss contemporary topics in core mathematics at advanced undergraduate level. Short courses will be delivered on selective topics of broader interest from analysis, algebra and geometry accompanied with the problem solving sessions. It will be useful for the participants to get familiar with the key topics in core mathematics. This workshop would provide a prime opportunity for young researchers and graduate students to develop their understanding about core mathematics and exchange ideas.



Analysis

Qaisar Latif
Jacobs University
Bremen, Germany

Waleed Noor
Universidade Estadual
de Campinas, Brazil

Muhammad Usman
LUMS, Lahore



Algebra

Imran Anwar
ASSMS, Lahore

Waqas Mehmood
QAU, Islamabad

Ayesha Asloob Qureshi
Sabanci Üniversitesi,
Istanbul, Turkey

Shafiq ur Rehman
CIIT Attock



Geometry

Sohail Iqbal
CIIT, Islamabad

Shaheen Nazir
LUMS, Lahore

Imran Qureshi
LUMS, Lahore

Registration

Please visit the website: <http://www.sms.edu.pk/workshop-17/>

There is no registration fee for this Workshop.

Limited funds are available to support the accommodation of registered participants.

Last date for registration is 05 July, 2017.



Abdus Salam School of Mathematical Sciences
68-B New Muslim Town, Lahore.



Symposium on Recent Developments in Theoretical Physics

November 22, 2017

The topic of the symposium is Einstein's general theory of relativity and the recent discovery of gravitational waves. The discovery of gravitational waves by LIGO last year marks a milestone in our understanding of the universe. The Nobel prize in physics this year was awarded to the people associated with the discovery. This week marks the 102nd anniversary of the Einstein's paper on general relativity and the center is very pleased that Asghar Qadir from the National University of Science and Technology will be giving talks for the students and the faculty.

SYMPOSIUM ON RECENT DEVELOPMENTS IN THEORETICAL PHYSICS

9AM - 12:05PM NOVEMBER 22, 2017

DERIVATION OF EINSTEIN'S FIELD EQUATIONS
9AM - 10:15AM

GRAVITATIONAL WAVES: THEORY & DETECTION
10:45AM - 12:05PM

ASGHAR QADIR
NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

**NATIONAL CENTER FOR MATHEMATICS
G. C. UNIVERSITY, LAHORE**

Workshop on Contemporary Topics in Analysis, Algebra and Geometry

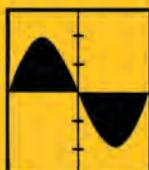
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Analysis

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Sabanci Üniversitesi,
Istanbul, Turkey

Shafiq ur Rehman
CIIT Attock



Geometry

Sohail Iqbal
CIIT, Islamabad

Shaheen Nazir
LUMS, Lahore

Imran Qureshi
LUMS, Lahore

Registration

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Abdus Salam School of Mathematical Sciences
68-B New Muslim Town, Lahore.



BINOMIAL EDGE IDEALS AND PROPER INTERVAL GRAPHS: GRÖBNER BASIS AND SOME OTHER BASIC PROPERTIES

HEROLISTRA BASKOROPUTRO (AS-SMS)

2:30PM | JANUARY 3, 2017

The binomial edge ideal associated with a ring were introduced by Herzog, Hibi, Hreinsdóttir, Kahle & Rauh and, independently, Ohtani. In this talk, we would like to discuss several basic properties of binomial edge ideals of graphs. In particular, we would like to discuss the reduced Gröbner basis of this class of ideals.

**Abdus Salam School of Mathematical Sciences
G. C. University, Lahore**

BINOMIAL EDGE IDEALS AND PROPER INTERVAL GRAPHS: SOME HOMOLOGICAL PROPERTIES

HEROLISTRA BASKOROPUTRO (AS-SMS)

2:30PM | JANUARY 5, 2017

In this talk, we would like to discuss several results of homological invariants of binomial edge ideals. For this, we would like to quickly review the concept of minimal graded free S-resolution and related numerical data, including graded Betti number and (Castelnuovo-Mumford) regularity.

**Abdus Salam School of Mathematical Sciences
G. C. University, Lahore**

IRREGULARITY STRENGTH OF GRAPHS

MUHAMMAD IRFAN (AS-SMS)



January 12, 2017, 2:30pm

SMS Seminar Room

Let G be a simple graph of order n with no isolated edges. For a positive integer k , an assignment function f on G is a function $f: E(G) \rightarrow \{1, 2, \dots, k\}$. For a vertex v , $f(v)$ is defined as the sum of all $f(e)$ over all edges e of G incident with v . f is called irregular if all $f(v)$ are distinct. The smallest k for which there exists an irregular assignment on G is called the irregularity of G and it is denoted by $s(G)$.

Abdus Salam School of Mathematical Sciences
G. C. University, Lahore

SOME INTERESTING PROPERTIES OF RING EXTENSIONS

ANAM RANI (AS-SMS)



January 16, 2017, 2:30pm

SMS Seminar Room

In this talk, I will present some interesting facts about ring extensions that are commonly used in commutative algebra. In commutative algebra, “going up” and “going down” are terms which refer to certain properties of chains of prime ideals in integral extensions. The major results are the Cohen–Seidenberg theorems, which were proved by Irvin S. Cohen and Abraham Seidenberg. More precisely, I will explain Cohen-Seidenberg theorems and their applicability through some nice examples.

Abdus Salam School of Mathematical Sciences
G. C. University, Lahore



FRACTIONAL CALCULUS



NASIR JAVAID (AS-SMS)

2:30PM JANUARY 19, 2017

In this talk, I will present a brief history and some repercussion of fractional derivatives. Moreover, I will discuss some results related to the multivalued functions and their continuity.

Abdus Salam School of Mathematical Sciences
G. C. University, Lahore

IRREGULAR STRENGTH OF A NETWORK OF SIMPLE REGULAR GRAPHS

Ali Ovais (AS-SMS)

2:30PM February 7, 2017

The network is a simple graph such that each edge in N is labeled by a positive integer. The network will be irregular if the sum of the labels to each edge adjacent to each vertex is distinct. We find the positive integer (s) known as the irregular strength of a network which is minimum in the strengths of an irregular network of regular graphs. We find the irregular strength (s) of the regular graphs and its relation with integral adjacency matrix of weights and draw conclusion about the irregular strength of t -extension G of simple regular graphs. We make partition of cycles corresponding to the length and determined their irregular strength.

m-Dissipative differential inclusions

SHAMAS BILAL (AS-SMS)



February 9, 2017, 2:30pm

SMS Seminar Room

In this talk we will discuss about well known Filippov-Pliss lemma for evolution inclusions given by multivalued perturbation of m -dissipative differential inclusions in Banach spaces with uniformly convex dual.

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KHOVANOV HOMOLOGY OF BRAID LINKS



ABDUL RAUF NIZAMI
UNIVERSITY OF EDUCATION, LAHORE

2:30PM FEBRUARY 14, 2017

Although computing the Khovanov homology of links is common in literature, no general formulas have been given for all families of knots and links. We give general formulas of the Khovanov homology of some families of 2- and 3-strand braid links.

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INTRODUCTION TO TORIC GEOMETRY

UMAR SHAHZAD (AS-SMS)



February 16, 2017, 2:30pm

SMS Seminar Room

Toric varieties become very famous among the algebraic geometric community after its first formal introduction by Demazure. One can think toric variety as region in \mathbb{A}^n . The simplest example that one can think is a sphere as circles fibred over an interval in \mathbb{A}^1 . In this talk, I will discuss the basics of toric geometry, and how we can construct toric varieties using the strongly convex rational polyhedral cones. I will demonstrate a certain class of toric varieties known as toric Calabi Yau threefolds.

