ABSTRACTS OF TALKS

3rd East Asian Conference in Harmonic Analysis and Applications
University of Tokyo, Komaba, Tokyo
August 10 – 14, 2015
(1) Jong-Guk Bak  
bak@postech.ac.kr  
Pohang University of Science and Technology (POSTECH)  

Title: Bilinear restriction estimates for the complex paraboloid and other surfaces of codimension larger than one  

In connection with the restriction conjecture, bilinear (adjoint) restriction estimates have been extensively studied in the case of hypersurfaces. But not much is known about such estimates for surfaces with codimension (and dimension) larger than one. In this talk we will discuss optimal bilinear $L^2$ restriction estimates for the complex paraboloid and other more general quadratic surfaces of higher codimension. In certain special cases, we can apply them to obtain linear estimates. This is joint work with Jungjin Lee, Sanghyuk Lee and Andreas Seeger.

(2) Jiguang Bao  
jgbao@bnu.edu.cn  
Beijing Normal University  

Title: Eshelby conjecture in linear elasticity  

I first survey results on determination of inclusion to divergence form elliptic equations and systems with discontinuous principal coefficients. Then I will concern the infinitely rigid inclusions in linear elasticity, and establish the necessary and sufficient conditions for “the inclusion is an ellipsoid in an infinite media” under any uniform applied loading, which are related to Eshelby conjecture. This is joint work with Haigang Li and Bo Wang.

(3) Chu-Hee Cho  
akilusius@gmail.com  
Pohang University of Science and Technology (POSTECH)  

Title: Estimates for divergence sets of the nonelliptic Schrödinger equation  

In this talk, we consider the nonelliptic Schrödinger equation. We obtain a maximal estimate of the solution, which implies pointwise convergence with respect to fractal measure. Also we estimate the size of the sets on which almost everywhere convergence fails.

(4) Yong-Kum Cho  
ykcho@cau.ac.kr  
Chung-Ang University  

Title: Fourier characterization of probability measures with finite absolute moments and related problems  

We present an explicit formula for evaluating absolute moments of probability measures on $\mathbb{R}^d$ in terms of Fourier transforms. By making use of our formula, we find the precise Fourier images of the space of probability measures possessing finite absolute moments of an arbitrary order and give Fourier-based probability metrics which make the space complete. As applications, we evaluate absolute moments of stretched exponentials and probability measures of Scheonberg classes. We also discuss Fourier multiplier problems.
related with probability measures and measure-valued solutions to the Cauchy problem for some diffusion equations.

(5) **Yutae Choi**

yutae_choi@postech.edu

Pohang University of Science and Technology (POSTECH)

Title: Averaged decay estimates for Fourier transform of measures over space curves

In this talk, we consider averaged decay estimates for Fourier transform of measures when the average is taken over the space curves. We extend the results due to Erdogan and Wolff to higher dimensions. This is joint work with Seheon Ham and Sanghyuk Lee.

(6) **Jayson Mesitas B. Cunanan**

jsonm11@gmail.com

Graduate School of Mathematics, Nagoya University

Title: On $L^p$-boundedness of pseudo-differential operators of Sjöstrand’s class

We extended the known result that symbols from modulation spaces $M^{\infty,1}(\mathbb{R}^{2n})$, also known as the Sjöstrand’s class, produce bounded operators in $L^2(\mathbb{R}^n)$, to general $L^p$ boundedness at the cost of loss of derivatives. Indeed, we showed that pseudo-differential operators acting from $L^p$-Sobolev spaces $L^p_s(\mathbb{R}^n)$ to $L^p(\mathbb{R}^n)$ spaces with symbols from the modulation space $M^{\infty,1}(\mathbb{R}^{2n})$ are bounded, whenever $s \geq n|1/p−1/2|$. This estimate is sharp for all $1 < p < \infty$.