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Topological Vertex Formalism

UMAR SHAHZAD (AS-SMS)



February 21, 2017, 2:30pm

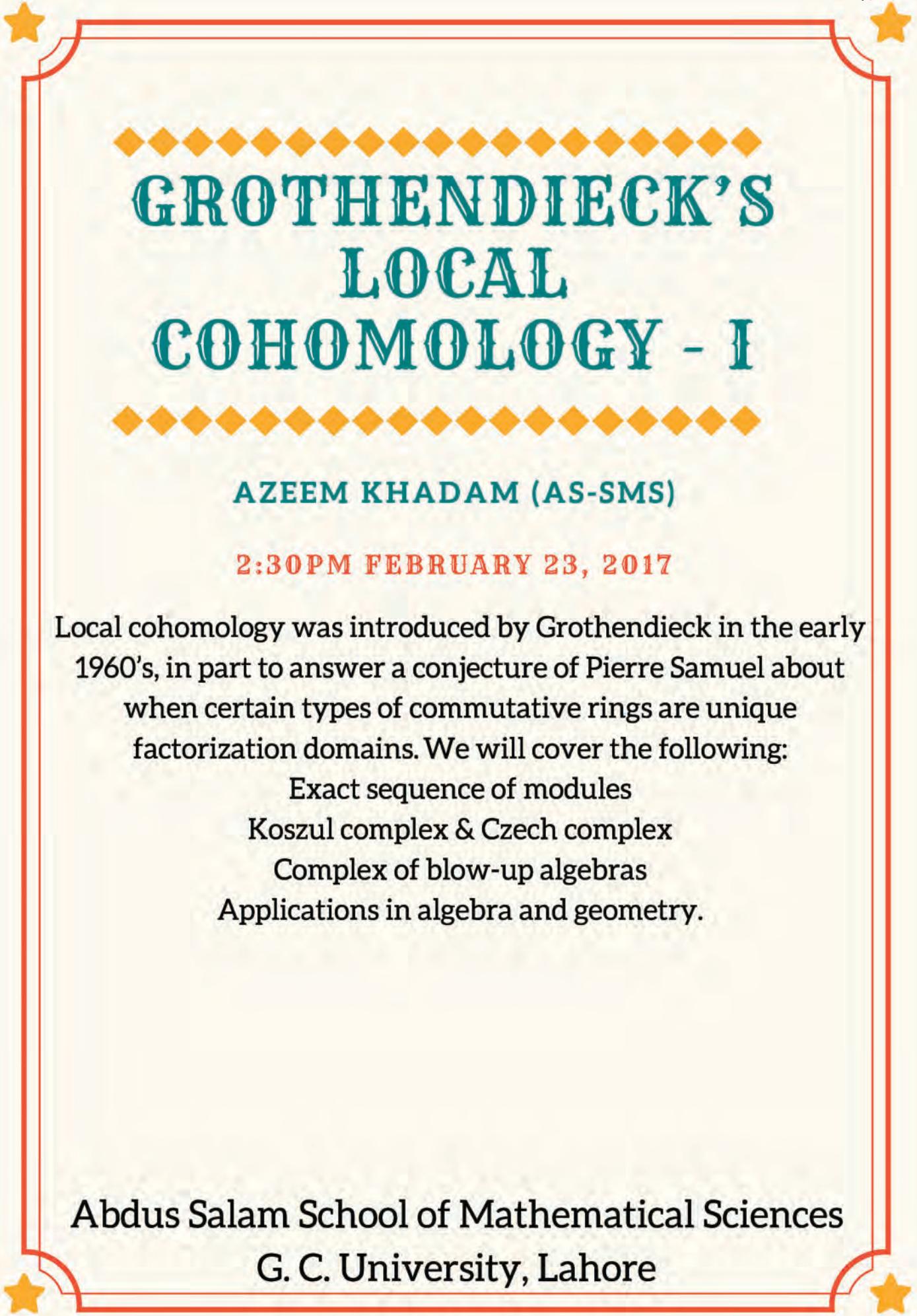
SMS Seminar Room

Gopakumar and Vafa introduced new topological invariants associated to a Calabi-Yau threefold .

Later on, Vafa and others introduced a combinatorial algorithm to calculate these invariants associated to the toric Calabi-Yau threefold . Having the trivalent graph associated to , they associated a topological vertex (a rational function) to each vertex of the graph. ; and are the partitions assign to each edge of the vertex. In this talk, I will try to explain the algorithm for calculating the Gopakumar-Vafa invariants which I discussed above. We will also try to discuss some examples as well.

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GROTHENDIECK'S LOCAL COHOMOLOGY - I

AZEEM KHADAM (AS-SMS)

2:30PM FEBRUARY 23, 2017

Local cohomology was introduced by Grothendieck in the early 1960's, in part to answer a conjecture of Pierre Samuel about when certain types of commutative rings are unique factorization domains. We will cover the following:

- Exact sequence of modules
- Koszul complex & Czech complex
- Complex of blow-up algebras
- Applications in algebra and geometry.

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LORENTZ INVARIANCE IN QUANTUM FIELD THEORY II



BABAR QURESHI
SBASSE, LUMS

10 MARCH, 3:00 P.M.
AS-SMS, LAHORE

ADVANCED TOPICS IN THEORETICAL PHYSICS

In the second lecture on the topic, I will discuss Dirac, Weyl and Majorana Lagrangians, coupling of electromagnetic field to matter, equations of motion, discrete symmetries, Noether's theorem and conserved currents associated with various symmetries of these Lagrangians.

Advanced Topics in Theoretical Physics is a regular series of lectures on topics ranging from quantum field theory, string theory, gravity and condensed matter physics

www.sms.edu.pk/adv-phy

ABDUS SALAM SCHOOL OF MATHEMATICAL SCIENCES,
68-B, NEW MUSLIM TOWN, LAHORE

MESH-FREE METHODS IN NUMERICAL ANALYSIS

Laila Naqvi (AS-SMS)

2:30PM March 3, 2017

Traditional numerical methods, such as finite element, finite difference, or finite volume methods, were motivated mostly by early one and two dimensional simulations of engineering problems via partial differential equations (PDEs). The discretization involved in all of these methods requires some sort of underlying computational mesh, e.g., a triangulation of the region of interest. Creation of these meshes (and possible re-meshing) becomes a rather difficult task in three dimensions, and virtually impossible for higher-dimensional problems. This is where mesh-free methods enter the picture. Mesh-free methods are often – but by no means have to be – radially symmetric in nature. This talk is to understand mesh-free methods specifically scattered data interpolation by using radial basis functions. We will also do analysis of interpolation via radial basis function by presenting theorems on the wellposedness of the problem.

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Actuarial Science: A Success Story

Seyedeh Zahra Rezaei Lalami
(University of Leicester)

2:30PM MARCH 7, 2017

This talk aims at discussing the Actuarial Science as emerging academic discipline. Actuarial Science is the combination of Mathematics with couple of other science fields to bring practical world scenarios into consideration. The real world implications of Actuarial Sciences are countless but worthwhile. What Actuarial qualifications you would be getting if you choose to enroll yourself for this degree. The University of Leicester is here to provide you comprehensive roadmap for getting you in Actuarial Science. There are wider scope of it in industry and University of Leicester is one which have top employers on its panel for student placement.

**INTRODUCTION TO
FRACTIONAL ORDER
VISCOELASTICITY**
ITRAT ABBAS (AS-SMS)

2:30PM • MARCH 09, 2017
SMS SEMINAR ROOM

The fractional calculus and fractional differential equations are used quite often to describe many physical phenomena. I will explain, using some examples, the use of fractional calculus to model some materials which lie between Hook's solid and Newtonian fluids.

**Abdus Salam School of Mathematical
Sciences, G. C. University, Lahore**

LORENTZ INVARIANCE IN QUANTUM FIELD THEORY II



BABAR QURESHI
SBASSE, LUMS

10 MARCH, 3:00 P.M.
AS-SMS, LAHORE

ADVANCED TOPICS IN THEORETICAL PHYSICS

In the second lecture on the topic, I will discuss Dirac, Weyl and Majorana Lagrangians, coupling of electromagnetic field to matter, equations of motion, discrete symmetries, Noether's theorem and conserved currents associated with various symmetries of these Lagrangians.

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GROTHENDIECK'S LOCAL COHOMOLOGY - II

AZEEM KHADAM (AS-SMS)

2:30pm March 14, 2017

Local cohomology was introduced by Grothendieck in the early 1960's, in part to answer a conjecture of Pierre Samuel about when certain types of commutative rings are unique factorization domains. We will cover the following: Exact sequence of modules
Koszul complex & Czech complex
Complex of blow-up algebras
Applications in algebra and geometry.

National Center for Mathematics &
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G. C. University, Lahore

INTRODUCTION TO BORDER BASES

SHAMSA KANWAL (AS-SMS)



March 16, 2017, 2:30pm

SMS Seminar Room

Tropical geometry is a relatively new area in mathematics with connection to various other fields. I will discuss the basics of tropical geometry starting with tropical arithmetic. I will define tropical polynomials and use them to define tropical hypersurfaces. I will also explain the relation between the Newton polygons and the hypersurface of the tropical polynomials.

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G. C. University, Lahore

INTRODUCTION TO TROPICAL GEOMETRY

NUMAN AMIN (AS-SMS)



March 21, 2017, 2:30pm

SMS Seminar Room

Tropical geometry is a relatively new area in mathematics with connection to various other fields. I will discuss the basics of tropical geometry starting with tropical arithmetic. I will define tropical polynomials and use them to define tropical hypersurfaces. I will also explain the relation between the Newton polygons and the hypersurface of the tropical polynomials.

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INSTANTONS AND QUANTUM TUNNELING



PERVEZ HOODBHOY
FCCU, QAU

28 MARCH, 5:30-7:30 P.M.
AS-SMS, LAHORE

ADVANCED TOPICS IN THEORETICAL PHYSICS

This lecture will be on a fairly simple but surprisingly rich topic - tunneling in a double well potential using the method of pseudoparticles or instantons. Although instantons are crucial in quantum field theory, even in quantum mechanics they are an important means of systematically improving non-perturbative calculations. It turns out that there are tunneling phenomena in condensed matter physics that people seem not to have paid attention to but with possibly important consequences. Students will benefit from this lecture only if they read about Feynman's path integral method before coming to the lecture.

$$\langle x_t | e^{-i\hat{H}t/\hbar} | x_0 \rangle =$$

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x_t

COMPLETENESS AND MORPHISMS OF ALGEBRAS

ASMA KHALID (AS-SMS)



March 30, 2017, 2:30pm
SMS Seminar Room

National Center for Mathematics &
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G. C. University, Lahore

Riemann Surfaces and its Triangulations



AMBREEN AHMED (AS-SMS)

2:30PM TUESDAY APRIL 11, 2017

A Riemann surface is a one dimensional complex manifold. It arises naturally in the study of complex functions. The study of maps from Riemann surfaces to other spaces is a rich and very active field. In this talk we will discuss examples of Riemann surfaces and holomorphic maps on them. We will also discuss the triangulation of Riemann surfaces, Hurwitz formula, the construction of Riemann surface associated with square root of z and the one with genus one.

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G. C. UNIVERSITY, LAHORE



NESTED ARTIN STRONG APPROXIMATION



SHAMSA KANWAL (AS-SMS)

2:30PM APRIL 13, 2017

A standard basis of an ideal is nothing but a special set of generators, which allows the computation of many invariants of the ideal just from its leading monomials. In this talk I will give a brief introduction about the importance and inception of the concept of standard basis in commutative algebra. I will discuss different algorithms to compute standard basis.

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A UNIFORM GENERAL NERON DESINGULARIZATION

ASMA KHALID (AS-SMS)



April 18, 2017, 2:30pm
SMS Seminar Room

I will discuss the uniform general Neron desingularization for one dimensional local rings with respect to morphisms which coincide modulo a high power of the maximal ideal. Moreover, we will also see some interesting examples of general Neron desingularization with the help of algorithms.

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ORLIK- TERAQ ALGEBRA OF HYPERPLANE ARRANGEMENT

SHAHEEN NAZIR (LUMS)



April 20, 2017, 2:30pm

SMS Seminar Room

Hyperplanes arrangements have connections with many mathematical objects in areas as diverse as topology, invariant theory, combinatorics, algebraic geometry, and statistics. The Orlik Solomon algebra, which is the cohomology ring of the arrangement complement, is a combinatorial object. Orlik and Terao introduced a commutative analog of the Orlik-Solomon algebra to answer a question of Aomoto and showed the Hilbert series depends only on the intersection lattice. In this talk, we study the relation between Orlik Terao algebra and 2-formality, introduced by Falk and Randell.

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HARMONICALLY (S,M)-
CONVEX FUNCTIONS AND
RELATED INEQUALITIES

IMRAN ABBAS BALOCH (AS-SMS)



April 25, 2017, 2:30pm
SMS Seminar Room

National Center for Mathematics &
Abdus Salam School of Mathematical Sciences
G. C. University, Lahore

DIOPHANTINE APPROXIMATION ON MANIFOLDS: THEORY AND APPLICATIONS

MUMTAZ HUSSAIN
LA TROBE UNIVERSITY



April 26, 2017, 2:30pm

SMS Seminar Room

The well-known theorems of Khintchine and Jarnik in Diophantine approximation provide a comprehensive description of the measure theoretic properties of real numbers approximable by rational numbers with a given error. Various generalisations of these fundamental results have been obtained for other settings, in particular, for curves and more generally manifolds. In this talk, I will explain my recent Jarnik type results for a parabola in homogeneous settings. This result is the first of its kind.

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FUZZY LATTICE AND STATISTICAL METRIC

SAMINA MAZHAR
QUEEN MARY COLLEGE, LAHORE



May 2, 2017, 2:30pm

SMS Seminar Room

In this talk, I will discuss some concepts from lattice theory aiming to introduce $[0,1]$ as a complete bounded lattice possessing an involution but unfortunately failing to follow some desirable Laws. Then, I will relate the above stated lattice as range of the mapping known as "Fuzzy Set". Afterwards, I will introduce some mappings from Statistical Metric Spaces to enrich our theory on fuzzy sets. Lastly, I will attempt to show some marvelous applications of this area.