(7) **Denny Ivanal Hakim**

dennyivanalhakim@gmail.com

Tokyo Metropolitan University (TMU)

Title: The complex interpolation of certain closed subspaces of Morrey spaces

It is known in [3] that Morrey spaces are closed under the second complex interpolation functor introduced by Calderón. In this talk, we shall discuss the interpolation for the closure in Morrey spaces of the set of all compactly supported functions. By using the characterization of the closure of all essentially bounded functions in Morrey type space discussed in [1], we also present the description of the interpolation of these spaces. Our results extend the interpolation theorem for the closure of essentially bounded and compactly supported functions with respect to the Morrey norm, discussed in [2].

Keywords: Morrey spaces, the second complex interpolation functor, closed subspaces of Morrey spaces

Seheon Ham  
hamsh@kias.re.kr  
Korea Institute for Advanced Study (KIAS)  

Title: Convolution estimates for measures on some complex curves.  

We consider the convolution operator for a measure supported on some complex curves. The measure which we consider here is an analogue of the affine arclength measure for real curves. Also we consider here some classes of degenerate complex curves, which were considered for the Fourier restriction estimates for complex curves. In this talk, we obtain the (nearly) optimal Lorentz space estimates by modifying a combinatorial argument called the band structure argument. We begin with studying some approaches which is used for the case of real curves and related Fourier restriction estimates. Then we move on to the modified band structure argument: the basic structure and motivational ideas. Finally, we will see the necessary conditions for Lorentz space estimates. This is a joint work with Hyunuk Chung (POSTECH).

Yaryong Heo  
yaryong@korea.ac.kr  
Korea University  

Title: Riesz means associated with star-shaped $C^n$ domains in the plane  

In this talk we study the $L^p$-boundedness properties of the Riesz means associated with star-shaped domains whose boundaries are $C^n$ plane curves with $n \geq 3$. The lack of convexity and differentiability prevent us from obtaining the $L^p$ boundedness of the Riesz means in the full range of $p$. We prove that the Riesz mean associated with star-shaped domains has $L^p$-boundedness property where the range of $p$ depends on the differentiability of the boundary. The results in this paper clearly recover those by P. Sjölin in [1] if we take the limit of the range of $p$ as $n \to \infty$.  

This is joint work with Chan Woo Yang.


Takeshi Iida  
tiida@fukushima-nct.ac.jp  
Department of General Education, Fukushima National College of Technology  

Title: Weighted estimates of higher order commutators generated by BMO-functions and the fractional integral operator on Morrey spaces  

The purpose of this paper is to investigate the weighted estimates of commutators generated by BMO-functions and the fractional integral operator on Morrey spaces. The main result generalized the Sawano Sugano and Tanaka result to a weighted setting.

Joeun Jung  
jj296@cornell.edu  
Cornell University  

Title: Few types of multi-linear operators given by singular multipliers
The plan of my talk is to describe a wide range of multi-linear singular operators and their $L^p$ estimates by applying time-frequency analysis.

(12) Takeshi Kawazoe  
kawazoe@sfc.keio.ac.jp  
Keio University at SFC  
Title: A new proof of the Kunze-Stein phenomenon for Jacobi analysis  
A simple proof of the endpoint estimate for the Kunze-Stein phenomenon for the Jacobi transform was given by J. Liu in 2005. In this paper we give an another simple proof based on the inversion formula for the Abel transform. In this proof we reduce the convolution for Jacobi analysis to the Euclidean convolution of their Abel transforms.

(13) Joonil Kim  
jikim7030@yonsei.ac.kr  
Yonsei University  
Title: Oscillatory integrals over global domains  
We discuss about the asymptotic behaviors for the 2D oscillatory integrals with polynomial phase functions. Especially, we study the cases that (1) the domain of integral is unbounded, or (2) the phase function involves a vector polynomial. Similar problem is measuring a sublevel-set which can be an unbounded set, or an intersection of various different sublevel sets. Our results are described in terms of generalized notions of Newton polyhedra.