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INTRODUCTION TO ONE-DIMENSIONAL DYNAMICS

WAQAS ALI AZHAR (AS-SMS)



May 4, 2017, 2:30pm

SMS Seminar Room

The goal of this talk is to introduce many of the basic techniques from the theory of dynamical systems in a setting as simple as possible. For this reason, all the dynamics will be considered one dimensional i.e. on the real line or unit circle in the plane. We introduce topics such as hyperbolicity, topological conjugacy and structural stability. The main idea is to understand in the light of examples what it means for a dynamical system to be chaotic.

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THERMODYNAMICS FORMALISM IN ERGODIC THEORY

SHAMSA ISHAQ (AS-SMS)



May 9, 2017, 2:30pm
SMS Seminar Room

The Introduction of thermodynamics formalism in mathematics was due to Yakov Sinai, David Ruelle and Rufus Bowen in early 70s. The aim of this talk is to provide a brief introduction thermodynamics formalism in ergodic theory.

Throughout the talk our dynamical system will remain symbolic dynamical system. The main idea is to introduce the concept of pressure function, equilibrium state, potential and phase transition in the language of invariant probability measures.

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BINOMIAL EDGE IDEALS OF K-DEFICIENT GRAPHS

SOHAIL ZAFAR (UMT, LAHORE)



May 11, 2017, 2:30pm

SMS Seminar Room

In this talk, we will study binomial edge ideals, some of its combinatorial and algebraic properties. The class of k -deficient graphs came into existence, when the sequentially Cohen-Macaulay property of binomial edge ideals was discussed. If we remove k edges (with one fixed vertex) from the complete graph, such a connected graph is called k -deficient graph. We will study primary decomposition, krull dimension, depth, Hilbert series and Castelnuovo-Mumford regularity of binomial edge ideal of k -deficient graphs.

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ALGEBRAIC VARIETIES VIA UNPROJECTIONS: TOM & JERRY

IMRAN QURESHI (LUMS)



May 18, 2017, 2:30pm

SMS Seminar Room

Many interesting classes of algebraic varieties can be studied in terms of their corresponding graded rings. In many interesting cases the corresponding ring is a Gorenstein ring. In codimension greater than 3, one method of constructing algebraic varieties is the technique of unprojection. The aim of this talk is to explain the idea of unprojection by explicit examples. In particular, I will focus on two matrix formats, Tom and Jerry which gives the construction of algebraic varieties in codimension 4 via unprojection of 3 dimensional algebraic varieties.

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NATURAL CONVECTION
FLOWS OF VISCOUS FLUIDS
AND DIFFERENT MOTIONS OF
COUPLE STRESS FLUIDS

SHEHRAZ AKHTAR (AS-SMS)



May 19, 2017, 11:00am
SMS Seminar Room

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WHAT IS SCHUBERT CALCULUS?

HANIYA AZAM (LUMS)



May 25, 2017, 2:30pm

SMS Seminar Room

Nearly 150 years ago Schubert published his book on 'Calculus of Enumerative Geometry' which was the first systematic study of what is now called Intersection Theory. This work became rigorous later on by the introduction of Schubert Varieties. In this talk we will introduce Schubert varieties inside a Grassmanian . This will be followed by Schubert Calculus - an application of intersection theory to problems in enumerative geometry. Lastly, we will be demonstrating what generates the cohomology of this manifold. Hopefully, we will have enough time to give concrete examples.

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TOTAL AND ENTIRE LABELING OF GRAPHS

MARIA NASEEM (AS-SMS)



May 26, 2017, 11:00am

SMS Seminar Room

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G. C. University, Lahore

DIFFERENTIAL EQUATIONS WITH CASUAL OPERATORS

TAHIRA JABEEN (AS-SMS)



June 5, 2017, 11:00am
SMS Seminar Room

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G. C. University, Lahore



FREE CONVECTION FLOWS OF
A VISCOUS FLUID AND
VARIOUS MOTIONS OF RATE
TYPE FLUIDS

NIAT NIGAR (AS-SMS)



July 4, 2017, 2:30pm
SMS Seminar Room

National Center for Mathematics &
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G. C. University, Lahore





LOCAL BEZOUT INEQUALITIES AND HOMOLOGICAL METHODS

AZEEM KHADAM (AS-SMS)



August 1, 2017, 12:05pm
SMS Seminar Room

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Questions on (generalized) Local Cohomology - I

Malik Tusif Ahmed &
Azeem Khadam (AS-SMS)

We will discuss some aspects of Grothendieck's local cohomology and its variations. We will begin with explanation of the direct limit in the category of modules with some examples including Cech complex.

11AM Thursday August 08, 2017

National Center for Mathematics &
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G. C. University, Lahore

Questions on (generalized) Local Cohomology - II



**MALIK TUSIF AHMED AND
AZEEM KHADAM (AS-SMS)**

11AM FRIDAY AUGUST 11, 2017

We will continue with the discussion of local cohomology and will explain the idea of an inverse limit in the category of modules using the example of p -adic numbers.

We will also try to explain how the various local cohomology theories are connected with each other.

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QUESTIONS ON (GENERALIZED) LOCAL COHOMOLOGY - III

Malik Tusif Ahmed & Azeem Khadam
AS-SMS

11AM Thursday, August 24, 2017

We continue with our discussion of local cohomology theories and their properties. We also describe some work the second speaker carried out with Peter Schenzel.

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THE STUDY OF TRANSPORT PROCESSES IN FLUID DYNAMICS

ITRAT ABBAS MIRZA (AS-SMS)



August 29, 2017, 2:30pm
SMS Seminar Room

National Center for Mathematics &
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G. C. University, Lahore



INTERPOLATION SPACES AND GENERAL HOLMSTEDT'S FORMULAE

ALI RAZA (AS-SMS)

11:00AM • SEPTEMBER 08, 2017
SMS SEMINAR ROOM

Interpolation space is a space which lies "in between" two other Banach spaces. The main applications are in Sobolev spaces. In this talk, I will give a brief description of interpolation theory and explain the construction of K -interpolation spaces. For these K -interpolation spaces, we will discuss the general Holmstedt's formulae and the corresponding reiteration theorems.

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Understanding Equivariant Cohomology - I

Umar Shahzad (AS-SMS)

11AM Monday September 11, 2017

Equivariant cohomology is a cohomology theory from algebraic topology which applies to topological spaces with a group action. It can be viewed as a common generalization of group cohomology and an ordinary cohomology theory. This is a series of talks on understanding equivariant cohomology and equivariant integration.

In this first talk I will explain manifolds, differential forms and De-Rham cohomology.

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NON-LOCAL PROBLEMS FOR M-DISSIPATIVE EVOLUTION INCLUSIONS

Shamas Bilal (AS-SMS)

2:30pm Tuesday September 12, 2017

Dissipative systems are dynamical systems which satisfy the so-called "dissipation inequality". In this talk, we will discuss the proof of the existence of solutions for one-sided Lipschitz perturbations of general m -dissipative evolution inclusions with nonlocal initial conditions in certain Banach spaces. Moreover, we will discuss examples to illustrate the applicability of our result.



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TOTAL EDGE IRREGULAR STRENGTH OF COMPLETE GRAPHS

Ali Ovais (AS-SMS)

2:30PM THURSDAY SEPTEMBER 14, 2017

A total edge irregular k -labelling of a graph G is a labelling of vertices and edges with labels from the set $\{1, 2, \dots, k\}$ in such a way that for any two different edges the weights are different. The minimum k for which the graph G has an edge irregular total k -labelling is called the total edge irregularity strength of G . In this talk, we will discuss various techniques used to determine the exact value of the total edge irregular strength for complete graph.

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PERINORMAL RINGS AND DOMAINS

ANAM RANI (AS-SMS)



September 19, 2017, 2:30pm

SMS Seminar Room

Recently, Epstein and Shapiro introduced and studied the perinormal domains. These domains fall strictly between the Krull domains and the seminormal domains. In this talk, I will discuss the concept of P-domain introduced by Mott and Zafrullah. I will show that every P-domain is perinormal and has no proper lying over over-ring. At the end, I will give basic properties of this class and discuss some illuminating examples.

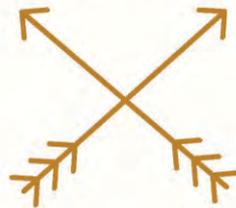
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GRADED FREE RESOLUTIONS AND HILBERT FUNCTIONS

IMRAN ANWAR

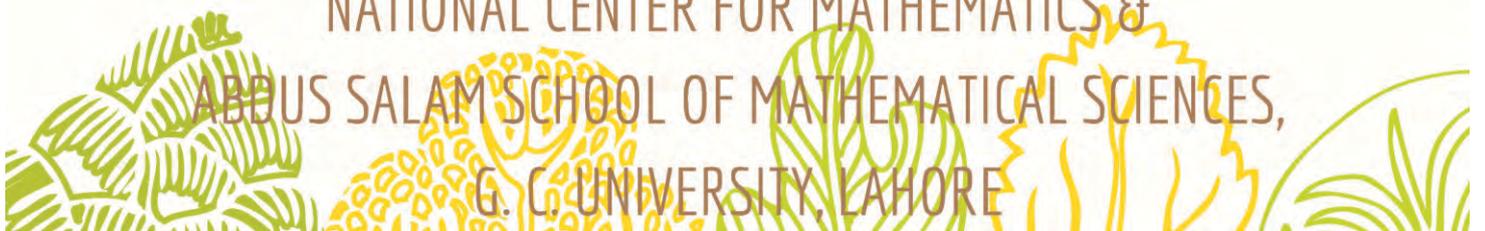
ABDUS SALAM SCHOOL OF MATHEMATICAL SCIENCES



STARTING SEPTEMBER 20, 2017
WEDNESDAY & FRIDAY @ 11AM

THE AIM OF THESE SEMINARS IS TO EXPLAIN THE GRADED ALGEBRAIC STRUCTURES, FREE RESOLUTIONS OF GRADED RINGS AND MODULES, BETTI NUMBERS, HILBERT FUNCTION AND HILBERT SERIES WITH ILLUSTRATING EXAMPLES. IT WILL PROVIDE A GLIMPSE ON SOME EXCITING DIRECTIONS IN WHICH COMMUTATIVE ALGEBRAISTS ARE WORKING.

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HIBI RINGS AND RANK BOUNDED HIBI SUBRINGS

NADIA SHOUKAT (AS-SMS)



September 21, 2017, 2:30pm

SMS Seminar Room

Hibi rings and their defining ideals are attached in a natural way to finite distributive lattices. They were first introduced by Hibi in 1987. In the last decades, many authors have investigated various properties and invariants of Hibi rings. In this presentation, we will discuss certain characteristics of Hibi rings and Grobner Basis of the Hibi ideal. Moreover, we will discuss rank bounded Hibi subrings. They were introduced by Aramova, Herzog and Hibi in 2000.

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CHARACTERIZATION OF
PERINORMAL RINGS WITH
ZERO DIVISORS

ANAM RANI (AS-SMS)



September 22, 2017, 11:00am
SMS Seminar Room

National Center for Mathematics &
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G. C. University, Lahore

Understanding Equivariant Cohomology - II

Umar Shahzad (AS-SMS)

11AM Monday September 25, 2017

Equivariant cohomology is a cohomology theory from algebraic topology which applies to topological spaces with a group action. It can be viewed as a common generalization of group cohomology and an ordinary cohomology theory. This is a series of talks on understanding equivariant cohomology and equivariant integration.

In this second talk I will explain explain fiber bundles, and maps between fiber bundles

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ON R-STANDARD BASES

SHAMSA KANWAL (AS-SMS)



September 26, 2017, 2:30pm

SMS Seminar Room

In this talk, we will discuss r -standard basis, which mainly involve restricted division introduced by V. Gerdt. Moreover, we will discuss standard bases for special subspaces. We use modular methods to solve problems to compute these bases and discuss various algorithms.

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ELLIPTIC CURVES

YASIR MAHSUD (AS-SMS)



September 28, 2017, 2:30pm

SMS Seminar Room

Elliptic curves are especially important in number theory, and constitute a major area of current research; for example, they were used in the proof, by Andrew Wiles, of Fermat's Last Theorem. They also find applications in elliptic curve cryptography and integer factorization. During this talk, I will discuss elliptic curves over \mathbb{R} and \mathbb{C} along with their brief introduction over finite fields. I will also discuss their geometry over \mathbb{R} and \mathbb{C} . Furthermore I will discuss what are they algebraically.

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Understanding Equivariant Cohomology - III

Umar Shahzad (AS-SMS)

11AM Monday October 02, 2017

Equivariant cohomology is a cohomology theory from algebraic topology which applies to topological spaces with a group action. It can be viewed as a common generalization of group cohomology and an ordinary cohomology theory. This is a series of talks on understanding equivariant cohomology and equivariant integration.

In this third talk I will continue with the discussion of fiber bundles and explain principal G -bundles, Hopf bundles and pullback of a fiber bundle.

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PROBLEMS ABOUT A "VARIATION" OF LOCAL COHOMOLOGY

AZEEM KHADAM(AS-SMS)



October 3, 2017, 2:30pm

SMS Seminar Room

Local cohomology was introduced by Grothendieck in the early 1960s, in part to answer a conjecture of Pierre Samuel. Local cohomology has since become an indispensable tool and is the subject of much research. We will discuss further problems about a variation of local cohomology which was investigated by in the PhD dissertation "local Bezout inequalities and homological methods", by the speaker and available in ASSMS library. Moreover, there will be a surprise problem at the end of the seminar.

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COMPRESSIVE SENSING BASED ELASTICITY IMAGING

ABDUL WAHAB
KOREA ADVANCED INSTITUTE OF
SCIENCE & TECHNOLOGY



October 5, 2017, 2:30pm

SMS Seminar Room

In this talk, I will focus on an inverse problem arising in Magnetic Resonance Elastography. A compressive sensing based algorithm will be presented for efficient and accurate reconstruction of the spatial support and material parameters of multiple inhomogeneous elastic inclusions in a bounded elastic material. Our proposed algorithm is not only very accurate but also computationally efficient as it does not require any linearization or iterative procedure.

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SYMMETRIES AND CONSERVED QUANTITIES

AZHAR FAROOQ (AS-SMS)



October 10, 2017, 2:30pm

SMS Seminar Room

Symmetries play an important role in both physics and mathematics. The laws which govern our universe are based on principles of symmetry. Our quest for understanding these laws have led us to a deeper understanding of symmetries. Noether's theorem, named after the German mathematician Emmy Noether, relates the continuous symmetries of a system to the conservation laws obeyed by the system. We will discuss the theorem using some examples.

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SIMPLE BRANCHES OF PARAMETRIZED PLANE CURVES

KHAWAR MEHMOOD (AS-SMS)



October 12, 2017, 2:30pm

SMS Seminar Room

There are several ways of describing a curve. One way is to use the equations and another way is to describe it via parametrization. In this talk, I will try to explain some basic notions of local analytical geometry. Moreover, I will classify simple parameterized plane curve by using invariants.