(14) Doowon Koh  
koh131@chungbuk.ac.kr  
Chungbuk National University  
Title: Restriction of averaging operators to algebraic varieties in finite fields  
In this talk, we study the mapping properties of restricted averaging operators related to algebraic varieties $V$ of $d$-dimensional vector spaces over finite fields $\mathbb{F}_q$ with $q$ elements. Given an algebraic variety $V \subset \mathbb{F}_q^d$, let us denote by $\sigma$ the normalized surface measure on $V$. For functions $f: \mathbb{F}_q^d \to \mathbb{C}$, the restricted averaging operator $A_V$ is defined by restricting $f * \sigma$ to the algebraic variety $V$. The main purpose of this talk is to investigate $L^p \to L^r$ estimates of the restricted averaging operator $A_V$. We relate this problem to both the Fourier restriction problem and the averaging problem over $V$. As a consequence, we establish the sharp $L^p - L^r$ estimates of the restricted averaging problem for algebraic varieties $V$ such as spheres or paraboloids. In addition, in the case when the variety $V$ is a cone, we obtain the sharp weak-type estimates for restricted averaging operators $A_V$.

(15) Hyelim Koh  
kohr@snu.ac.kr  
Seoul National University  
Title: Fourier transform and regularity of characteristic functions
We discuss the problem of the regularity property of $\chi_E$ and integrability of $c\chi_E$ when its boundary $\partial E$ satisfies a certain condition. By making use of Lorentz and Lorentz-Sobolev spaces we obtain the endpoint cases of the previous known results. Our results are based on a refined version of Littlewood-Paley inequality, which makes it possible to exploit cancelation effectively. This is a joint work with Sanghyuk Lee.

(16) **Youngwoo Koh**  
ywkoh@kias.re.kr  
Korea Institute for Advanced Study (KIAS)  

Title: Endpoint Strichartz estimates for the three-dimensional magnetic Schrödinger equation  

We study the endpoint case of Strichartz estimates for the magnetic Schrödinger equation in $\mathbb{R}^3$. More specifically, we show the estimate  

$$\|e^{itH}f\|_{L^4_t L^6_x(\mathbb{R}; L^6(\mathbb{R}^3))} \leq C_H \|f\|_{L^2(\mathbb{R}^3)}$$  

when $H = -\Delta_A + V$ satisfies some conditions. To prove this, we investigate the equivalence $\|H^\alpha f\|_{L^q(\mathbb{R}^3)} \approx C_{H,q} \|D|^{2\alpha} f\|_{L^q(\mathbb{R}^3)}$ and find the conditions on $H$, $q$, $\alpha$ for which allows the equivalence holds.

(17) **Bongsuk Kwon**  
bkwon@unist.ac.kr  
Ulsan National Institute of Science and Technology  

Title: Quasi-neutral limit for the Euler-Poisson system  

In this talk, I will talk about the existence of stationary solutions to the Euler-Poisson equations and the corresponding quasi-neutral limit equations in an annulus domain. If time permits, the quasi-neutral limit problems and stability problems will be discussed. This is a joint work with Chang-Yeol Jung (UNIST) and Masahiro Suzuki (Tokyo Institute of Technology).

(18) **Yehyun Kwon**  
kwonyh27@snu.ac.kr  
Seoul National University  

Title: Uniform Sobolev inequalities for the second order differential operators  

We present uniform Sobolev inequalities for non-elliptic constant coefficient second order differential operators and its application to Carleman inequalities and unique continuation theorem. Our approach uses frequency localization and real interpolation. The talk is based on a recent work with Eunhee Jeong and Sanghyuk Lee.

(19) **Yan Lin**  
linyan@cumtb.edu.cn  
China University of Mining and Technology, Beijing (CUMTB)  

Title: Some results of strongly singular Calderón-Zygmund operators and commutators
The strongly singular Calderón-Zygmund operator has received increasing attentions since the kernel of the strongly singular Calderón-Zygmund operator is more singular near the diagonal than that of the standard case, and it correlates closely with a class of pseudo-differential operators. In this talk, we will discuss some properties of this kind of operators and their commutators, such as endpoint estimates, sharp maximal function estimates, boundedness on Lebesgue, Hardy, Morrey spaces, and some weighted estimates.