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PRIMARY DECOMPOSITION OF STANLEY REISNER IDEALS



SAFYAN AHMAD

2:30PM Monday, October 16



Primary Decomposition is one of the classical pillars of commutative algebra and Stanley Reisner ideals are fundamental objects of interest in combinatorial commutative algebra. In this talk, I will discuss the importance of Primary Decomposition starting from basics. Later on, I will explain this idea for the famous Stanley Reisner Ideals related to simplicial complexes.



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THE WALDSCHMIDT CONSTANT FOR MONOMIAL IDEALS OF SIMPLICIAL COMPLEXES

NIMRA JAVED (AS-SMS)



October 17, 2017, 11:00am
SMS Seminar Room

The Containment-problem is one of the central problems in commutative algebra. It was discovered by Ein, Lazarsfeld and Smith in characteristic zero and by Hochster and Huneke in positive characteristic. The aim of this talk is to explicate the combinatorial approaches of computing Waldschmidt constant of the monomial ideals associated to the different classes of simplicial complexes.

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TOPOLOGICAL STRINGS ON CALABI-YAU THREEFOLDS I,II

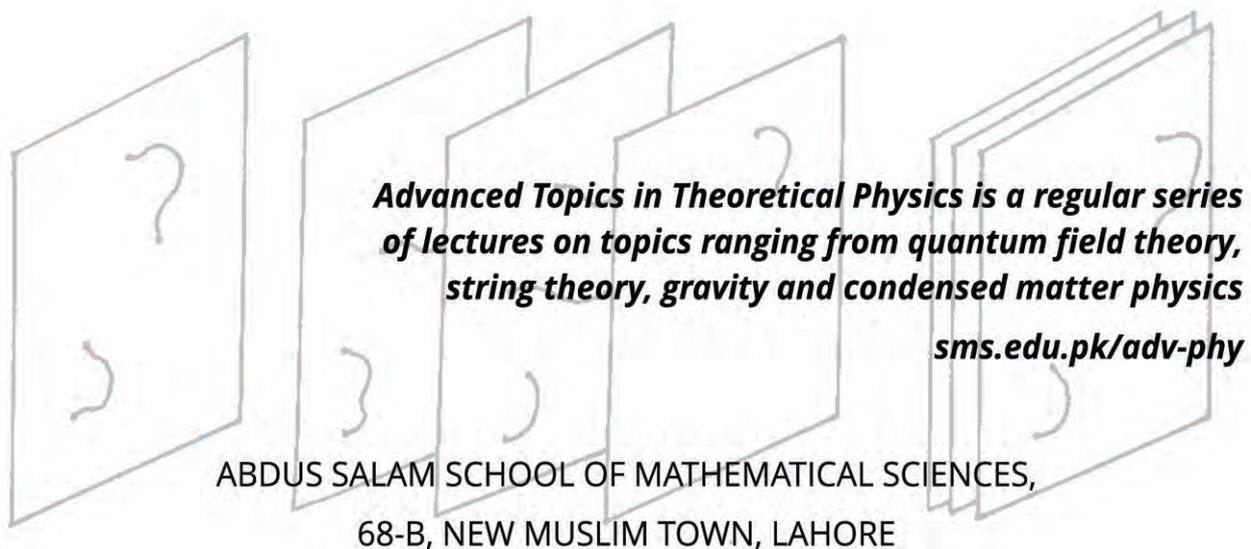


AMER IQBAL

17 & 24 OCTOBER, 2:30 P.M.
AS-SMS, LAHORE

ADVANCED TOPIC IN THEORETICAL PHYSICS

In these two lectures, Amer Iqbal will discuss A&B models with Calabi-Yau threefold target space and their coupling with gravity to obtain topological strings. He will also discuss the origin of holomorphic anomaly equation. The talks will assume familiarity with (2,2) supersymmetry and complex geometry.





Sudoku, algebraic geometry and computer algebra

Gerhard Pfister

Department of Mathematics
University of Kaiserslautern

2PM WEDNESDAY, OCTOBER 18

The idea of a Sudoku goes back to Leonard Euler. He called it Latin squares. In our days it was reinvented by Howard Garns (USA) and called Number place. It came to Japan and became famous under the name Sudoku. We want to solve a Sudoku using algebraic geometry and computer algebra. The idea is to associate to the places in a Sudoku the variables x_1, \dots, x_{81} and describe the sudoku as the zeroset of about 1000 polynomials in these variables. With the help of computer algebra we can solve the polynomial equations to obtain the solution of the sudoku.



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HOPF ALGEBRAS AND QUANTUM FIELD THEORIES ON NONCOMMUTATIVE SPACES



BABAR QURESHI
SBASSE, LUMS

19 OCTOBER, 2:30 P.M.
AS-SMS, LAHORE

ADVANCED TOPICS IN THEORETICAL PHYSICS

In this talk I will introduce the notion of mathematical structures called Hopf Algebras, discuss their origins with some examples and finally, describe their one particular application in physics i.e., construction of quantum field theories on non-commutative spaces.

$$\begin{array}{ccc}
 H \otimes H & \xrightarrow{S} & H \otimes H \\
 \Delta \swarrow & & \searrow \nabla \\
 H & \xrightarrow{\varepsilon} & K \xrightarrow{\eta} H \\
 \Delta \searrow & & \swarrow \nabla \\
 H \otimes H & \xrightarrow{\text{id} \otimes S} & H \otimes H
 \end{array}$$

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Advanced Topics in Theoretical Physics



LOCALIZATION IN SUPERSYMMETRIC GAUGE THEORIES

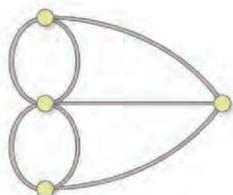
Nouman Muteeb

11am Friday, October 20

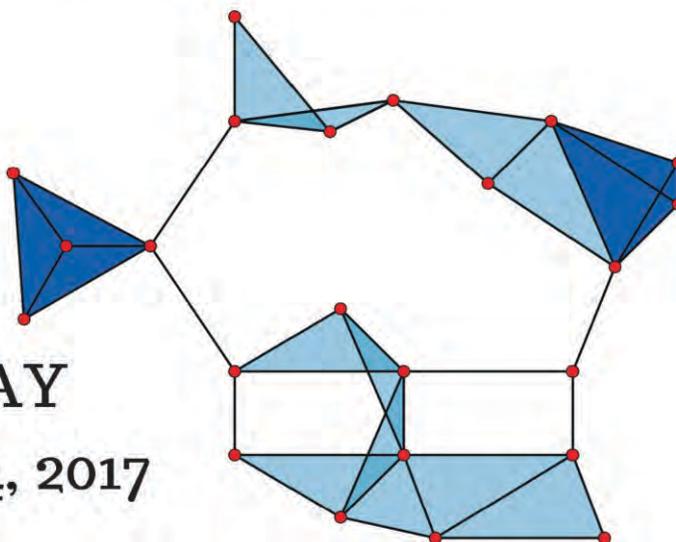
In this talk I will first briefly discuss the basics of Equivariant Localization technique and how it is fruitfully applied in the context of four dimensional supersymmetric gauge theories with eight supercharges. Then I will describe the computation of partition function of the this supersymmetric gauge theory on four dimensional hemi-sphere with suitable boundary conditions. Finally there will be a brief discussion on how various partition function/wavefunctions on hemi-sphere are related to various amplitudes in two dimensional Liouville field theory in the context of AGT-correspondence

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GRAPHS WITH GALLAI'S PROPERTY



Ayesha Shabbir



2PM TUESDAY
OCTOBER 24, 2017

In 1966 T. Gallai asked the question: do all the longest paths in a graph meet? Soon afterwards, Walther presented a counter example, a planar graph with twenty five vertices. In last fifty years many variants of this problem have appeared and some of them received positive answers but still a sufficient number of unsolved problems exist. In this talk I will present a brief history of Gallai's and related problems and and some possible ways to solve these problems.

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GRADED FREE RESOLUTIONS AND HILBERT FUNCTIONS

LECTURE THREE

IMRAN ANWAR (AS-SMS)

11AM WEDNESDAY, OCTOBER 25, 2017

The aim of these lectures is to explain the graded algebraic structures, free resolutions of graded rings and modules, Betti numbers, Hilbert Function and Hilbert series with examples to provide a glimpse of some exciting directions in which commutative algebra research is going.

This will be lecture three of this series, I will discuss truncated complexes, homomorphism of complexes and exact sequences. At the end, I will discuss the construction of graded free resolutions and graded betti numbers with various examples. It will provide

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Algorithms for Primary Decomposition

ALI AHMAD (AS-SMS)

**2:30PM WEDNESDAY
OCTOBER 25, 2017**

Primary decomposition plays an important role in the dimension theory of commutative algebra and algebraic geometry. The computational algorithms which help in primary decomposition have proven to be very useful in research. I will discuss various algorithms for primary decomposition. In particular, I will discuss the improvement given by Noro and Kawazoe in the existing algorithm of Shimoyama and Yokoyama.

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VARIATIONAL TIME STEPPING AND STABILIZATION SCHEMES

Naveed Ahmed

Weierstrass Institute for Applied Analysis and Stochastics

2:30PM Thursday, October 26, 2017

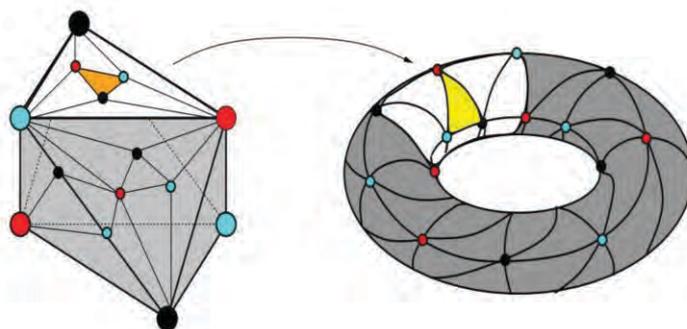
In this talk, I will consider the numerical solution of time dependent linear convection-diffusion-reaction equations. Combinations of streamline-upwind Petrov--Galerkin and local projection stabilization methods in space with the higher order variational time discretization schemes will be considered. In particular, I will discuss the time discretizations by discontinuous Galerkin methods and continuous Galerkin--Petrov methods and will present a numerical comparison between them.

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ALGEBRAIC CHARACTERIZATION OF MONOTONE SIMPLICIAL COMPLEXES

Ghazanfar Abbas (AS-SMS)



In this talk, I will introduce the monotone simplicial complexes using the concept of monotone paths, first introduced by Erdos and Szekers. I will discuss various construction of graphs for which the face ring and facet ideal of the respective monotone simplicial complex is Cohen-Macaulay and Sequentially Cohen-Macaulay respectively.

October 27, 2017 | 11 am

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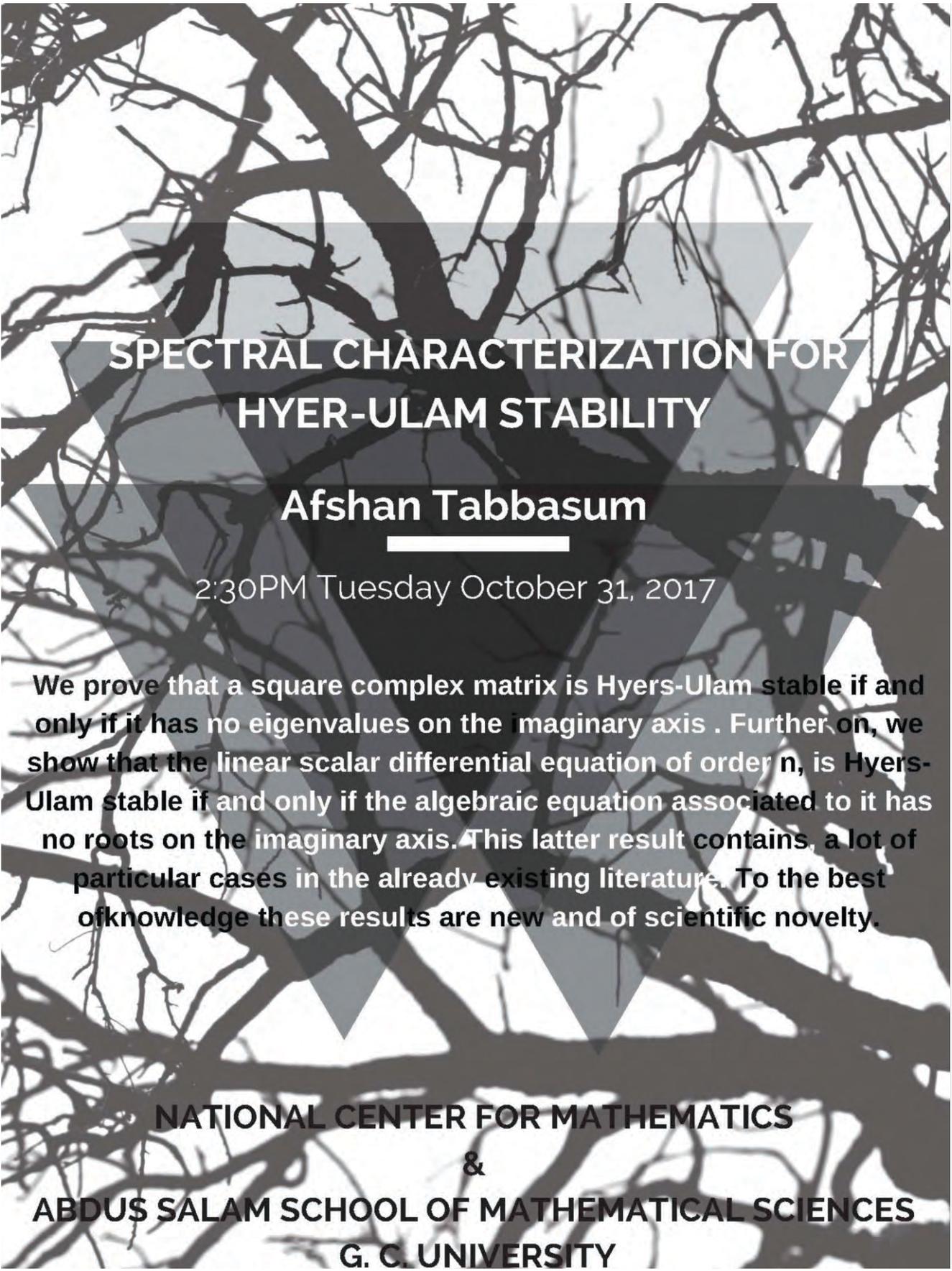
L-FUNCTIONS IN NUMBER THEORY

Ali Raza (AS-SMS)

12:05PM Friday October 27, 2017



L-functions in number theory are related to the distribution of prime numbers as well as prime ideals in number fields. The most well know L-function is Riemann zeta function. In this talk, I will explain the theory of L-functions, their analytic continuation, functional equations and the product representation.