(20) Yongping Liu
ypliu@bnu.edu.cn
Beijing Normal University

Title: Optimal recovery of multivariate functions restricted by second order differential operator

Let \( P(t) = t^2 - \lambda^2 (\lambda > 0, t \in \mathbb{R}) \) be an algebraic polynomial of second order only with the real zeros \( \lambda \), and \(-\lambda\). For a unite vector \( r \in \mathbb{R}^d \), let \( P(\frac{\partial}{\partial r}) = \frac{\partial^2}{\partial r^2} - \lambda^2 I \) (here \( I \) is the unit operator) denote the directional derivative operator induced by the polynomial \( P \) in the direction of \( r \). For a bounded convex body \( G \) of \( \mathbb{R}^d \), denote by \( W_G(P) \) the class of continuously differentiable functions \( f : G \to \mathbb{R} \) such that for each unit vector \( r \), the directional derivative \( \frac{\partial^2}{\partial r^2} f \) exists inside \( G \) in a generalized sense and the usual \( L^\infty \)-norm \( \| P(\frac{\partial}{\partial r}) f \|_G \leq 1 \) on \( G \). For a given basis \( \{ w_1, w_2, \ldots, w_d \} \) of \( \mathbb{R}^d \), let the full-rank lattice \( L = \{ k_1 w_1 + \ldots + k_d w_d : k_1, \ldots, k_d \in \mathbb{Z} \} \) be the integral span of the basis, and let \( \Pi(L) := \{ \lambda_1 w_1 + \ldots + \lambda_d w_d : \lambda_1, \ldots, \lambda_d \in [0,1) \} \) be the fundamental parallelepiped (domain) of the lattice \( L \). Denote by \( \tilde{W}_L(P) \) the class of the \( L \)-periodic functions \( f : \mathbb{R}^d \to \mathbb{R} \) (i.e. \( f(x + w) = f(x) \) for any \( x \in \mathbb{R}^d \) and \( w \in L \) ) such that for every unit vector \( r \), the directional derivative \( \frac{\partial^2}{\partial r^2} f \) exists in a generalized sense and the usual \( L^\infty \)-norm \( \| P(\frac{\partial}{\partial r}) f \|_{\Pi(L)} \leq 1 \) on \( \Pi(L) \).

In the talk, we consider the optimal recovery problems of the function classes \( W_G(P) \) and \( \tilde{W}_L(P) \), and obtain some sharp results.

(21) Zengjian Lou
zjlou@stu.edu.cn
Shantou University

Title: Embedding of Möbius invariant function spaces into tent spaces

On the unit disk, we introduce a new class of tent spaces \( T^q_{s,t}(\mu) \) for any positive Borel measure \( \mu \), consider a class of Möbius invariant spaces \( Z_p \) of analytic functions, and show that \( Z_p \) is contained in \( T^1_{p,1} \) if and only if \( \mu \) is a \( p \)-Carleson measure.

This is joint work with Junming Liu and Kehe Zhu.

(22) Guozhen Lu
gzh2001@gmail.com
Wayne State University

Title: Multilinear and multi-parameter Fourier multipliers, pseudo-differential operators and Fourier integral operators

In this talk, we will discuss the boundedness of multilinear and multi-parameter Fourier multipliers which include bilinear and biparameter Hilbert transforms. We will also
discuss the multilinear and multi parameter pseudo-differential operators and Fourier integral operators.

(23) Satoshi Masaki  
masaki@amath.hiroshima-u.ac.jp  
Hiroshima University  
Title: Restriction estimate and its application to generalized KdV equation in $\hat{L}^p$ space

Well-posedness theory of dispersive equations such as NLS equation and KdV equation is well studied in Lebesgue spaces or in Sobolev spaces. In this talk, I want to introduce a well-posedness result of generalized KdV equation in $\hat{L}^p = \mathcal{F}L^p'$. A key is generalized Strichartz’ estimate on $\hat{L}^p$ space which follows from restriction estimates for Airy equation.

(24) Akihiko Miyachi  
miyachi@lab.twcu.ac.jp  
Tokyo Woman’s Christian University  
Title: Multilinear Fourier multipliers with minimal regularity

Let $H^q(\mathbb{R}^n)$ denote the Hardy space when $0 < q \leq 1$ and the Lebesgue space $L^q(\mathbb{R}^n)$ when $1 < q \leq \infty$. We find optimal conditions on $m$-linear Fourier multiplier operators to be bounded from $H^{p_1} \times \cdots \times H^{p_m}$ to $L^p$ when $1/p = 1/p_1 + \cdots + 1/p_m$ in terms of local product type $L^2$-Sobolev norm estimates for the symbol of the operator. Our conditions provide multilinear analogues of the linear results of Hörmander [1] and Calderón and Torchinsky [2] and of the bilinear results of Miyachi and Tomita [3]. This is a joint work with Loukas Grafakos, Hanh Van Nguyen, and Naohito Tomita.


(25) Makoto Nakamura  
nakamura@sci.kj.yamagata-u.ac.jp  
Yamagata University  
Title: Nonrelativistic limits of semilinear field equations

The nonrelativistic limits of semilinear field equations are considered in uniform and isotropic spaces. The scale-functions of the spaces are constructed based on the Einstein equation. The Cauchy problems of the limit-equations are considered, and the global and blow-up solutions are shown in Sobolev spaces. The roles of spatial variance on the problems are studied, and some dissipative properties of the limit-equations are remarked.
In this talk, we propose a new weight class $B_{\phi,q}$ and consider the generalized weighted Morrey space $M_{\phi}^{q}(\omega)$ with the norm:

$$\|f\|_{M_{\phi}^{q}(\omega)} := \sup_{Q \text{ cube}} \phi(\ell(Q)) \left( \frac{1}{|Q|} \int_{Q} |f(x)|^q \omega(x) \, dx \right)^{\frac{1}{q}}.$$  

For the weight $\omega$ belonging the class $B_{\phi,q}$, we investigate the boundedness of classical operators on $M_{\phi}^{q}(\omega)$. In particular, we pick up the boundedness of Hardy-Littlewood maximal operator on the space and also consider the vector-valued maximal inequality to explain the roll of $B_{\phi,q}$. In 2009, two papers on weighted Morrey spaces appeared. Komori-Furuya and Shirai investigated weighted Morrey spaces mainly in connection with the boundedness of operators in [1]. Meanwhile, Samko considered weighted Morrey spaces in the context of Cauchy integral in [2]. Our weighted norm is a type of one considered by Samko. We will introduce other results about the generalized fractional maximal operator, the generalized fractional integral operator, and the singular integral operator time permitting.


**Kempka** has proved molecular decompositions for two-microlocal Triebel–Lizorkin space with variable exponents $F_{p(\cdot),q(\cdot)}^{w}(\mathbb{R}^n)$ and two-microlocal Besov spaces with variable exponent $B_{p(\cdot),q(\cdot)}^{w}(\mathbb{R}^n)$ but summability parameter $q$ was constant in the $B_{p(\cdot),q(\cdot)}^{w}(\mathbb{R}^n)$ case (H. Kempka, Atomic, molecular and wavelet decomposition of 2-microlocal Besov and Triebel-Lizorkin spaces with variable integrability. Funct. Approx. Comment. Math. 43, No. 2 (2010), 171-208.). In this talk, we consider the molecular decompositions for two-microlocal Besov spaces with variable exponents $B_{p(\cdot),q(\cdot)}^{w}(\mathbb{R}^n)$.

**Saito** has obtained an estimate of the operator norm of the weighted Kakeya (Nikodým) maximal operator without dilation on $L^2(w)$. Here we assume that a radial weight $w$ satisfies the doubling and supremum condition. We give an example of a
non-constant weight showing that $\sqrt{\log N}$ cannot be removed. However, it should be remarked that the classical example $f(x) = 1/|x|$ does not work to get optimality for the power weight.