SPECTRAL CHARACTERIZATION FOR HYER-ULAM STABILITY

Afshan Tabbasum

2:30PM Tuesday October 31, 2017

We prove that a square complex matrix is Hyers-Ulam stable if and only if it has no eigenvalues on the imaginary axis. Further on, we show that the linear scalar differential equation of order n , is Hyers-Ulam stable if and only if the algebraic equation associated to it has no roots on the imaginary axis. This latter result contains a lot of particular cases in the already existing literature. To the best of knowledge these results are new and of scientific novelty.

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FREE SURFACE FLOWS AND MOVING CONTACT LINES

Muhammad Faheem Afzal

2PM Thursday November 2, 2017

This study deals with the complex interfacial phenomena, in particular droplet dynamics on a planar but chemically heterogeneous substrate with a small pore. Our approach is based on a diffuse-interface model appropriately modified by incorporating a local inflow boundary condition allowing constant liquid flux in to the droplet. A finite element method is then applied to solve the diffuse-interface model numerically. It is shown that the droplet exhibits stick-slip motion that can be observed by monitoring the droplet shift. Under certain conditions the droplet can also undergo break up into satellite droplets with chaotic behaviour.

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SCIENCES, G. C. UNIVERSITY

TROPICAL GEOMETRY AND QUANTUM CURVES

NUMAN AMIN (AS-SMS)

2pm Friday November 3, 2017

I will discuss geometry defined using tropical arithmetic known as tropical geometry and its relation with toric geometry. I will discuss the certain differential and difference operators called quantum curves and their relation with tropical geometry.

MODELING TRANSMISSION DYNAMICS OF INFLUENZA SOME MODELS AND CHALLENGES

MUDASSAR IMRAN

A deterministic model is formulated to investigate the transmission dynamics of two strain influenza (flu). In particular, our model takes into account the effects of cross-immunity. Dynamical Systems analysis of the model is performed and conditions are obtained for the stability of the disease-free state. We also show that if the disease-free equilibrium is unstable, the endemic state is persistent. Moreover, the model undergoes competitive exclusion where Strain i drives out Strain j , ($i, j = 1, 2$) to extinction under certain conditions. Finally, we evaluate the efficacy of hospitalization as a control measure for the disease.

TUESDAY NOVEMBER 14, 2017

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A PROOF OF THE MALGRANGE – EHRENPREIS THEOREM BY HILBERT SPACE METHODS

Waqas Shah (AS-SMS)

11AM THURSDAY NOVEMBER 16, 2017

The famous Malgrange - Ehrenpreis theorem states that a non-zero linear partial differential operator with constant coefficients has a fundamental solution in the space of distributions, or generalized functions. The aim of this talk is to give a complete and extended account of a very interesting proof by Rosay. This proof is "Hahn - Banach and Fourier - free" and uses only methods from Hilbert space.

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Σ^p Method of Extrapolation Spaces

Qamar Hussain (AS-SMS)



The theory of extrapolation spaces has applications in analysis, functional analysis and function Spaces. The extrapolation theory allows one to extend the classical extrapolation theorem of Yano to quasi-Banach interpolation spaces. We will discuss the theory of extrapolation spaces Σ^p with complete proofs and generalizations of Yano's classical extrapolation theorem.

2pm Thursday November 30, 2017



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GRADED FREE RESOLUTIONS

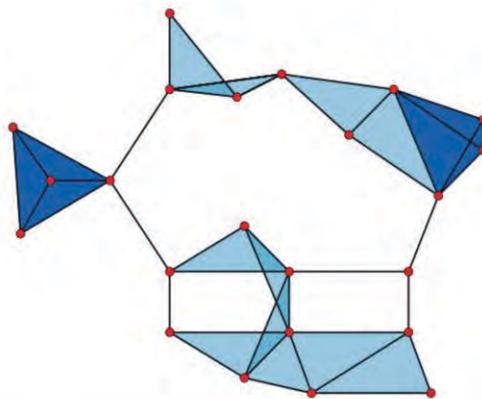
AND HILBERT FUNCTIONS

Lecture 4

IMRAN ANWAR (AS-SMS)

THURSDAY DECEMBER 7, 2017

The aim of this series of lectures is to explain the graded algebraic structures, free resolutions of graded rings and modules, Betti numbers, Hilbert Function and Hilbert series using a number of examples. This is lecture four of this series. I will discuss truncated complexes, homomorphism of complexes and exact sequences. I will also discuss the construction of graded free resolutions and graded Betti numbers with various examples. It will provide a glimpse of some exciting recent work in commutative algebra.



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Radical and Invertible-Radical Factorization in Commutative Rings

Malik Tusif Ahmed (AS-SMS)

11AM Friday December 8, 2017

In this talk, I will discuss the properties of the commutative rings whose ideals are products of radical ideals. I will also discuss those integral domains in which every proper ideal can be written as an invertible ideal multiplied by a non-empty product of proper radical ideals.

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ON H-IRREGULARITY STRENGTH OF GRAPHS

Faraha Ashraf (AS-SMS)

2PM Tuesday December 12, 2017

Motivated by the irregularity strength, total edge and vertex irregularity strength of a graph G , Baca et al. introduced new parameters total H-irregularity strength of a graph G , as a natural extension of the parameters mentioned earlier. This is special in a sense that here we define H-weight instead of edge or vertex weight which is more challenging task. I will elaborate results related to total H-irregularity strength of graphs.

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Homology of configuration spaces of spheres

Yameen Khan (AS-SMS)

2PM Thursday December 14, 2017

The configuration spaces naturally appear in various branches of mathematics such as algebraic geometry, algebraic and geometric topology. The ordered configuration spaces of topological space is defined as the space of k particles moving in the topological space without collision. The symmetric group acts naturally on the ordered configuration spaces by permuting the coordinates. The orbit spaces are called unordered configuration spaces of topological space. In this talk, I will discuss the homology of configuration spaces of spheres.

ALGEBRAS OF TRUNCATED TOEPLITZ OPERATORS

Ahsan Khan (AS-SMS)

2pm Tuesday December 19, 2017

Toeplitz operators and matrices have many interesting properties. In this talk, we will discuss necessary and sufficient conditions for the product of two truncated Toeplitz operators to be a truncated Toeplitz operator. This will allow a characterization of the maximal algebras of bounded truncated Toeplitz operators.

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CW Complexes and Classifying Spaces

Umar Shehzad (AS-SMS)

IN THIS TALK I WILL DISCUSS THE
CONSTRUCTION OF CW COMPLEXES
AND THE CLASSIFYING SPACES
ASSOCIATED TO THE TOPOLOGICAL
GROUPS. IN PARTICULAR I WILL
DISCUSS THE CLASSIFYING SPACE OF
 S^1 .

10AM Wednesday December 20, 2017

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VECTOR VALUED MODEL SPACES

Rewayat Khan (AS-SMS)

2pm Thursday December 21, 2017

In this talk, we will discuss various properties of unitary operators on the model spaces corresponding to different operator-valued inner functions. Matrix valued truncated Toeplitz Operator will also be introduced and discussed.





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