This is joint work with Yoshihiro Sawano and Hitoshi Tanaka.

(29) **Yoshihiro Sawano**  
yawano@tmu.ac.jp  
Tokyo Metropolitan University (TMU)

Title: Generalized Hardy Morrey spaces

We shall discuss decomposition of generalized Hardy Morrey spaces. This work is a continuation of my series of recent papers on Hardy spaces. When we consider Hardy Morrey spaces, that is, Morrey-spaces based Hardy spaces, the non-density of the functions having compact support will cause problems. In this talk, I would like to discuss how to overcome this problem. If time permits, I would like to pass to the general Banach function spaces which satisfies the Fefferman-Stein type vector-valued inequality. In this case, Herz spaces play a key role.

The first half of these works is done jointly with Ali Akbulut (Turkey), Vagif Guliyev (Turkey) and Takahiro Noi (TMU). The second one is a joint work with Kwok Pun Ho (Hong-Kong).

(30) **Ihyeok Seo**  
ihseo@skku.edu  
Sungkyunkwan University

Title: From resolvent estimates to unique continuation for the Schrödinger equation

In this talk we develop a new method to handle the problem of unique continuation for the Schrödinger equation with potentials. In general the problem is to find a function class of potentials which allow the unique continuation. There were numerous earlier research works on this problem and most of them dealt with time-dependent potentials by establishing certain type of Carleman estimates directly. But, such Carleman estimates seem to be hard to establish for time-independent case, at least not directly. So we change the direction by connecting, in an abstract way, weighted resolvent estimates for Laplacian and Carleman estimates, therefore avoided the trouble of proving Carleman estimates directly for a specific potential function. This is the key point of our method which makes a direct link between the problem and the weighted resolvent estimates. To do so, we will make use of limiting absorption principle and Kato H-smoothing theorem in spectral theory, and employ some tools from harmonic analysis. Once the resolvent estimate is set up for a potential class, from our abstract theory the unique continuation would follow from the same potential class. We also exhibit a few useful applications of the method to other problems.

(31) **Lisheng Shu**  
shulsh@mail.ahnu.edu.cn  
Anhui Normal University, P. R. China

Title: Hardy type operators and commutators on Herz spaces with variable exponents
In this talk, we will give the boundedness of two Hardy type operators and commutators on Herz spaces with variable exponents.

This is joint work with Min Wang and Meng Qu.

(32) **Xiangxing Tao**  
xxtau@163.com  
Zhejiang University of Science and Technology, P. R. China  

Title: On the option pricing under fractional model

Under the assumption of the underlying asset is driven by the fractional Black-Scholes Brownian Motion, we use a self-financing $\Delta$-hedging strategy to obtain a discrete time pricing formula for perpetual American put option. Within fractional Wick Itô Skorohod integral formwork, we explore pricing problems of one spread option, which underlying assets come from two different interactive markets that are modeled by two mixed fractional BS model with Hurst parameters. In this talk, some related integral estimates will be discussed.

(33) **Yohei Tsutsui**  
tsutsui@shinshu-u.ac.jp  
Department of Mathematical Sciences, Faculty of Science, Shinshu University  

Title: Div - curl lemma with critical power weights in dimension three

We discuss the inequality of the from

$$\|(u \cdot \nabla)v\|_Z \leq c\|u\|_X\|\nabla v\|_Y$$

with weighted Hardy spaces $X$, $Y$ and $Z$. Here, $u = (u_1, \cdots, u_n)$ and $v = (v_1, \cdots, v_n)$ and div $u = 0$. This inequality was first established by Coifman-Lions-Meyer-Semmes in the frame work of Hardy spaces. The term $(u \cdot \nabla)v$ appears in fluids equations as the nonlinear term with $v = u$. Our critical div-curl lemma concerns with the critical decay rate of $L^2$-energy of solutions to the incompressible Navier-Stokes equations by Wiegner.

(34) **Chengbo Wang**  
wangcbo@zju.edu.cn  
Zhejiang University  

Title: Long time existence for semilinear wave equations on asymptotically flat space-times

Recently, there have been many works for the global existence part (supercritical $p > p_c$), as well as the blow up part (subcritical and critical, $1 < p \leq p_c$), for the Strauss conjecture on various spacetimes, including exterior domain, asymptotically Euclidean manifolds and Kerr black hole backgrounds. In this talk, we will address the issue of the estimates of the lifespan in the subcritical and the critical case, for semilinear wave equations of the form $u_{tt} - \Delta u = |u|^p$ with compactly supported small data, on a large class of $(1 + n)$-dimensional nonstationary asymptotically flat backgrounds, which models the black hole space-times. Under the assumption that uniform energy bounds and a weak form of local energy estimates hold forward in time, we give a sharp lower bound of the lifespan for the 3-dimensional subcritical case. For the critical case with $n = 3, 4$, we obtain an exponential lower bound of the lifespan.
Title: Unified blow-up criteria for abstract dynamical systems and the applications to liquid crystals

In this paper, we establish some unified blow-up criteria for some abstract dynamical systems, for which the solutions satisfy several energy inequalities which are commonly fulfilled in the context of fluid dynamical systems. We take the general liquid crystal system as an example to demonstrate the applications of our unified blow-up criteria to the fluid dynamical systems.

Title: Theorems on massless Dirac operators

Theorems on massless Dirac operators in Saito and Umeda’s paper (Hokkaido M. J. 37 (2008), 363-388) are discussed and improved.

Title: The generalized Hardy-Littlewood-Sobolev inequality and Selberg’s integral formula

First, we characterize the sufficient and necessary conditions which ensure validity of the doubly weighted Hardy-Littlewood-Sobolev inequality. Secondly, we give the sharp constants of the doubly weighted Hardy-Littlewood-Sobolev inequality for some special cases. Moreover, we give the sharp constants for the generalized Hardy-Littlewood-Sobolev inequality as well. Finally, we investigate some necessary and sufficient conditions which make the Selberg’s integral formula hold. It should be pointed out that the Selberg’s integral formula has the close relationship with the sharp constants. This is joint work with Zuoshunhua Shi and Di Wu.

Title: Hardy and BMO spaces associated to operators and their applications to harmonic analysis and PDE

In the last decades, a theory of Hardy and BMO spaces associated with various operators was introduced and well developed. In this talk I will survey some progress on this Hardy and BMO theory including various equivalent definitions of a Hardy space in terms of the square function, atomic decomposition, the nontangential (or radial) maximal functions, Littlewood-Paley functions and duality of Hardy and BMO spaces under
some mild assumptions of the operators. Some applications to harmonic analysis and PDE are also presented.

(39) **Minsuk Yang**  
yangm@kias.re.kr  
Korea Institute for Advanced Study (KIAS)

Title: Hausdorff measure of boundary singular points in the magnetohydrodynamic equations

We study boundary singular points of suitable weak solutions to the three dimensional incompressible magnetohydrodynamic equations. By using the generalised Hausdorff measure we estimate the size of boundary singular points and present the improved range of powers of logarithmic factors.

This is joint work with Hi Jun Choe.

(40) **Xiaohua Yao**  
yaoxiaohua@mail.ccnu.edu.cn  
Central China Normal University (CCNU)

Title: Endpoint Strichartz estimates for charge transfer Hamiltonians

We prove the optimal endpoint Strichartz estimates for Schrödinger equation with charge transfer potentials and a general source term in $\mathbb{R}^n$ for $n \geq 3$. The proof is based on using the projection on the scattering states defined implicitly by Rodnianski, Schlag and Soffer [2005, CPAM], and asymptotic completeness for such systems. The method works as well in the matrix non-selfadjoint case.

This is a joint work with Qingquan Deng and Avy Soffer.

(41) **Zhifei Zhang**  
zfzhang@math.pku.edu.cn  
School of Mathematical Sciences and LMAM, Peking University

Title: Global well-posedness results for the Navier-Stokes equations

I will present some global well-posedness results of the Navier-Stokes equations based on the Fourier analysis method, especially Littlewood-Paley theory and Bony’s decomposition.

(42) **Jiman Zhao**  
jzhao@bnu.edu.cn  
School of Mathematical Sciences, Beijing Normal University, Beijing 100875, China

Title: Strichartz estimates for the wave equation with the full Laplacian on the quaternion Heisenberg group

In this article, we prove dispersive and Strichartz estimates for the solution of the wave equation related to the full Laplacian on the quaternion Heisenberg group, by means of homogeneous Besov space defined by a Littlewood-Paley decomposition related to the full Laplacian. This is joint work with Dr. Naiqi Song.
Title: $L^\infty$-variational problem: uniqueness

Let $U \subset \mathbb{R}^n$ be a bounded domain, and consider $L^\infty$-variational problems involving Hamilton functions $H : U \times \mathbb{R}^n \to [0, \infty)$. Jessen, Wang and Yu [ARMA 2008] posed the following

Conjecture 1.3. Assume that the Hamiltonian functions $H \in C^2(U \times \mathbb{R}^n) \cap C(U \times \mathbb{R}^n)$ satisfy (1) $H(x, \cdot)$ is convex for any $x \in U$, and (2) $0 = H(x, 0) < H(x, p)$ for any $0 \neq p \in \mathbb{R}^n$ and $x \in U$. For any given boundary $g \in C(\partial U)$, there is a unique absolute minimizer $u \in W^{1, \infty}_{\text{loc}}(U) \cap C(U)$ with the given boundary $g$.

We confirm this conjecture positively.

Title: Boundedness of strong maximal functions with respect to nondoubling measures

The main purpose of this paper is to establish a boundedness result for strong maximal functions with respect to certain non-doubling measures in $\mathbb{R}^n$. More precisely, let $d\mu(x_1, \cdots, x_n) = d\mu_1(x_1) \cdots d\mu_n(x_n)$ be a product measure which is not necessarily doubling in $\mathbb{R}^n$ (only assuming $d\mu_i$ is doubling on $\mathbb{R}$ for $i = 2, \cdots, n$), and let $\omega$ be a non-negative and locally integral function such that $w_i(\cdot) = \omega(x_1, \cdots, x_{i-1}, x_{i+1}, \cdots, x_n)$ is in $A^{1, \infty}(d\mu_i)$ uniformly in $x_1, \cdots, x_i-1, x_{i+1}, \cdots, x_n$ for each $i = 1, \cdots, n-1$, let $d\nu = \omega d\mu$, $\nu(E) = \int_E \omega(y)d\mu(y)$ and $M^n_{\omega d\mu}$ be the strong maximal function defined by

$$M^n_{\omega d\mu}f(x) = \sup_{x \in R \in R} \frac{1}{\nu(R)} \int_R |f(y)| \omega(y) d\mu(y)$$

where $R$ is the collection of rectangles with sides parallel to the coordinate axes in $\mathbb{R}^n$. Then we show that $M^n_{\omega d\mu}$ is bounded on $L^p_{\omega d\mu}(\mathbb{R}^n)$ for $1 \leq p < \infty$. This extends an earlier result of R. Fefferman who established the $L^p$ boundedness when $d\mu = dx$ is the Lebesgue measure on $\mathbb{R}^n$ and $d\nu = \omega d\mu$ is doubling with respect to rectangles in $\mathbb{R}^n$, $\omega$ satisfies a uniform $A^{1, \infty}$ condition in each of the variables except one.

Moreover, we also establish some boundedness result for the Cordoba maximal functions associated with the Córdoba-Zygmund dilation in $\mathbb{R}^3$ with respect to some non-doubling measures. This generalizes the result of R. Fefferman-Pipher.

This is joint work with Dr. Wei Ding.